MOTOR'S AUTO REPAIR MANUAL

"KEEP 'EM ROLLING"
WITH MOTOR'S MANUALS

INDEX

Car Chapters

Service Details

This book giv s specific instructions on the removal, replacement, fitting and adjustment of all m chanical parts on all cars built from 1935 to date.

MOTOR'S

AUTO REPAIR MANUAL

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TUNE UP

SATISFACTORY performance of modern engines requires scientific testing equipment in order to restore the engine to the original condition in which it operated when new. In conjunction with this testing equipment, the manufacturer's specifications should be closely followed when making all necessary adjustments in order to obtain smooth performance of the engine with economical results.

The fundamentals of engine tune up are (1) compression, (2) ignition, (3) carburetion. Since compression does not depend in any way upon either ignition or carburetion, it should be checked first.

COMPRESSION

The engine cannot be tuned to develop maximum power and give smooth performance unless normal compression pressure is obtained in each cylinder on every compression stroke. In order to have uniform and maximum compression, the following conditions must be present:

1. Cylinder head bolts must be uniformly tight.
2. Cylinder head and spark plug gaskets must seal securely.
3. Piston rings must seal properly throughout the entire piston stroke.
4. Intake and exhaust valves must be properly adjusted and must seat tightly.

CYLINDER HEAD BOLTS—On overhead valve engines, cylinder head bolts not tightened sufficiently will cause changes in valve lash and may permit leakage past the gasket. And on all type engines, uneven or excessively tightened bolts may distort the cylinder bores, causing compression loss and excessive oil consumption.

Tighten all cylinder head bolts to the values given in the *Tune Up* chart in the car chapters, using a torque wrench to compress the head gasket evenly and avoid distortion of head and cylinder bores. The bolts should be tightened in the sequence shown in the illustrations in the car chapters. If no diagram is given, start tightening at the center and work from side to side outward toward the ends.

Installing Spark Plugs—When installing either new or used spark plugs, always blow away dirt from around plug holes, and use new gaskets to insure tight seals without excessive tightening. Excessive tightening may change the gap between electrodes and may crack the insulator.

Make sure the gasket surfaces on spark plugs and cylinder head are clean. Screw the plugs down by hand into firm contact with the gaskets, then tighten them ¼ turn more.

Valve Adjustment—Oil, water and engine temperatures must be stabilized or brought to normal operating temperatures before the valves can be properly adjusted for normal lash. This applies to all engines where the manufacturer specifies that the lash should be adjusted when the engine is warm. Some car companies, Studebaker for example, recommend that the adjustment be made when the engine is cold, which means at normal room temperature.

When an engine is warmed up by running without load in the shop, the oil, water and engine temperatures level off at different points than those obtained on the road; therefore, a wider lash adjustment is required. Thus, if the manufacturer specifies a *road operating clearance* of .015 inch, best results will be obtained by setting the lash at .017 inch if the engine is warmed up in the shop. Of course, if the adjustment is being made after the car has made a hard run on the road, the clearance of .015 inch should be adhered to.

Some car companies recommend an additional .002 inch clearance for exhaust valves on cars that are operated continuously at high speeds.

IGNITION

PRIMARY CIRCUIT

BATTERY—Since the battery is the source of all electrical energy, its efficiency must first be checked, since starting and idle performance are always poor if the battery and its connections are not up to standard. Besides, a low or defective battery will cause inaccuracies in any tests to the starter, generator or ignition systems.

Specific gravity of the electrolyte must be tested *before adding water* as water does not mix immediately and a true reading will not be obtained.

When a hydrometer is used for testing the condition of a battery, a correction must be made for the temperature of the electrolyte, because hydrometer readings are correct only when the electrolyte is at 80 deg. F. For each 5 deg. *decrease* below 80 deg. the specific gravity *rises* 2 points (.002) of gravity. Likewise, for each 5 deg. *increase* above 80 deg. the specific gravity *lowers* .002.

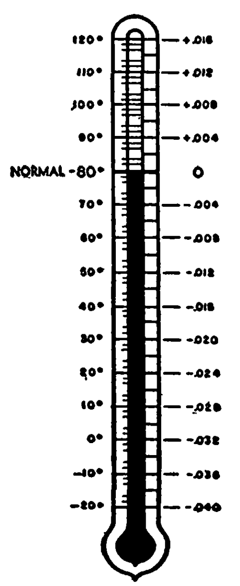


Fig. 1 Sp cific gravity c rr cti n scal

Take the temperature of the electrolyte in each cell with a thermometer. Take the specific gravity of the electrolyte in each cell with a hydrometer. Obtain the actual specific gravity by changing the hydrometer reading by the amount shown on the right side of the scale, Fig. 1, opposite the temperature of the electrolyte. For example, if the temperature of the electrolyte is 60 deg., and the hydrometer reading is 1.290, the actual specific gravity is 1.282 because the correction at 60 deg. is .008 (1.290 minus .008 equals 1.282).

A battery in good condition should have specific gravity of not less than 1.250 in seasons when freezing of water may occur, or 1.235 in seasons when freezing of water is unlikely. The battery must be recharged if the specific gravity is less than the above values.

Add pure distilled water to bring level of electrolyte to ¼ inch above the plates in each cell. Do not fill higher as the electrolyte may overflow and cause damage. Turn filler caps down finger tight.

BATTERY CABLES & TERMINALS—Inspect the battery cable and ground strap for broken insulation, corroded or broken strands, and loose or corroded terminals.

Repair broken or chafed insulation with loom or tape. If cable strands are broken, corroded, or loose in the terminals, the cables should be replaced, being sure the new cable has ample capacity to carry the current.

Since loose terminals are usually corroded, disconnect loose terminals and thoroughly clean contact surfaces by scraping until bright or by washing with a strong soda solution. Coat cleaned contact surfaces of battery post and terminal with vaseline to retard corrosion. Connect the terminal and tighten securely.

CAUTION—If the car is equipped with an electric clock, wind the clock in the following manner before connecting the cable.

1. Make sure all electrical units are turned off.
2. Hold the cable terminal firmly on the battery post for several seconds to make initial wind of clock.
3. Remove the terminal and immediately strike it against battery post to see if there is a spark.
4. If there is a spark, allow clock to run down until it stops ticking. Repeat steps 2 and 3 until there is no spark.
5. Immediately install and tighten the terminals before the clock runs down completely, which requires about 3 minutes.
6. Reset clock after terminal is tightened.

STARTER CIRCUIT — A voltmeter should be used to determine the condition of the starter circuit under actual operation.

On cars equipped with a starter switch in the carburetor, connect a jumper wire to the primary terminal of the distributor and to ground on the engine so that the engine can be cranked without firing. This is not re-

quired on cars without the carburetor switch as the engine can be cranked with the ignition switch off.

Attach the negative voltmeter test lead to the engine for the ground connection, and the positive lead to the starting motor switch, where the cable from the battery fastens, for the positive connection. (This hook-up is used when the negative post of the battery is grounded; reverse the connections if the opposite is true.)

By cranking the engine with the starter, a discharge load will be put on the starter circuit. If the starter turns the engine at a good rate of speed, the average voltage reading should be between 4½ to 5 volts for a normal operating circuit.

When the starting switch is closed, the starter should crank the engine for 15 seconds, during which the normal voltage reading should be 4½ to 5 volts without any appreciable drop because of the drain on the battery. If the circuit meets the demands for this test, further tests are unnecessary; if not, further testing is required.

STARTER SOLENOID SWITCH TEST—Connect the voltmeter positive lead to the positive terminal on the solenoid switch. Turn on the ignition and crank the engine for 15 seconds while observing voltmeter reading. If the voltmeter reads more than 1/10th volt, the switch should be repaired or replaced.

MANUAL TYPE STARTER SWITCH TEST—Remove the dust band from the starter and connect the positive lead of the voltmeter to the switch terminal. The negative lead should be connected to the end of the field coil. Close the starting switch and observe the reading on the voltmeter. If the reading exceeds ½ volt, the switch is defective.

BATTERY CABLE TEST—Connect the positive voltmeter test lead to the positive battery post and the negative test lead to the battery cable terminal on the starter switch. Crank the engine for 15 seconds while observing the voltmeter reading. If the reading is more than 2/10s of a volt, recheck for loose or dirty terminals. If terminals are clean and tight, replace the cable.

BATTERY GROUND CABLE—This test is made in the same manner as the battery cable test except that the negative voltmeter lead should be connected to the engine (or transmission) terminal of the ground cable or strap, and the positive voltmeter lead connected to the negative battery post.

GENERATOR—The tune up job will not remain satisfactory for an extended period of service if the generator output is low because the battery will soon fall below a safe state of charge and ignition then will be starved when the total current draw is heavy.

Remove the cover band and carefully inspect the interior of the generator for (1) worn, rough, or dirty commutator; (2) high mica between commutator segments; (3) thrown solder, which indicates loose connections between the armature windings and commutator segments. These conditions will cause low generator output.

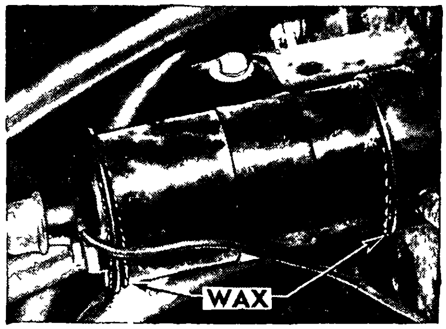


Fig. 2 Wax leaking from ignition coil

If the commutator is in good condition but dirty, clean off all grease with a cloth soaked with cleaning fluid. Then polish the commutator with a strip of fine sandpaper placed over a wooden block having a smooth, square end. Carefully blow out all dust and replace the cover band.

If inspection indicates that the armature requires turning down and undercutting of the mica, this should be done.

Tighten all wiring connections at the generator, regulator, and ammeter.

PRIMARY IGNITION CIRCUIT—Carefully inspect the terminals, connections, and visible portions of the following wires: (1) Starter switch to ammeter; (2) ammeter to ignition switch; (3) ignition coil to terminal on distributor housing.

The wires must be securely attached to the terminals and the insulation must be in good condition. If any connections are loose, disconnect and clean the terminals thoroughly, then connect and tighten securely. Turn the ignition switch on and off a few times to be certain it is making positive contact.

Faulty ignition coil operation can be caused by moisture, grease or dirt on the outside shell. Wax leaking to the outside of the coil, Fig. 2, does not indicate that the coil is defective; it may have been caused by an abnormal heat condition which did not affect the internal structure of the coil.

The high tension terminal socket may be corroded as a result of arcing caused by previous failure to insert properly the end of the cable into the socket. Corrosion also may develop in sea coast areas due to salt air.

Any corrosion will cause resistance to the flow of current. Therefore, the socket should be thoroughly cleaned out with a terminal cleaner, sandpaper or a stiff wire brush, and cable terminal should be cleaned with sandpaper.

All parts of the distributor which affect the primary circuit must be inspected and tested, and worn and defective parts must be replaced to insure satisfactory ignition.

The contact points may be cleaned and adjusted without removing the distributor, but if the interior is dirty or saturated with oil, or new parts are to be installed, the distributor must be removed from the engine.

To determine whether it is necessary to remove the distributor, as well as to find out what parts are to be replaced, first make all the inspections and tests outlined below.

CENTRIFUGAL ADVANCE—This mechanism must operate freely and the springs must return the advance weights to the full retard position during idle speed operation.

Sticking advance weights will result in poor acceleration, whereas weak springs will cause a too rapid spark advance, causing the engine to ping, resulting in engine roughness and a decrease in gasoline economy. Sticking weights can be cleaned but weak springs must be replaced.

To test the action of the weights, turn the rotor in the direction required to advance the weights to their fully extended position. Then release the rotor and allow the springs to return the weights to retard position—which will be indicated by a metallic click when the weights strike the stop.

VACUUM ADVANCE—This unit may be inoperative due to a broken diaphragm or spring. To determine whether this condition exists, crank the engine with the starter and hold the choke closed and throttle open. If the distributor plate will advance and return, the parts are not broken. But the breaker plate will not advance if the diaphragm is broken. If it advances but does not return, the spring is broken.

A leak at the vacuum advance connection will allow excess air to enter the carburetor, which may result in poor gasoline economy through fixed-throttle intermediate speeds because of incorrect operation of the vacuum advance mechanism.

If the pigtail leads are broken at any point, or if the distributor housing is worn so that the breaker plate can shift sidewise as it is oscillated by the vacuum advance mechanism, the ignition will be erratic enough to cause flat spots or ignition miss. This condition will usually occur at idle speed or up to 15 m.p.h.

To detect this trouble, disconnect the vacuum line at the distributor. If the trouble disappears, test the pigtail leads, and also check the groove in the distributor housing where the breaker plate "floats."

CONDENSER—There are several good condenser testers commercially available and when making tests, the condenser must be at normal operating temperature.

The resistance test, measured in microhms, is to determine if there is a high series resistance in the condenser circuit caused by the conditions shown in Fig.3.

The capacity test, measured in microfarads, is to determine if the condenser capacity is actually within specification limits.

The insulation test, measured in megohms, is to determine if the condenser insulation will hold a charge satisfactorily.

BREAKER POINTS—Carefully examine the points for burns, pits, dirt, and see that they are not sticking on the pivot. Check to see that they are properly spaced and have the correct spring tension. Point spring tension too weak or too strong will limit high speed performance, either by the point "floating", which is due to a weak spring, or "bouncing", which is caused by a spring with too much tension. Consult the

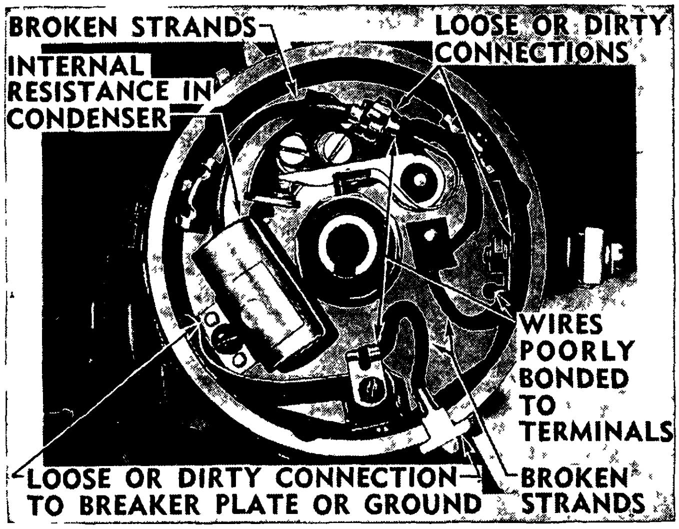


Fig. 3 Points of resistance in condenser circuit

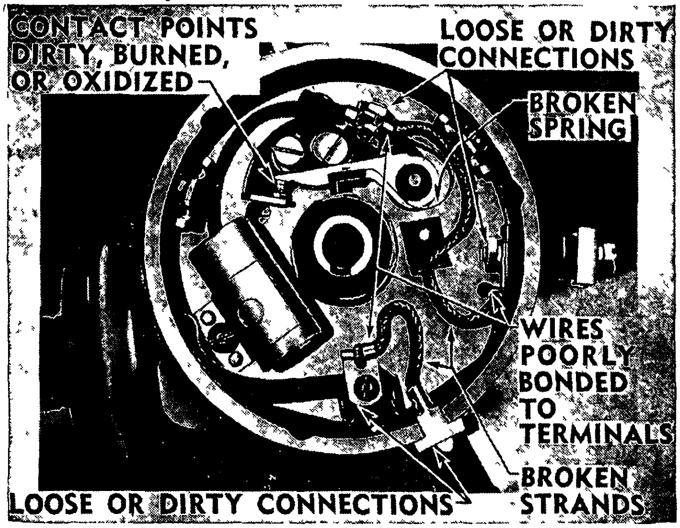


Fig. 4 Points of resistance in distributor primary circuit

Ignition chapter for the correct spring tension and the method of measuring same.

Breaker points in service for some time will appear dull and gray. This condition is normal, and points should not be replaced or filed if full contact of the mating surfaces is obtained.

If points do not meet squarely, align the contact surfaces by bending the contact arm.

Delco-Remy recommends that points that are blackened or slightly burned or pitted may be cleaned with a special stone or a clean point file. Auto-Lite, on the other hand, claim that their points are so hard that they should never be filed because minute pieces of file are broken off and imbed themselves in the contact surfaces, causing greater concentration of heat and welding of the steel to the contacts.

In filing points, remove the high spots only — it is not necessary to remove all traces of build-up or pit. Do not use emery cloth or sandpaper to clean points as the residue left on the points causes them to burn.

Excessively burned, pitted or worn points cannot be cleaned up and aligned satisfactorily. Therefore, they must be replaced to insure good ignition.

RESISTANCE TEST THROUGH PRIMARY CIRCUIT—Any abnormal resistance in the primary circuit of the distributor may be tested with a low-reading voltmeter. To do this, remove the distributor cap and turn over the engine until the breaker arm rubbing block is midway between any two cam lobes—which closes the points.

Connect the positive voltmeter lead to the distributor primary terminal, and the negative lead to ground on the engine. With ignition switch on, a reading of more than 1/10th of a volt indicates abnormal resistance at some point in the circuit.

Locate the source of any abnormal resistance by progressively eliminating parts of the circuit, Figs. 3 and 4, noting the result on the voltmeter. To do this, unclip the test lead from the primary terminal and connect it successively to all terminals and connections.

Source of resistance can be caused by dirty or corroded points, bad points, poor contact between the breaker plate and distributor housing, and between housing and engine. Remove the source of resistance by cleaning and tightening loose or corroded connections, or by replacement of parts as required.

SECONDARY CIRCUIT

This circuit consists of the coil, high tension wires, rotor, distributor cap and spark plugs.

COIL — The ignition coil terminals should be inspected to be sure they are tight and in good condition, the coil insulation checked for burned or chipped places or cracks, the coil case checked for loose seams, dents or punctures, and the coil tested electrically.

The coil must be tested at normal operating temperature because internal defects often fail to show up on a cold test. Coil testers are commercially available for this purpose and the manufacturers of such equipment provide full instructions as to their use.

The high frequency type coil tester is valuable in that it detects such defects as shorted primary or secondary coil turns, especially if only a few turns are shorted. A few shorted turns do not markedly affect the peak voltage which an ignition coil can produce, but they will seriously decrease the length of time each spark lasts, since shorted turns have a dampening effect.

In other words, the length in fractions of an inch of the spark may not change noticeably, but the length of time in fractions of a second that the spark lasts is considerably shortened by shorted turns in the coil windings.

Thus, a coil with shorted turns, while it could produce sparks of normal length, might not be able to provide good ignition because the sparks do not last long enough in the engine cylinder to ignite the fuel mixture properly.

It must be remembered, also, that an ignition coil with shorted turns in the primary or secondary winding is on the road to failure, since these shorted turns tend to overheat the coil, causing additional turns to become shorted. Finally, enough turns are shorted to cause complete coil failure. The high frequency coil tester, therefore, serves to detect ignition coils that are still good enough to operate the engine, but will very likely soon fail—possibly on the road.

DISTRIBUTOR CAP & ROTOR — Corrosion in the terminal sockets and on the segments of the distributor cap, or on the contact button and segment of the rotor, will cause high resistance in the secondary circuit and a weak spark at the plugs.

Widening of the gap between the rotor and cap segments, due to burning of these parts, will also cause high resistance. If they cannot be cleaned satisfactorily or if they are burned excessively, they should be replaced, using the following procedure:

1. Mark the location of the No. 1 cable on the distributor cap, remove the cap from the distributor and pull the cables from the cap.
2. Thoroughly inspect the cap for cracks and for carbon streaks caused by arcing of current between segments through moisture on the cap. Discard the cap if damaged or cracked. Remove carbon streaks by polishing with fine sandpaper and coating the cleaned area with distributor varnish.
3. Clean the inside of the cap terminal sockets, using sandpaper or a brush made for the purpose. Blow all dust out of sockets.
4. Clean corrosion from contact surfaces of terminal segments inside cap by scraping with a knife. Don't use emery cloth or sandpaper as the residue may cause burning of the segments.
5. Polish the contact button of the rotor with fine sandpaper. Clean edge of rotor segment with a knife, being careful not to remove any metal as this would increase the gap between the rotor and cap segments.
6. Wipe rotor and cap clean, and dry with a clean cloth. Do not wash in

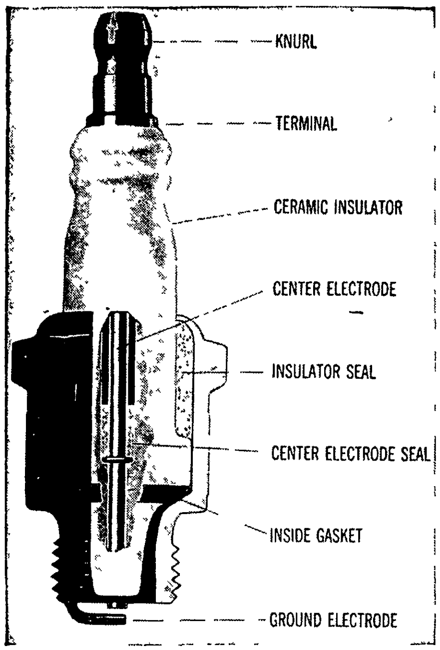


Fig. 5 A typical spark plug

cleaning solvent since this will damage the insulating properties of these parts.

7. Install rotor and cap on distributor.

IGNITION CABLES—Cracked, swollen or deteriorated cable insulation permits leakage of high voltage current, which causes weak sparks and loss of power. Such cables should be replaced, but be sure the new cables have ample current carrying capacity. It is advisable to install a complete new set, since the old cables will be deteriorated to about the same extent.

Wipe the cables with cloth moistened with kerosene. Bend the cables to check for cracks or loose or swollen insulation. Thoroughly inspect the terminals for corrosion, looseness or poor contact with wire strands.

If the cables are in good condition, clean any terminals that are corroded, and replace any terminals that are broken or distorted. Replace any broken or deteriorated rubber nipples.

Wash all oil out of recesses around spark plugs with kerosene or other solvent and blow out with air to dry thoroughly. Then install the cables in the following manner:

Starting with No. 1 cable in terminal socket previously marked for No. 1, install the cables in the distributor cap according to the firing order of the engine. If the distributor operates clockwise, install the cables in the distributor cap clockwise; if counter-clockwise, install cables thus. Push the ends of all cables into the terminal sockets.

Push rubber nipples (if equipped) down into place to seal the connections against entrance of moisture, which would cause corrosion of terminals. If the nipples grip the cables too close to the end so that they buckle when installed, they may pull the cables partially out of the sockets and cause arcing and corrosion.

SPARK PLUGS—Under normal operating conditions, spark plugs, Fig. 5, must be cleaned and adjusted every 3,000 to 5,000 miles. Ignition failure may result from using spark plugs too long before cleaning, or the space between shell and insulator may become so tightly packed with carbon or lead oxide deposits that proper cleaning is impossible.

Carbon or oxide deposits are conductors of electricity and may cause intermittent or steady missing, particularly at high speeds and on hard pulls.

Formation of hard carbon or oxide deposits on spark plugs is a normal operating condition, since they are products of combustion resulting from burning of the fuel. The hard carbon is usually black or gray, while the lead oxide deposits may be red, brown or yellow. Both may be accompanied by blistered spots on the insulator.

Slow speed driving during the new car "break-in" period, combined with oil leakage past the rings before they are worn to a good seat, may cause formation of soft carbon in the inner end of the spark plugs. Therefore, it is usually necessary to clean the plugs at the 1,000 and 2,000 mile inspection periods.

Excessive carbon formation after the "break-in" period may be caused by an over-rich carburetor or choke, faulty ignition, worn or scored piston rings, or by continuous slow speed driving. If slow speed driving is the cause, it is advisable to install a "hotter" plug.

If the car is driven continuously at high speeds the engine may operate better and give longer spark plug life with a "colder" plug.

Spark plug manufacturers provide for these conditions of continuous slow or high speed driving by making plugs with longer insulators for use in slow speed driving and shorter insulators for high speed driving, Fig. 6.

When removing or replacing spark plugs, use a wrench which fits the plug snugly. An oversize or worn wrench may distort the spark plug shell and crack the insulator. If a socket wrench is allowed to press against the outer end of the plug, the insulator will be cracked or broken.

Carefully inspect the insulators and electrodes of all spark plugs. Replace any plug which has a cracked or broken insulator, or with loose electrodes. If the insulator is worn away around the center electrode, or if the electrodes are burned or worn so they cannot be adjusted for proper gap, the plug is worn out and should be discarded.

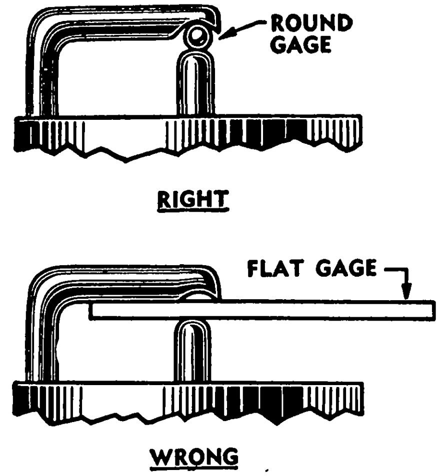


Fig. 7 Correct and inc r- rect spark plug gauges

Plugs which are in good condition except for carbon or oxide deposits should be thoroughly cleaned and adjusted.

To clean plugs, soak them in a carburetor cleaning solvent from 15 to 30 minutes. Thoroughly dry the interior of plugs with compressed air, then scrape out all carbon and oxide deposits from the shells and insulators with a pointed steel scraper. Blow out all scrapings and use sand-blasting equipment to complete the job. Manufacturers of sand blasters furnish complete instructions as to their use.

When adjusting spark plugs, use a round wire feeler gauge of the diameter specified by the manufacturer and as listed in the *Tune Up* chart in the car chapter. Flat feeler gauges will not give the correct measurement if the electrodes are worn (see Fig. 7). Adjust the gap by bending the side electrode only; bending the center electrode will crack the insulator.

IGNITION TIMING—The use of a timing light, Fig. 8, is recommended for checking and setting ignition timing. Timing that is set back as much as six degrees from the best setting will definitely decrease acceleration and top speed performance. See the car chapters for ignition timing details.

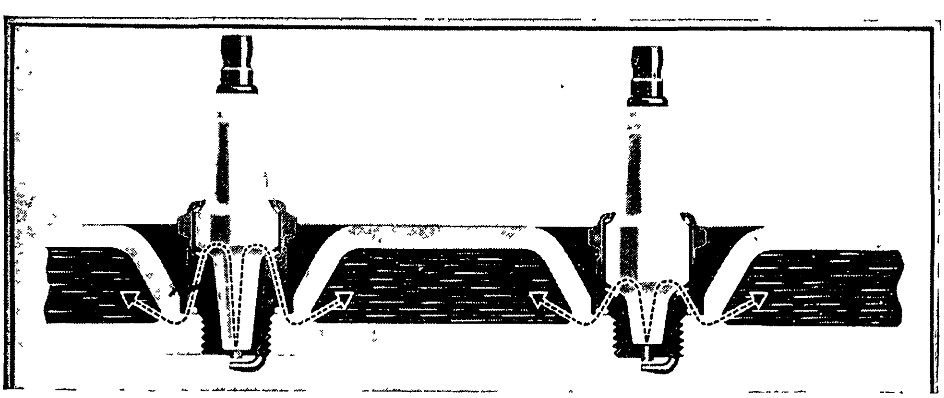


Fig. 6 H at range f spark plug is d t rmin d by the distance h at must travel fr m the c nter el ctr de t the cylinder h ad co lant. H t plug l ft, cold right

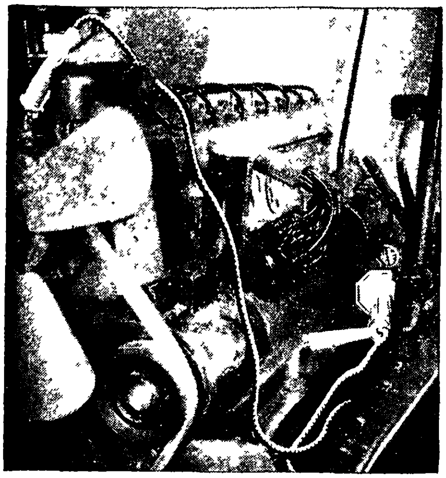


Fig. 8 Checking ignition timing with timing light

CARBURETION

Since carburetion is dependent in several ways on both compression and ignition, it should always be checked last when tuning an engine. See the *Carburetor* chapter for adjustments for the unit you are interested in.

Before adjusting the carburetor, consider the factors outlined below and which definitely affect engine performance.

CARBURETOR FLANGE — Check the flange for looseness on the manifold. If one of the flange nuts is loose as little as one-half turn, a sufficient amount of air will enter the intake manifold below the throttle plate to destroy engine idle and all engine performance.

If a tight fit cannot be obtained by tightening the nuts, install a new gasket but be sure that all the old gasket material has been removed.

THROTTLE LINKAGE—If the throttle linkage is adjusted so that the accelerator pedal will strike the floor board before the throttle plate is wide open, it will result in low top speed.

FUEL LINES—A restriction of the fuel line will result in an apparent vapor lock action or a definite cut-off of gasoline. This can generally be corrected by blowing out the line with compressed air. In some cases, it may be necessary to replace the line.

FUEL PUMP — The pump should be tested to make sure that it will draw an adequate supply of fuel from the tank and deliver it to the carburetor under all conditions of operation. If the pump functions inefficiently, proper adjustment and operation of the carburetor is impossible because the fuel will not be maintained at the prescribed level in the idle passages and main discharge jet (or jets) of the carburetor under all operating conditions.

FUEL TANK—The fuel tank should not be overlooked as a possible source of trouble with carburetion. A shortage of fuel at the fuel pump or carburetor may be caused by pieces of filling station pump hose or other material obstructing the mouth of the feed pipe in the tank, or by a restriction of the air vents in the filler cap and neck.

An unusual amount of dirt, water or gum in the fuel filter indicates that the tank is contaminated with these substances, which should be cleaned out to prevent future failure of the pump or carburetor.

HEAT CONTROL VALVE — The heat control valve performs an important function in carburetion during the warm-up period, Fig. 9. Carbon or rust formation around the shaft may cause the valve to stick or become sluggish in operation.

A valve sticking in the open position will cause slow engine warm-up, excessive spitting and sluggish engine operation when cold. A valve sticking in the closed position will cause overheating, loss of power and hard starting when the engine is hot, and may also cause warped or cracked manifolds. Sticking in either position will adversely affect fuel economy.

Grasp the counterweight and rotate the valve through its entire range. The valve must rotate freely and the shaft must have a slight end play. If the shaft is frozen in the manifold, free it up by gently tapping on the ends with a light hammer, and by rotating the counterweight at the same time.

Lubricate the shaft with a thin mixture of powdered graphite and alcohol or kerosene while moving the counterweight back and forth to work the lubricant into the bearings. *Do not use oil as this will form carbon and cause sticking of the valve.*

Inspect the thermostat and the anti-rattle spring to make sure they are properly assembled.

INTAKE MANIFOLD LEAKS — Leakage of air into the intake manifold at any point will affect carburetion and general engine performance. Air may leak into the manifold through the joints at the carburetor or cylinder head, cracks in the manifold, cracks or poor connections in the windshield wiper or windshield washer hose lines, or the connections of any accessories which may be connected to the manifold. All such joints should be tested for leaks.

To test the intake manifold for leaks, apply oil from an oil can along the gasket joints with the engine idling. An air leak is indicated when oil is drawn past the gaskets by the suction of the engine. Tighten the nuts or cap screws holding the manifold to the engine and retest for leaks. If tightening fails to stop the leaks, replace the manifold gaskets. If the new gaskets fail to stop the leaks, carefully inspect the manifold for cracks and test any suspicious area with oil.

AIR CLEANER—An air cleaner with a dirty element, or with oil that is dirty, too heavy, or too high in the sump, will restrict the air flow through the carburetor and cause a rich mixture at high speeds. In such a condition the air cleaner likewise will not properly remove dirt from the air, and the dirt entering the engine will cause rapid formation of carbon, sticking valves, and wear of piston rings and cylinder bores.

AUTOMATIC CHOKE—The choke mechanism must be inspected and cleaned to make sure it is operating freely. Sluggish action or sticking of the choke will cause excessive fuel consumption, poor performance during warm-up, and possibly hard starting.

The choke thermostat should be set in accordance with the average air temperature as well as the volatility of the fuel being used. It is desirable to have the thermostat set as lean as operating conditions permit in order to avoid an over-rich mixture during engine warm up. See the *Automatic Choke* chapter for details.

PERFORMANCE TEST

After an engine has been tuned up, the car should be given a thorough and systematic road test to make certain that engine power and performance are up to standard under all operating conditions. The gasoline used in making the test must be of good quality and proper octane rating in order to obtain the performance described in the following tests.

ENGINE WARM UP — On cars with automatic chokes, a cold engine should operate on fast idle for two to five minutes, depending upon air temperature.

At 32 deg. F. the fast idle cam should move to the slow idle position in approximately ½ to ¾ mile of driving. At higher temperatures, it should move to the slow idle position in a correspondingly shorter distance.

If the engine loads excessively or runs rich on warm up due to a rich choke setting, excessive fuel consumption, carbon formation, and spark plug fouling will result.

An engine which is adjusted for

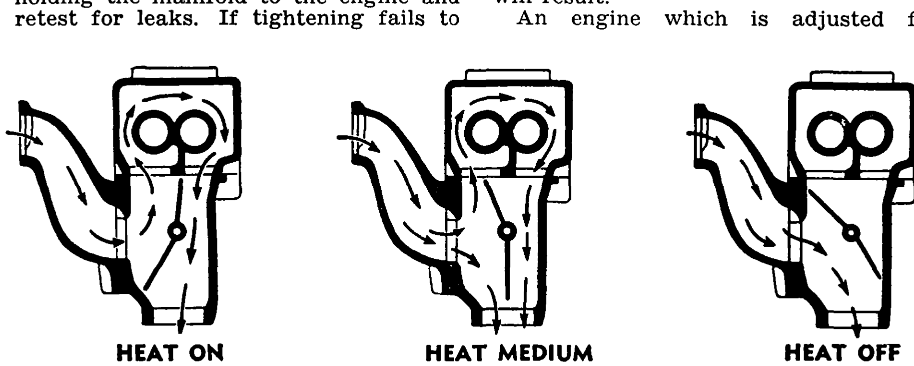


Fig. 9 Op rati n of a typical manifold heat contr l valv

smooth idling in cold outside temperature will not idle smoothly for any length of time in a warm building, since the required carburetor adjustment will cause richness of mixture in the warmer atmosphere.

IDLE PERFORMANCE TEST—The engine must idle smoothly in outside air even though the carburetor adjustments required to accomplish this causes the engine to roll slightly from richness when idled for any length of time in a warm shop.

With the engine warmed up to operating temperature, drive the car on a level road or on a slight upgrade. With the transmission in high gear and throttle closed the car should idle smoothly at 8 m.p.h. without surging, missing or bucking.

If this test is performed on a slight downgrade, a slight buckle may occur when the car speed equals the engine speed so that the engine is operating alternately with and without a load.

GRADUAL ACCELERATION TEST—Starting at idling speed in high gear, gradually open the throttle to increase smoothly the speed of the car through the entire range. Note any roughness, flat spots, or surging in engine performance during acceleration, and the speed at which the unusual condition occurs.

Roughness or poor performance at speeds below 20 m.p.h. indicates improper carburetor idle adjustment, restriction in idle passages in carburetor, tight valve lash or sticking valves, or faulty ignition.

Faulty ignition usually causes a more pronounced roughness than imperfect compression or carburetion.

Roughness or poor performance at speeds above 20 m.p.h. indicates restriction or improper settings in the high speed circuit of the carburetor, or faulty ignition.

WIDE OPEN THROTTLE ACCELERATION TEST—With the car running at idling speed in high gear, quickly press the accelerator pedal to the floor and hold it there, meanwhile noting the performance of the engine as the car is accelerated. Repeat the acceleration test, starting at different constant speeds throughout speed range of car. The car should accelerate smoothly without hesitation, spitting, or loading of the engine.

A hesitation, spitting, or a flat spot indicates that the accelerating pump is not discharging sufficient gasoline into the engine. Sluggishness or loading indicates that the accelerating pump is adjusted too rich.

CONSTANT SPEED TEST — Hold the car speed constant at various points through the speed range and note engine performance. The engine should operate smoothly without hesitation or surging under load at all constant speeds.

At some point between 15 and 22 m.p.h. with the car rolling along on a level road or slight upgrade, a slight leanness, surging or missing may be detected. Depressing or releasing the accelerator pedal slightly will eliminate this condition and no attempt should be made to correct it by altering carburetion or ignition. This condition seldom appears in the normal operation of the car.

With Carter carburetors, a surging or loss of power at 55 to 65 m.p.h. constant speed indicates that the metering rod adjustment is too lean. This may occur even though top speed performance is satisfactory.

With Stromberg carburetors, surging at 75 to 80 m.p.h. constant speed indicates that the power jet is stopped up or the vacuum piston is sticking.

SPARK KNOCK — Light detonation or spark knock will occur when operating with part throttle on a hard pull, even though the ignition is properly timed and Ethyl or other high octane fuel is used. Light detonation also will occur when accelerating with fully opened throttle on a hard pull. These operating conditions are normal and no attempt should be made to eliminate light detonation by retarding the ignition timing.

If regular or low octane fuel is used, detonation will probably be excessive with the standard ignition timing, and it may be necessary to retard the timing, which will reduce fuel economy and over-all performance.

Extreme heavy detonation is injurious to any automobile engine. A car driven continuously under conditions and fuels which produce heavy detonation will overheat and lose power, with the possibility of damage to pistons and bearings.

VALVE NOISE — With the valves adjusted uniformly to specifications, the noise level should be very low as observed in the car while driving. The sound of valve action should be audible, however, when the hood is raised or when the engine is operating on fast idle during warm up.

The valve lash should not be reduced below specifications in an attempt to eliminate valve noise, as this will cause formation of carbon on valve seats and stems, which will then increase valve noise and lower the engine performance.

Sticking valves usually are indicated by an intermittent loudness of action, although the valves will be unusually noisy at all times if they are sticking badly. Sticking valves will cause irregular operation or missing on a low speed pull.

MINOR TUNE UP

A minor engine tune up is intended as a preventive measure for engines which are in fairly normal condition. It is usually good on cars having low mileage or on those which have traveled 5,000 miles or so since having a major tune up. The frequency of use depends upon the conditions under which the car is operated. A minor tune up should include the following items:

1. Check battery electrolyte specific gravity and level.
2. Inspect battery terminals and cables.
3. Inspect primary wires and ignition switch.
4. Clean coil and terminal socket.
5. Inspect distributor automatic advance weight mechanism.
6. Inspect distributor vacuum control.
7. Clean and adjust distributor contact points, lubricate cam wick and rubbing block.
8. Reset ignition timing.
9. Inspect and clean distributor cap and rotor.
10. Inspect ignition cables.
11. Clean and adjust spark plugs, or install new plugs if required.
12. Clean fuel strainer and filters.
13. Inspect and lubricate manifold heat control valve.
14. Check for intake manifold air leaks.
15. Clean and/or refill air cleaner.
16. Inspect and set choke thermostat.
17. Check fast idle cam and choke unloader adjustments.
18. Lubricate carburetor countershaft (Carter).
19. Check starter vacuum switch timing (if equipped).
20. Adjust throttle linkage.
21. Adjust carburetor.
22. Inspect and adjust fan belt.
23. Inspect water pump, radiator and car heater hose connections, and radiator water level.
24. Clean oil filler cap.
25. Test performance after tune up.

THE IGNITION SYSTEM on all passenger cars can be divided as follows, Fig. 1.

1. Battery to supply current.
2. Ignition wiring to carry current to the units in the system.
3. Ignition switch to control the circuit.
4. Ignition coil to increase the voltage delivered to the spark plugs.
5. A distributor to distribute current to each cylinder.
6. Spark plugs to ignite the fuel in each cylinder.

But inasmuch as the *Tune Up* chapter deals with such service as comes within the province of tuning up an engine—such as batteries, spark plugs, testing procedures, etc.—this chapter will discuss the functions and service requirements of the distributor itself, together with any additional data not included in the *Tune Up* chapter.

Since Auto-Lite and Delco-Remy distributors are quite similar in design, they are treated together. Ford distributors are discussed separately.

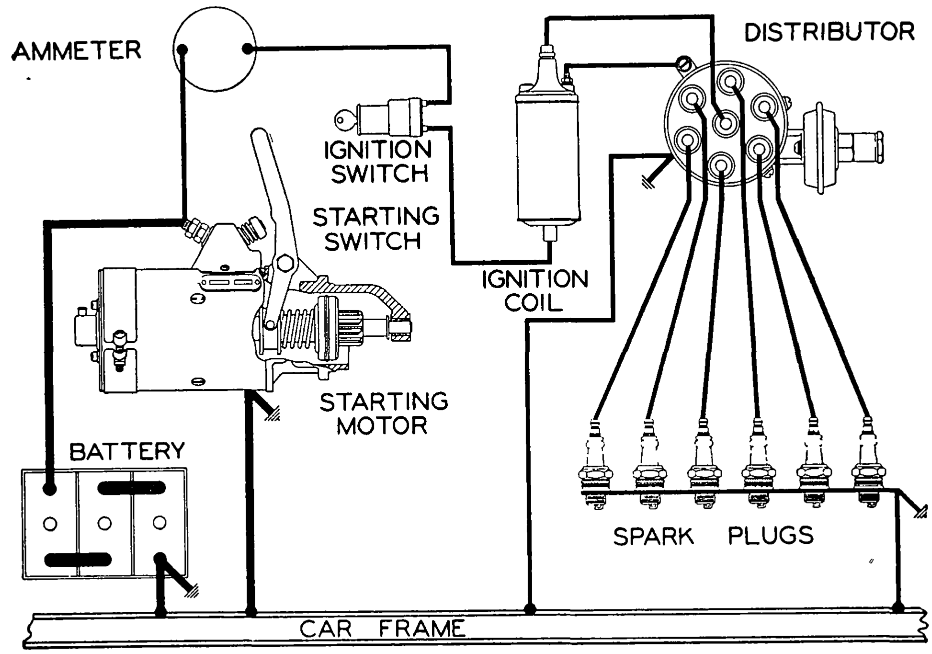


Fig. 1 Wiring circuit of a typical six-cylinder battery igniti n circuit

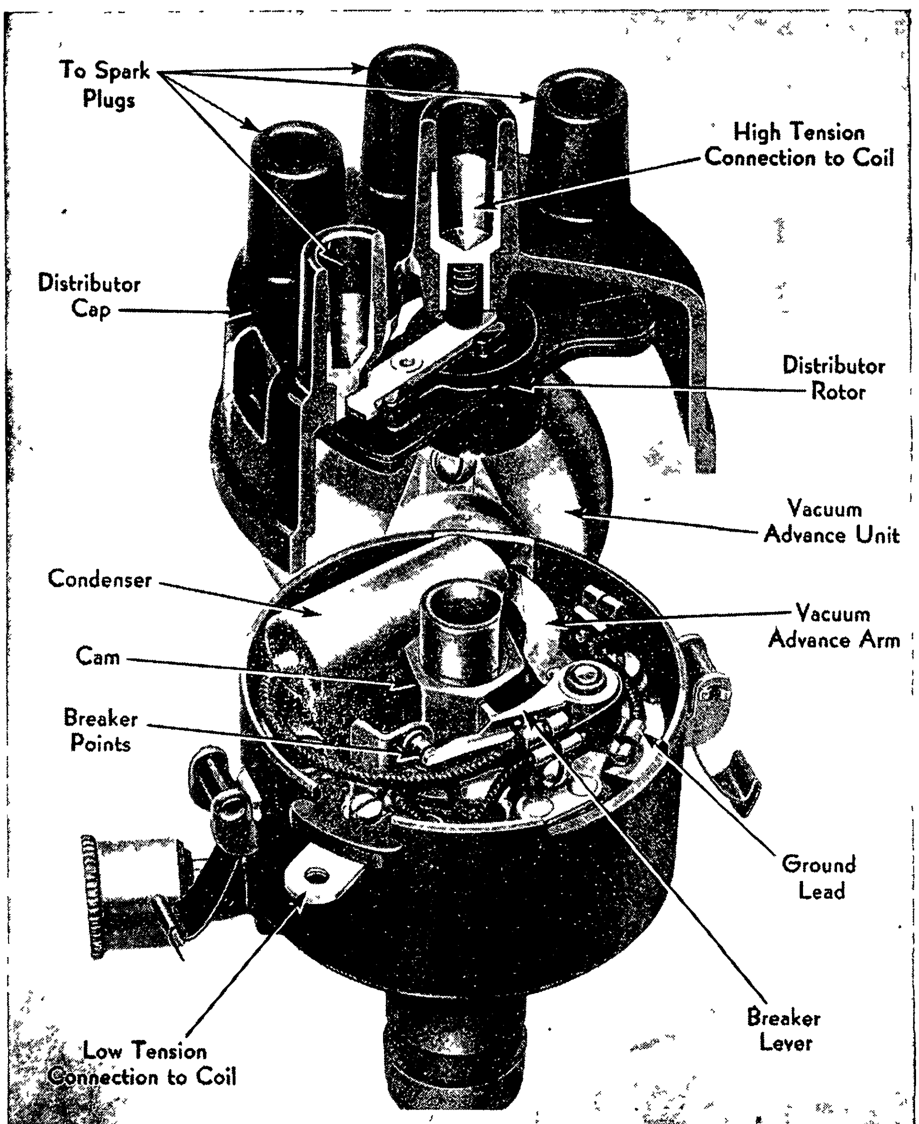


Fig. 2. C mp nents f a typical Auto-Lite distributor

AUTO-LITE & DELCO-REMY

DISTRIBUTOR REMOVAL—If the inspections and tests given in the *Tune Up* chapter indicate that the distributor requires cleaning or the installation of new parts, remove the distributor from the engine so that the work can be done properly.

Each time a distributor is removed and reinstalled, or when a new one is installed, it is essential that it be properly timed. Determine whether the timing mark is on the flywheel, on the vibration damper or on the lower fan pulley. To make it easily visible, clean the mark and trace a narrow line on it with chalk or white paint.

1. Remove the spark plugs to relieve the compression and crank the engine to the firing position for No. 1 cylinder.
2. Trace the No. 1 spark plug wire to its terminal in the distributor cap.
3. Mark the distributor housing directly under this terminal, either by scratching with a screw driver or by a chalk mark so that the rotor position for No. 1 cylinder will be known when the distributor is reinstalled.
4. Release the distributor cap clamps and raise the cap (with wires attached) and note the position of the rotor. Its segment should be directly over the mark previously made on the distributor housing. If not, the distributor drive shaft gear or coupling is broken or the drive pin sheared.
5. Disconnect the primary wire at the distributor terminal.

6. Remove the vacuum advance connection (if equipped) and remove the distributor clamp hold-down bolt.
7. Raise the distributor as a unit from its mounting.

DISTRIBUTOR DISASSEMBLY — The disassembly procedure on any of these distributors is fairly obvious and easy. On some of the units, there is a rather complex stack-up of insulating, flat and lock washers at the terminals, but a few moments study of this before the parts are detached from each other will aid in reassembling them correctly. See Figs. 2 and 3.

The first step in disassembly is to remove the cap and rotor, if not already done. Next, the vacuum advance mechanism. Then the breaker plate together with the contact points and condenser should be detached from the housing. The drive gear or coupling may then be removed from the drive shaft, and the drive shaft with its centrifugal governor mechanism lifted from the housing. Further disassembly of the breaker plate and governor mechanism is obvious.

At this time, the parts should be inspected, tested, assembled and adjusted in the manner described in subsequent paragraphs. Then the distributor should be installed and timed with the engine in the following manner.

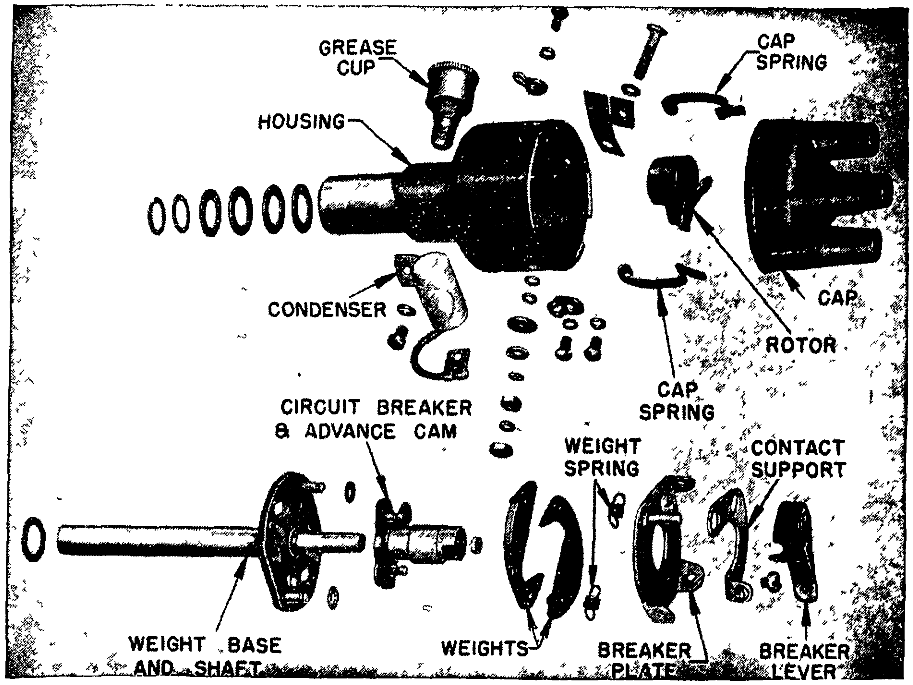


Fig. 3 Exploded view of a typical Delco-Remy distribut r

DISTRIBUTOR INSTALLATION & TIMING — Before installing the distributor, check the timing mark on the flywheel, vibration damper or pulley to be certain that the engine has not been rotated while the distributor was off, and that it still remains set on the timing mark for No. 1 cylinder.

If a new distributor is being installed, scratch or chalk a mark on it to correspond to the mark made on the old distributor and use this mark as a guide for the initial position of the rotor as the new distributor is temporarily set in place.

Temporarily set the distributor in its mounting with cap removed, being careful to see that the primary terminal and the vacuum control (if used) are in position to connect to the wire and pipe, respectively. However, do not connect them at this time.

With the rotor in approximately the same position as when the distributor was installed (in line with the mark on the distributor housing), allow the distributor to settle down to its permanent position in the mounting, being certain that the screw hole for the clamp hold-down bolt is in the center of the clamp slot.

In the case of a gear-driven distributor, notice that the rotor will move from the position in which it was set as the distributor is moved into position. When this occurs, raise the distributor and turn the rotor just far enough beyond the desired position to allow for the change made by the gear movement, and again set the distributor in place. Install the hold-down screw. Connect the primary wire to its terminal, and the vacuum pipe to the vacuum control. The distributor should now be properly timed.

However, to compensate for the grade of fuel being used, and for best performance and fuel economy, it may be necessary to alter the timing slightly from the original setting. The best setting is one which will produce a slight spark knock or "ping" when accelerating from about 10 M.P.H. with wide open throttle. (See the *Tune Up* chapter for other methods of setting ignition timing.)

CONTACT POINTS—The normal color of contact points should be light gray. If the contact point surfaces are black, it is usually caused by oil vapor, or grease from the cam. If they are blue, the cause is usually excessive heating due to improper alignment, high resistance or open condenser circuit.

Figs. 4, 5 and 6 show the condition of contact points after they have been in operation for several thousand miles. These illustrations illustrate the difficulty of setting contact points correctly with a feeler gauge. Unfortunately, points do not wear evenly, and with each thousand miles of operation, the surfaces deviate from being parallel with each other. Fig. 4 shows what happens when points are not in correct alignment—they lap over each other.

Fig. 5 shows uneven wear of the contact surfaces, while Fig. 6 pictures the development of a crater and projection, usually caused by a metal transfer from one point to the other.

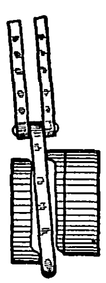


Fig. 4 C ntacts ut of alignment. A flat .020" gauge spaces c ntacts .030" to .040"

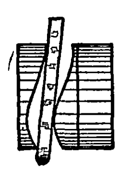


Fig. 5 Contacts worn un v nly. A flat .020" gauge spac s c ntacts .030" t .050"

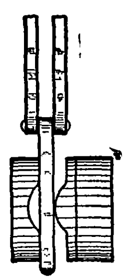


Fig. 6 Contacts pitt d. A flat .020" gauge spaces c ntacts .040" to .050"

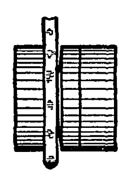


Fig. 7 Only Contacts c rrectly aligned can b c rr ctly spac d with gauge. New c ntacts are usually made up f one c nvex surfac p rating against n with a flat surfac

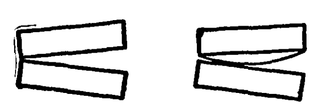


Fig. 8 Sh wing advantage of empl ying ne convex point (right) as against two flat p ints (l ft) wh n points are misaligned

AUTO-LITE DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch Note E	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data Dist. Degrees @ In. of Mercury	
						Advance Starts	Full Advance	Advance Starts	Full Advance
AMERICAN BANTAM & AUSTIN									
1935	1GB-4086A	46	.020	.20-.25	17-20	2 @ 500	11 @ 1400	None	None
1936-39	1GW-4105A	41	.020	.20-.25	17-20	1 @ 600	5 @ 1800	None	None
1936-39	1GW-4105B	41	.020	.20-.25	17-20	3 @ 820	11 @ 1800	None	None
1940-41	1GW-4105C	41	.020	.20-.25	17-20	2 @ 800	10 @ 2400	None	None
CHRYSLER									
1935, C6	1GS-4001-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1350	2 @ 7⅝	8 @ 12
1935, C6	1GS-4001A-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1530	2 @ 7⅝	8 @ 15
1935, CZ-1-2	1GT-4001-1	27-30	.017	.25-.28	17-20	3 @ 400	13 @ 1650	1 @ 6¼	6 @ 12
1935, C1-2	1GT-4001B-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1200	1 @ 6¼	6 @ 12
1935, C1-2	1GT-4002A-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1200	1 @ 6¼	6 @ 12
1935, C3	1GT-4001A-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1250	2 @ 7¼	8 @ 14
1936, C7	1GS-4006-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1530	2 @ 7⅝	8 @ 15
1936, C7	1GS-4006A-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 7⅝	8 @ 15
1936, C8	1GT-4001-1	27-30	.017	.25-.28	17-20	3 @ 400	13 @ 1650	1 @ 6¼	6 @ 12
1936, C8	1GT-4001D-1	27-30	.017	.25-.28	17-20	3 @ 400	13 @ 1900	1 @ 6¼	6 @ 12
1936, C9-10-11	1GT-4001C-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1600	1 @ 7	5 @ 14
1936, C9-10-11	1GT-4001E-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1850	1 @ 6¼	6 @ 12
1937, C16	1GS-4010-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 6¼	10 @ 12
1937, C14	1GT-4001D-1	27-30	.017	.25-.28	17-20	3 @ 400	13 @ 1900	1 @ 6¼	6 @ 12
1937, C14	1GT-4001G-1	27-30	.017	.25-.28	17-20	3 @ 400	10 @ 1450	1 @ 6⅝	6 @ 14
1937, C14	1GT-4001J-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1600	1 @ 6	7 @ 12
1937, C15	1GT-4001F-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1850	1 @ 6¼	6 @ 12
1937, C17	1GT-4001E-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1850	1 @ 6¼	6 @ 12
1938, C18	1GS-4010C-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 6	7 @ 12
1938, C19	1GT-4001K-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 2000	2 @ 7¾	8 @ 16
1938, C20	1GT-4001F-1	27-30	.017	.25-.28	17-20	3 @ 400	11 @ 1850	1 @ 6¼	6 @ 12
1939, C22	1GS-4102-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 6	7 @ 12
1939, C22	1GS-4102D-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 7¼	11 @ 17
1939, C23	1GT-4101-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 7¼	8 @ 14
1939, C23	1GT-4101A-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 8	8 @ 17
1939, C24	1GT-4101B-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 7	6 @ 17
1940, C25	1GS-4108A-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 7¼	11 @ 17
1940, C25	1GS-4108-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1940, C26	1GT-4101A-2	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 8	8 @ 17
1940, C27	1GT-4101B-2	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 7	6 @ 17
1941, C28	1GS-4113-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1941, C28	1GS-4202-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1941, C30	1GT-4103-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 8	8 @ 17
1941, C33	1GT-4103A-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	1 @ 7	6 @ 17
1942, C34	1GS-4202C-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1400	2 @ 7½	9 @ 16
1942, C34	1GS-4202B-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1530	2 @ 7¼	9 @ 15
1942, C36-37	1GT-4201B-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 7¼	10 @ 16
1942, C36-37	1GT-4201-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 8	8 @ 17
1946-48, C38	1GS-4208A-1	35-38	.020	.25-.28	17-20	3 @ 400	12 @ 1530	2 @ 7¼	9 @ 15
1946-48, C39, C40	1GT-4201-1	27-30	.017	.25-.28	17-20	3 @ 400	12 @ 1750	2 @ 8	8 @ 17
1949-50 C45, C48	IAP-4102C-1	35-38	.020	.25-.28	17-20	1 @ 450	11 @ 1550	1 @ 6	9 @ 15
1949-50, C46, C49	IAR-4101-1	27-30	.017	.25-.28	17-20	1 @ 450	10 @ 1550	2 @ 8	8 @ 17
1949-50, C47, C50	IAR-4101-1	27-30	.017	.25-.28	17-20	1 @ 450	10 @ 1550	2 @ 8	8 @ 17
1950 Six	IAT-4004	35-38	.020	.25-.28	17-20	1 @ 450	10 @ 1425	2 @ 7¼	9 @ 15
1951-52 Six	IAT-4012	35-38	.020	.25-.28	17-20	1 @ 450	10 @ 1425	2 @ 7¼	9 @ 15
1951-52 V8	IAZ-4001-A	(A)	.018	.25-.28	17-20	3½ @ 500	13½ @ 1700	1 @ 6	11½ @ 17

A—Each set 27½-30 degrees; total dwell angle of both sets, 34-36 degrees.

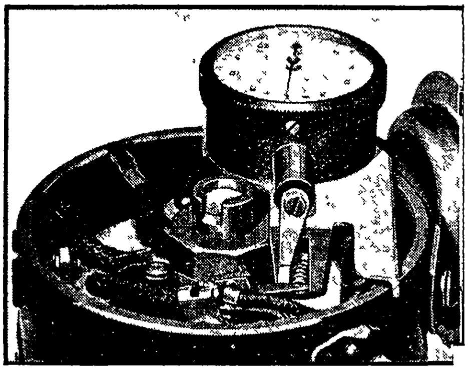


Fig. 9 Dial indicator for measuring c ntact p int pening on Delco-Remy distribut rs. A similar device is available f r Auto-Lite Distributors

Fig. 7 shows an enlarged view of a new set of contact points. The right-hand contact has a convex surface, while the left-hand point has a flat surface. This convexity is scarcely visible to the naked eye as it amounts to approximately .002 inch from the center of the point to its outside extremity. The advantage claimed for this design is that the contact of surfaces which break the arc will be nearer to the mass of metal in the two contacts, which gives better heat radiation. A further advantage is that should the points be misaligned, more metal will be in contact when a convex point is used than if both points were flat. Fig. 8 illustrates how this is accomplished.

Auto-Lite is strongly against filing of contact points, because the cutting surface of the file produces high spots on the contact surfaces, which means concentration of current and heat in extremely small areas.

Delco-Remy recommends that contact points which are blackened or slightly burned or pitted should be cleaned with a special point dressing stone or a clean contact point file. In dressing the points, remove the high spots only, as it is not necessary to remove all traces of build-up or pit.

Sandpaper or emery cloth should never be used to clean up points, since particles of sand or emery may imbed in the points and cause rapid burning and wear.

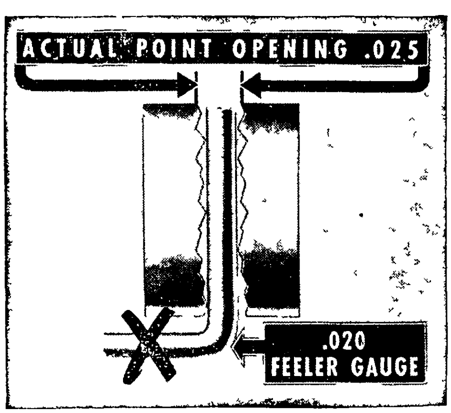


Fig. 10 Why fe ler gaug will n t pr vid accurate point spacing if p ints are r ugh

Specifications for contact point opening, *as measured with a wire gauge,* are given in the *Tune Up* table in each car chapter. However, if at all possible, this opening should be set on a distributor test fixture or a dial indicator, Fig. 9. This not only eliminates the possibility of a wrong gap setting, but if the points are slightly rough but otherwise in alignment, there is the danger of obtaining an incorrect gap, as shown in Fig. 10.

The advantage of a distributor test fixture or dial indicator is that it not only measures cam angle or dwell, Fig. 11, but it also uncovers irregularities between cam lobes, bouncing of contact points, alignment or rubbing block with cam, alignment of contacts, and breaker arm spring tension. Manufacturers of such equipment furnish complete instructions as to their use.

If the contacts develop a crater or depression on one point and a high spot of metal on the other, the cause is an electrolytic action transferring metal from one contact to the other, Fig. 12. This can be the result of some unusual operation of the car. A slow speed driver in city traffic or door-to-door delivery vehicles will be one extreme, and high speed long distance driving would be the other extreme. It may also be due to an unbalanced ignition system, which can sometimes be improved by a slight change in the condenser capacity.

If the mound is on the positive point, Fig. 13, install a condenser of greater capacity; if the mound is on the negative point, Fig. 14, install a condenser of lesser capacity.

One of the most prevalent causes of contact point failure is the presence of oil or grease on the contact surfaces, usually from over-lubrication of the wicks at the top of the cam, or too much grease on the rubbing block. This condition is indicated by a smudgy line on the point support and breaker plate, Fig. 15. If caught in time the contacts can be cleaned and the residue left on them can be wiped off by drawing a piece of lint-free tape between the contacts.

When new contacts are installed, the breaker arm should be free on the hinge pin, the contacts lined up with the outside diameters registering perfectly, and contact made in the center of the contact surfaces. This can be done by bending the contact support. Never bend the contact arm between the rubbing block and contact.

The rubbing block should be lined up with the cam by using a thin strip of white paper and carbon paper, held between the rubbing block and cam. By rotating the cam against the paper, a carbon impression will be made, showing which way the arm should be bent between the hinge pin and rubbing block to obtain correct alignment. When a straight-line impression is obtained from top to bottom of the rubbing block against the cam, even though it may be on only one edge of the block, it will be unnecessary to "run in" the block to improve the contact.

Breaker arm spring tension is extremely important. If the tension is too great, the arm will bounce, causing an interruption of the current in the coil and missing in the engine. If the spring tension is not sufficient, the rubbing

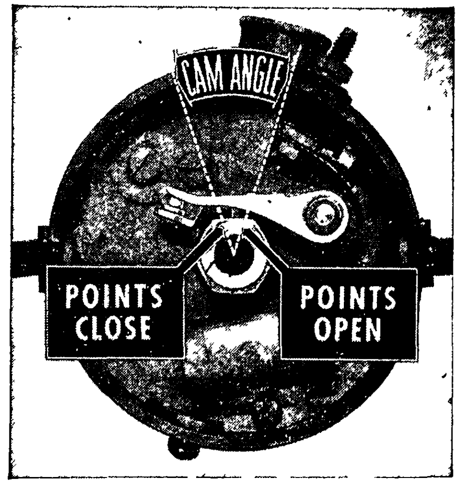


Fig. 11 Cam angle or dw ll is th number of degrees of breaker cam r tati n from th time the points close until th y pen again

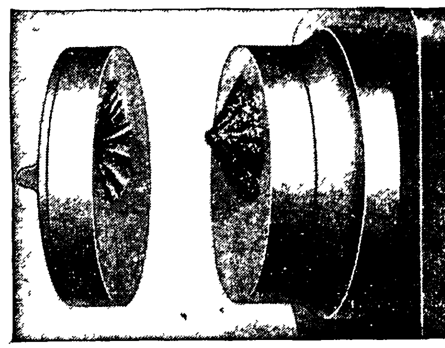


Fig. 12 Showing how metal fr m on contact point transfers t the th r

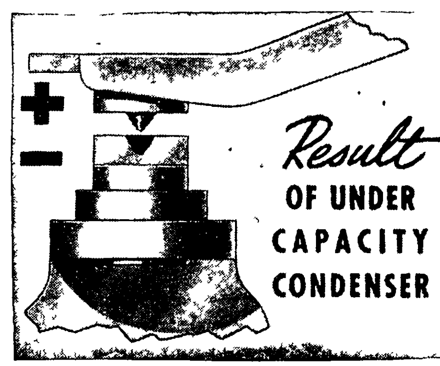


Fig. 13 Mound on p sitive p int

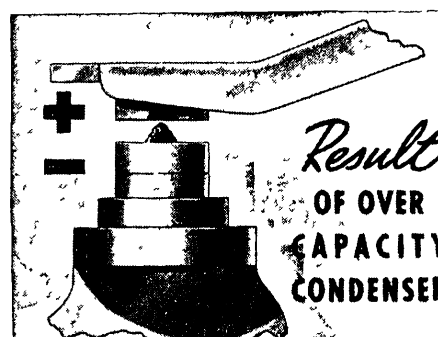


Fig. 14 M und n negativ p int

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch Note E	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data Dist. Degrees @ In. of Mercury	
						Advance Starts	Full Advance	Advance Starts	Full Advance
CROSLEY									
1939–42	1GW-4142A	46	.020	.20–.25	17-20	3 @ 480	14 @ 2300	None	None
1946–48	1GW-4181	46	.020	.20–.25	17-20	3 @ 515	12 @ 1000	None	None
1946–47	1GW-4181A	46	.020	.20–.25	17-20	3 @ 515	12 @ 1000	None	None
1949	1GW-4181B	46	.020	.20–.25	17-20	3 @ 515	12 @ 1000	None	None
1949–52	1GW-4181C	46	.020	.20–.25	17-20	3 @ 515	12 @ 1000	None	None
DE SOTO									
1935	1GS-4001-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1350	2 @ 7⅝	8 @ 15
1935	1GS-4001A-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1530	2 @ 7⅝	8 @ 15
1936	1GS-4006-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1530	2 @ 7⅝	8 @ 15
1936	1GS-4006A-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 7⅝	8 @ 15
1937–38	1GS-4010-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 6¼	10 @ 12
1938	1GS-4010C-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6	7 @ 12
1939	1GS-4102-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6	7 @ 12
1939	1GS-4102C-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1940	1GS-4108-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1941	1GS-4113-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1941	1GS-4202-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	1 @ 6½	7 @ 15
1942	1GS-4202A-1	35–38	.020	.25–.28	17-20	3 @ 400	11 @ 1400	1 @ 6⅝	6 @ 14
1942	1GS-4202C-1	35–38	.020	.25–.28	17-20	3 @ 400	11 @ 1400	2 @ 7½	9 @ 16
1946–48	1GS-4208-1	35–38	.020	.25–.28	17-20	3 @ 400	11 @ 1400	1 @ 6⅝	6 @ 14
1949–50	1AP-4102C-1	35–38	.020	.25–.28	17-20	1 @ 450	11 @ 1550	1 @ 6	9 @ 15
1950	1AT-4004	35–38	.020	.25–.28	17-20	1 @ 450	10 @ 1425	2 @ 7¼	9 @ 15
1951–52 Six	1AT-4012	35–38	.020	.25–.28	17-20	1 @ 450	10 @ 1425	2 @ 7¼	9 @ 15
1952 V8	1AZ-4002	A	.018	.25–.28	17-20				
A—Each set 27½-30; total dwell angle of both sets 34-36 degrees.									
DODGE									
1935–36	1GS-4002-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1530	2 @ 6¾	8 @ 12
1936–38	1GS-4002A-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 6¾	8 @ 12
1939	1GS-4101A-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 6¾	8 @ 12
1939	1GS-4101C-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 7¾	8 @ 16
1940	1GS-4107-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 7¾	8 @ 16
1941	1GS-4112-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 7¾	8 @ 16
1941	1GS-4203-1	35–38	.020	.25–.28	17-20	3 @ 400	12 @ 1750	2 @ 7¾	8 @ 16
1942	1GS-4203A-1	35–38	.020	.25–.28	17-20	3 @ 400	9 @ 1300	2 @ 7	9 @ 14
1942	1GS-4203B-1	35–38	.020	.25–.28	17-20	3 @ 400	10 @ 1150	2 @ 7⅝	8½ @ 16
1946–48	1GS-4207A-1	35–38	.020	.25–.28	17-20	3 @ 400	10 @ 1150	2 @ 7⅝	8½ @ 16
1949–50, D30, D34	1GS-4207B-1	35–38	.020	.25–.28	17-20	3 @ 400	10 @ 1150	2 @ 7⅝	8½ @ 16
1949–50, D29, D33	1AP-4103A-1	35–38	.020	.25–.28	17-20	1 @ 450	11 @ 1550	1 @ 6	8 @ 14
1950	1AT-4003	35–38	.020	.25–.28	17-20	1 @ 450	10 @ 1425	1 @ 5½	8 @ 14
1951–52	1AT-4011	35–38	.020	.25–.28	17-20	1 @ 450	10 @ 1425	1 @ 5½	8 @ 14
FRAZER									
1947–48	1GS-4211	35–38	.020	.20–.25	17-20	1 @ 365	10 @ 1700	2 @ 9½	7½ @ 14
1949–51	1GS-4214	35–38	.020	.20–.25	17-20	1 @ 450	9 @ 1675	1 @ 11	5@ 15
HENRY J									
1951–52 Four	1AT-4008-A	41	.020	.21–.25	17-20	1 @ 400	11 @ 2000	1 @ 5⅜	5 @ 8
1951–52 Six	1AT-4007	35–38	.020	.21–.25	17-20	1 @ 380	12 @ 1500	1 @ 5½	6 @ 15
HUDSON AND TERRAPLANE									
1935 Six	1GB-4301A	35–38	.020	.20–.25	17-20	4 @ 825	15 @ 2000	None	None
1935–36 Six	1GB-4301B	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1580	None	None
1935 Eight	1GP-4001A	27½–30	.017	.20–.25	17-20	4 @ 765	17½ @ 2000	None	None
1935–36 Eight	1GP-4001B	27½–30	.017	.20–.25	17-20	3 @ 400	17½ @ 1700	None	None
1937, 71	1GW-4012A	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1580	None	None
1937, 72, 73	1GW-4013A	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1850	None	None
1937–40 Eight	1GP-4008A	27½–30	.017	.20–.25	17-20	3 @ 400	17½ @ 1700	None	None
1938, 81, 89	1GW-4104A	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1580	None	None
1938, 82, 83	1GW-4103A	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1580	None	None
1939, 90	1GW-4125A	35–38	.020	.20–.25	17-20	3 @ 400	14 @ 1580	None	None

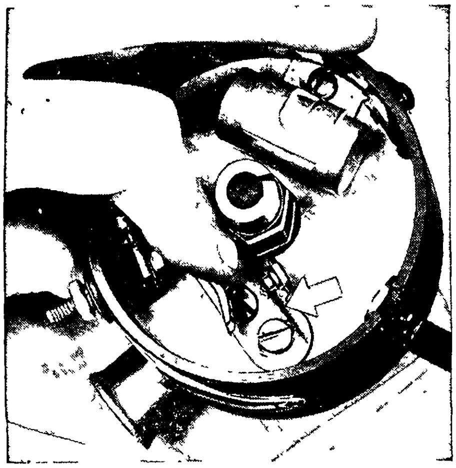


Fig. 15 Oil n c ntact points shown by smudgy lin n p int support and breaker plate

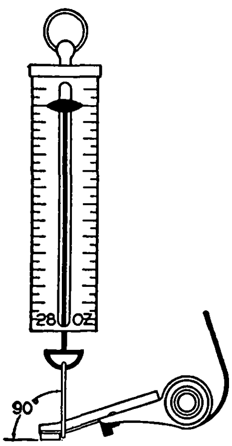


Fig. 16 Measuring breaker arm spring tension

block will not follow the cam, causing a variation in the cam angle. The spring tension should always be set at the high limit given in the *Distributor Specification* tables, as it will be reduced as the rubbing block wears. Fig. 16 illustrates how the tension is measured.

CONDENSER—A condenser should not be condemned because the points are burned or oxidized. Oil vapor, or grease from the cam, or high resistance may be the cause of such a condition.

Condensers should be tested with a good condenser tester for leakage, break-down, capacity, and resistance in series in the condenser circuit. Manufacturers of condenser testers furnish complete instructions as to their use.

IGNITION COIL—The function of the ignition coil is to increase the voltage supplied by the car battery high enough to jump the gap of the spark plug to start combustion.

Fig. 17 is a sectional view of an Auto-Lite coil. The secondary winding (inner) consists of approximately 21,000 turns of fine copper wire wound around a soft iron core, either laminated flat iron pieces or round iron wires. The primary winding (outer) consists of approximately 240 turns of comparatively heavy copper wire wound over the outside of the secondary winding. A soft iron shell encloses the outside of both windings and serves to complete the magnetic circuit.

Current is induced in the coil secondary by magnetic lines formed by the primary winding, cutting the turns of the secondary winding.

Moisture inside of any ignition coil is probably the principal factor that determines coil life. Ignition coils are subjected to rain, snow, road splash, and high pressure cleaning devices used in shops and garages. Moreover, some moisture gets inside the coil from condensation, and the normal breathing of the coil caused by temperature change.

Some Delco-Remy coils are filled with transformer oil and hermetically sealed to prevent the entrance of moisture. A large porcelain insulator is used at the secondary terminal to provide effective insulation.

When a coil secondary circuit is open, as when a spark plug cable is disconnected and not grounded, the voltage may be as high as 20,000 volts, which greatly increases the electrical strain on the coil, and if continued for more than a few minutes, may cause coil failure.

The polarity of the high tension terminal of the coil is important, as some car manufacturers specify positive polarity and others negative polarity. A reversal of this polarity when connecting the coil, or when replacing the coil, may affect the performance of the engine (or the radio).

A simple method of testing coil polarity on the car with a voltmeter is shown in Fig. 18. The voltmeter positive lead is connected to the high tension tower of the coil through a resistance of from 17,000 to 25,000 ohms (a radio suppressor of not less than 17,000 ohms is suitable for this purpose). The voltmeter negative lead is connected to the coil primary terminal that is connected to the distributor. With this connection, the voltmeter is across the coil high tension windings.

With the distributor contact points closed, turn the ignition switch on—which will cause the current to flow through the primary winding of the coil. Then turn off the ignition switch and note the movement of the voltmeter pointer. If it moves up the scale, the coil has a positive polarity; if it moves down the scale or below the zero, the coil has a negative polarity.

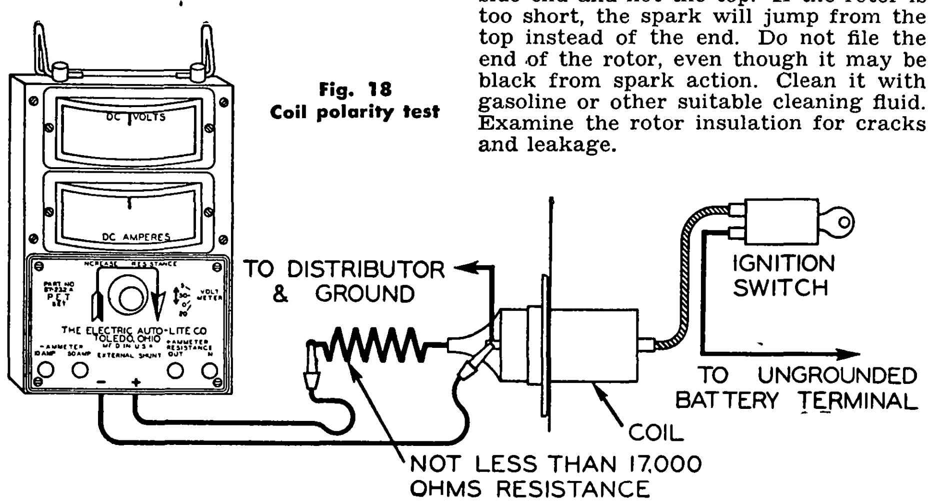


Fig. 18 Coil polarity test

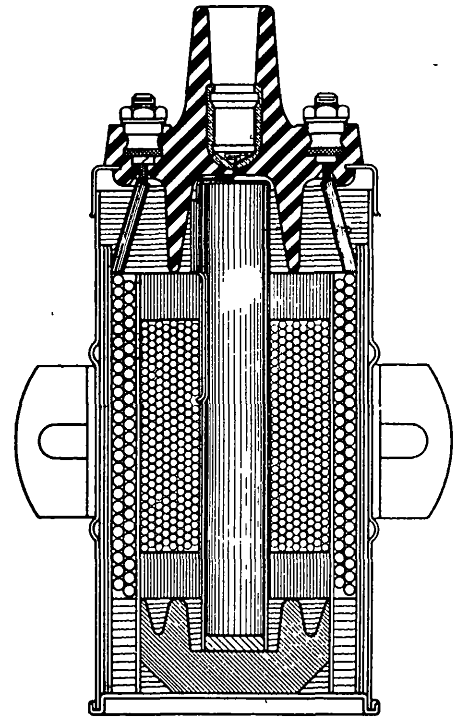


Fig. 17 Section of Auto-Lit igniti n coil

DISTRIBUTOR CAP — Inspect the cap for cracks, high tension leakage outside and inside, corroded high tension terminals and excessively burned segments inside the cap. Note if the segments show signs of spark jumping on the horizontal instead of the vertical part of the segments.

Ventilation of distributor caps is most important. This is accomplished by one or more holes in the cap, usually located to prevent dirt and moisture from getting inside the cap. If the vent holes are clogged, the ozone gas created by the high tension spark inside the cap could not escape, and in combination with moisture, form an acid which would corrode the metal parts.

DISTRIBUTOR ROTOR — Examine the end of the metal strip of the rotor to see that the spark is jumping from the outside end and not the top. If the rotor is too short, the spark will jump from the top instead of the end. Do not file the end of the rotor, even though it may be black from spark action. Clean it with gasoline or other suitable cleaning fluid. Examine the rotor insulation for cracks and leakage.

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch Note E	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist. Advance Starts	Centrifugal Full Advance	Vacuum Advance Data Dist. Degrees @ In. of Mercury Advance Starts	Vacuum Full Advance
HUDSON AND TERRAPLANE — (Continued)									
1939, 90	1GW-4202A	35-38	.020	.20-.25	17-20	3 @ 400	14 @ 1580	None	None
1939, 92, 93	1GW-4126A	35-38	.020	.20-.25	17-20	3 @ 400	14 @ 1580	None	None
1939, 92, 93	1GW-4201A	35-38	.020	.20-.25	17-20	3 @ 400	14 @ 1580	None	None
1940 Six	1GW-4203	35-38	.020	.20-.25	17-20	3 @ 400	14 @ 1580	2 @ 8	7½ @ 11¼
1941-47 Six	1GW-4203A	35-38	.020	.20-.25	17-20	3 @ 700	11¾ @ 1570	2 @ 8	7½ @ 11¼
1941-46 Eight	1GP-4008A	27½-30	.017	.20-.25	17-20	3 @ 400	17½ @ 1700	None	None
1946-47 Eight	1GP-4008A, B	27½-30	.017	.20-.25	17-20	3 @ 400	17½ @ 1700	None	None
1948-49 Six	1GS-4213-1	35-38	.020	.25-.28	17-20	3 @ 800	12 @ 2000	2 @ 10½	8½ @ 14
1948-49 Eight	1GT-4204A-1	27-30	.017	.20-.25	17-20	3 @ 400	17½ @ 1700	2 @ 10½	8½ @ 14
1949-50 Six	1GS-4213A-1	35-38	.020	.25-.28	17-20	1 @ 660	8½ @ 2000	1 @ 14	3½ @ 16
1949-52 Eight	1GT-4204B-1	27-30	.017	.20-.25	17-20	1 @ 335	17½ @ 1700	1 @ 14	3½ @ 16
1950 Pacemaker 6	1AT-4002	35-38	.020	.20-.25	17-20	1 @ 365	10 @ 1200	1 @ 10	5 @ 12
1951-52 Pacemaker 6	1AT-4009	35-38	.020	.21-.25	17-20	1 @ 365	10 @ 1200	1 @ 10	5 @ 12
1951-52 Six	1AT-4009A	35-38	.020	.21-.25	17-20	1 @ 670	9 @ 2000	1 @ 14	4 @ 16
KAISER									
1947-48	1GS-4211	35-38	.020	.20-.25	17-20	1 @ 365	10 @ 1700	2 @ 9½	7½ @ 14
1949-50	1GS-4214	35-38	.020	.20-.25	17-20	1 @ 450	9 @ 1675	1 @ 11	5 @ 15
NASH AND LAFAYETTE									
1935-36, 10	1GB-4317	35-38	.020	.20-.25	17-20	2 @ 500	10 @ 1300	None	None
1935, 10	1GB-4317A	35-38	.020	.20-.25	17-20	1 @ 450	5 @ 1050	None	None
1935-36, 20	1GE-4012A	35-38	.020	.20-.25	17-20	2 @ 305	9 @ 680	None	None
1935, 20	1GE-4012	35-38	.020	.20-.25	17-20	4 @ 410	15 @ 1000	None	None
1935-37, 80	1GK-4101	28-30	.017	.20-.25	17-20	4 @ 410	15 @ 1000	None	None
1936, 10	1GB-4317B	35-38	.020	.20-.25	17-20	2 @ 500	10 @ 1300	None	None
1936-37, 20	1GE-4012B	35-38	.020	.20-.25	17-20	2 @ 380	9 @ 1000	None	None
1936, 40	1GB-4328A	35-38	.020	.20-.25	17-20	3 @ 390	12 @ 1000	None	None
1936, 40A	1GB-4328B	35-38	.020	.20-.25	17-20	3 @ 390	12 @ 1000	None	None
1937, 10	1GW-4010	35-38	.020	.20-.25	17-20	3 @ 355	12 @ 1000	None	None
1937, 20	1GE-4012C	35-38	.020	.20-.25	17-20	3 @ 370	13 @ 1000	None	None
1937, 80	1GK-4101A	28-30	.017	.20-.25	17-20	2 @ 380	9 @ 1000	None	None
1937, 80	1GK-4101B	28-30	.017	.20-.25	17-20	4 @ 400	12 @ 1100	None	None
1938, 10	1GC-4276	40	.020	.20-.25	17-20	3 @ 355	12 @ 1000	None	None
1938, 10	1GC-4415	35-38	.020	.20-.25	17-20	3 @ 355	12 @ 1000	None	None
1938, 20	1GE-4018	35-38	.020	.20-.25	17-20	3 @ 370	13 @ 1000	None	None
1938, 80	1GK-4102	28-30	.017	.20-.25	17-20	4 @ 400	12 @ 1100	None	None
1939-40, 10	1GS-4104	35-38	.020	.20-.25	17-20	1 @ 300	5 @ 850	1 @ 7	5½ @ 12
1939-40, 10	1GS-4104X	35-38	.020	.20-.25	17-20	1 @ 300	5 @ 850	1 @ 7	5½ @ 12
1939-40, 20	1GE-4019A	35-38	.020	.20-.25	17-20	3 @ 370	11½ @ 875	None	None
1939-41, 80	1GK-4102	28-30	.017	.20-.25	17-20	4 @ 400	12 @ 1100	None	None
1941, 60	1GE-4024	35-38	.020	.20-.25	17-20	3 @ 370	11½ @ 875	None	None
1942, 60	1GS-4205	35-38	.020	.20-.25	17-20	2 @ 340	9 @ 900	1 @ 6⅝	6 @ 15
1942, 80	1GT-4202	27-30	.017	.20-.25	17-20	2 @ 410	12½ @ 1900	1 @ 14⅝	6 @ 17½
1946, 40	1GW-4184	35-38	.020	.20-.25	17-20	2 @ 330	11 @ 1400	2 @ 6⅛	7½ @ 15
1946, 60	1GS-4205A	35-38	.020	.20-.25	17-20	1 @ 385	12 @ 1350	1 @ 6⅝	6 @ 15
1946-47, 40	1GW-4184A	35-38	.022	.20-.25	17-20	2 @ 330	11 @ 1400	2 @ 6⅛	7½ @ 15
1946-48, 60	1GS-4205B	35-38	.020	.20-.25	17-20	3 @ 450	14 @ 1350	1 @ 6⅝	6 @ 15
1948, 40	1GC-4512	35-38	.020	.20-.25	17-20	1 @ 325	11 @ 1450	2 @ 6⅛	7½ @ 15

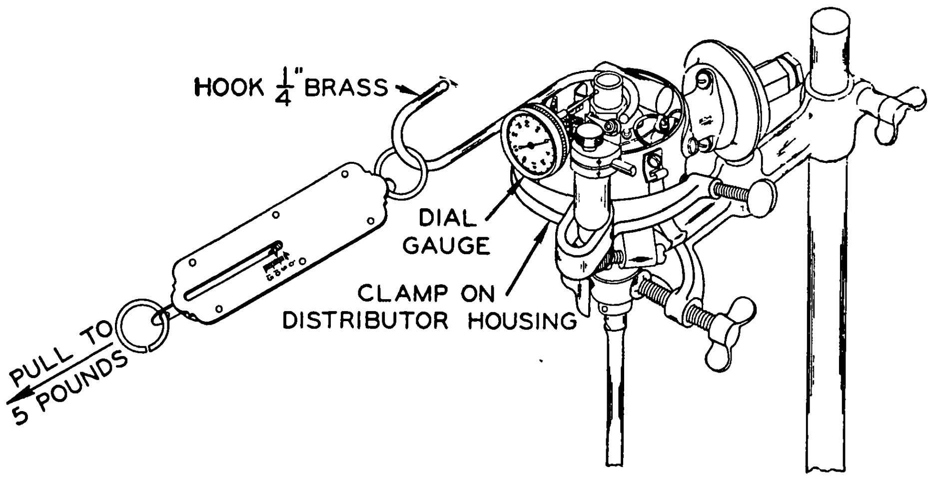


Fig. 19 Aut -Lite recommendation for checking side play of cam. With 5 pounds pull on scale, side play should not exceed .008 inch as indicated on dial gauge

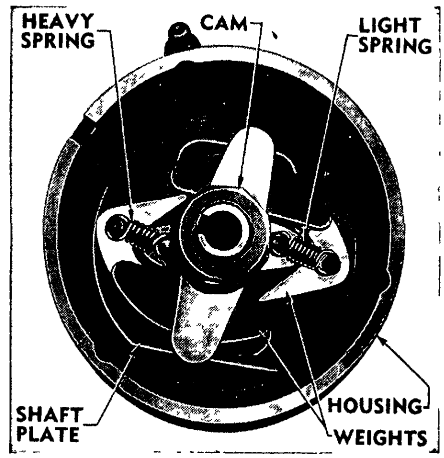


Fig. 20 Top view of Delco-Remy distributor with breaker plate rem v d t sh w centrifugal governor m chanism

Inspect the condition of the carbon brush in the center of the cap which rests on the rotor. This should be clean and free to move in and out of the segment so that it will make good contact with the rotor.

DISTRIBUTOR CAM — Examine the cam lobes for excessive wear. This can best be checked with a distributor test fixture. Excessive wear will be indicated by a difference in degrees between the contact opening for each cylinder. A few degrees variation in the cam angle for each cylinder is not so important as the exact spacing of the contact break for each cylinder. As this spacing controls the spark timing for each cylinder, this should not be greater than one degree.

Check for cam end play. The cam should be so located that the breaker arm rubbing block has full contact from top to bottom. If the cam is too low so that rubbing block extends above it, add a thin washer below the cam to raise it.

Side play of the cam with respect to the distributor housing can be checked as shown in Fig. 19. This should not be more than .008 inch with five pounds pull on the cam. If more than .008 inch, the cam and governor weight assembly should be removed and the shaft and bushing checked. Excessive side play can usually be corrected by installing new bushings in the distributor housing, or by replacing the cam, although replacement of both cam and bushing is sometimes necessary.

AUTOMATIC ADVANCE MECHANISM —All Auto-Lite and Delco-Remy distributors utilize an automatic advance mechanism which functions by virtue of centrifugal weights. Some distributors employ both centrifugal and vacuum advance mechanisms, while others make use of only the centrifugal mechanism.

When engine speed increases, the spark must be introduced in the cylinder earlier in the cycle in order that the fuel charge can be ignited and will have time to burn and deliver its power to the piston. To provide this spark advance based on engine speed, the centrifugal governor mechanism is used.

This mechanism, Fig. 20, consists of centrifugal advance weights which throw out against spring tension as the engine speed increases. This movement imparts, through a toggle arrangement, rotational motion to the breaker cam, causing it to rotate a number of degrees with respect to the distributor drive shaft. This causes the lobes on the cam to close and open the contacts earlier in the cycle so that the spark is induced and is delivered to the cylinder earlier with respect to the position of the upward moving piston.

When the engine is operated under part throttle, there is vacuum in the intake manifold and consequently the fuel taken into the cylinder is not so highly compressed. With lower compression in the cylinder, the spark must enter the cylinder earlier so that the mixture can

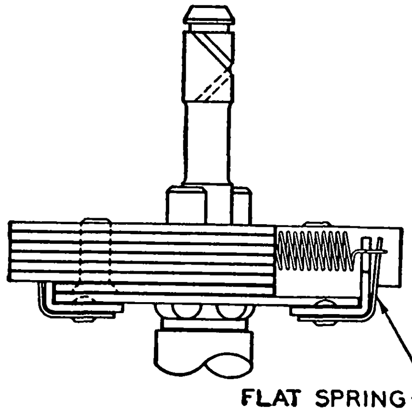


Fig. 21 Flat spring used on s m g vernors to provide a rapid spark advance

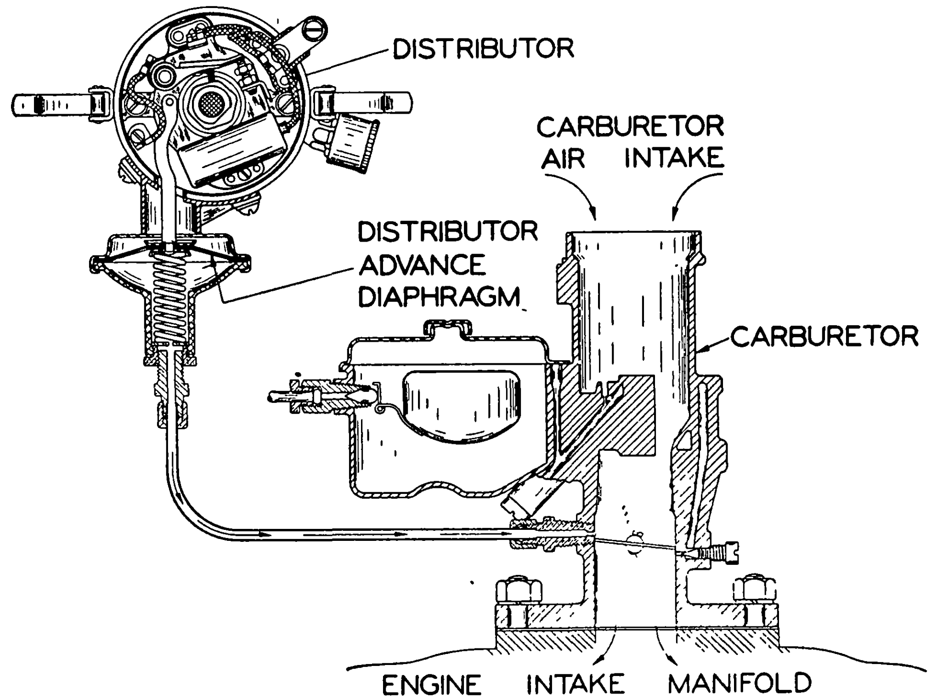


Fig. 22 Aut -Lite vacuum advance mechanism f the type which is m unt d n the sid f th distribut r. Br ak r plat is supp rted n a ball b aring, and th break r plat al ne r tates in the housing as vacuum c nditi ns change

AUTO-LITE DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch Note E	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist. Advance Starts	Centrifugal Advance Data Full Advance	Vacuum Advance Data Dist. Degrees @ In. of Mercury Advance Starts	Vacuum Advance Data Full Advance
PACKARD									
1935-39, V12	1GO-4002A	40	.020	.20-.25	17-20	2 @ 525	8 @ 1200	None	None
1936 Eight	1GH-4026A	36	.020	.20-.25	17-20	2 @ 680	10 @ 2200	None	None
1937 Six	1GS-4011	35-38	.020	.20-.25	17-20	2½ @ 600	10 @ 2000	2 @ 9	7½ @ 17
1937 Eight	1GT-4004	27-30	.017	.20-.25	17-20	2 @ 680	10 @ 2200	2 @ 9	7½ @ 17
1937 Super 8	1GT-4005	27-30	.017	.20-.25	17-20	2 @ 630	9 @ 1800	1 @ 8⅝	5½ @ 16
1938 Eight	1GT-4007	27-30	.017	.20-.25	17-20	2 @ 550	8¾ @ 2000	2 @ 9	7½ @ 17
1938-39 Eight	1GT-4007A	27-30	.017	.20-.25	17-20	2 @ 550	8¾ @ 2000	1 @ 11⅛	6 @ 17
1938 Super 8	1GT-4006	27-30	.017	.20-.25	17-20	2 @ 630	9 @ 1800	1 @ 8⅝	5½ @ 16
1939 Six	1GS-4013	35-38	.020	.20-.25	17-20	2 @ 550	8¾ @ 2000	2 @ 9	7½ @ 17
1939 Six	1GS-4201	35-38	.020	.20-.25	17-20	2 @ 550	8¾ @ 2000	2 @ 9	7½ @ 17
1939 Super 8	1GT-4006A	27-30	.017	.20-.25	17-20	2 @ 460	10½ @ 1600	1 @ 8⅝	5½ @ 16
1940 Six	1GW-4143	35-38	.020	.28-.32	17-20	2 @ 550	8¾ @ 2000	None	None
1940 Six	1GW-4143A	35-38	.020	.28-.32	17-20	3 @ 590	9½ @ 1600	None	None
1940 Six	1GC-4503	35-38	.020	.28-.32	17-20	3 @ 590	9½ @ 1600	None	None
1940 Eight	1GP-4501	27-30	.017	.20-.25	17-20	3 @ 400	8 @ 1200	None	None
1940 Eight	1GP-4501A	27-30	.017	.20-.25	17-20	3 @ 525	11½ @ 1550	None	None
1940-47 Super 8	1GT-4102	27-30	.017	.20-.25	17-20	3 @ 475	11½ @ 1800	1@8⅝	5½ @ 16
1941-47 Six	1GC-4505	35-38	.020	.28-.32	17-20	3 @ 590	9½ @ 1600	2 @ 9	7½ @ 17
1941 Eight	1GP-4502	27-30	.017	.20-.25	17-20	3 @ 525	11½ @ 1550	1 @ 11⅛	6 @ 17
1941-47 Eight	1GP-4502A	27-30	.017	.20-.25	17-20	3 @ 600	10¾ @ 1550	1 @ 11⅛	6 @ 17
1942, 2003	1GT-4203	27-30	.017	.20-.25	17-20	3 @ 475	11½ @ 1800	1 @ 8⅝	5½ @ 16
1948-50 Except Custom	1GP-4502B	27-30	.017	.20-.25	17-20	1 @ 400	8 @ 1600	2 @ 9⅜	7 @ 14
1948-50 Custom 8	1GT-4203	27-30	.017	.20-.25	17-20	3 @ 475	11½ @ 1800	1 @ 8⅝	5½ @ 16
1951-52	IGP-4502C	27-30	.017	.20-.25	17-20	1 @ 400	8 @ 1600	1 @ 6¾	10½ @ 17
PLYMOUTH									
1935-36	1GS-4003-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1600	2 @ 6¾	10 @ 14
1936	1GS-4003A-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1600	2 @ 6¾	10 @ 14
1936-38	1GS-4003B-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 6¾	10 @ 14
1939	1GS-4103-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 6¾	10 @ 14
1939	1GS-4103A-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 7⅜	10 @ 17
1940	1GS-4109-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 7⅜	10 @ 17
1941	1GS-4111-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 7⅜	10 @ 17
1941	1GS-4204-1	35-38	.020	.25-.28	17-20	3 @ 400	11 @ 1850	2 @ 7⅜	10 @ 17
1942	1GS-4203A-1	35-38	.020	.25-.28	17-20	3 @ 400	9 @ 1300	2 @ 7	9 @ 14
1942	1GS-4203B-1	35-38	.020	.25-.28	17-20	3 @ 400	10 @ 1150	2 @ 7⅝	8½ @ 16
1942	1GS-4203C-1	35-38	.020	.25-.28	17-20	3 @ 400	10 @ 1150	2 @ 7⅝	7½ @ 15
1946-48	1GS-4207-1	35-38	.020	.25-.28	17-20	3 @ 400	9 @ 1300	2 @ 6¾	10 @ 14
1949-50	1GS-4207B-1	35-38	.020	.25-.28	17-20	3 @ 400	9 @ 1300	2 @ 6¾	10 @ 14
1949-50	1AP-4103-1	35-38	.020	.25-.28	17-20	1 @ 370	9 @ 1300	1 @ 6	10 @ 14
1949-50	1AP-4103A-1	35-38	.020	.25-.28	17-20	1 @ 450	11 @ 1550	1 @ 5½	8 @ 14
1950	IAT-4003	35-38	.020	.25-.28	17-20	1 @ 450	10 @ 1425	1 @ 5½	8 @ 14
1951-52	IAT-4011	35-38	.020	.25-.28	17-20	1 @ 450	10 @ 1425	1 @ 5½	8 @ 14
STUDEBAKER									
1936-37 Dic.	1GW-4001	35-38	.020	.20-.25	17-20	2 @ 600	10 @ 1400	2 @ 5	6 @ 12
1938-41 Com.	1GW-4101	35-38	.020	.20-.25	17-20	2 @ 600	10 @ 1400	2 @ 5	6 @ 12
1939-40 Champ.	1GW-4131	35-38	.020	.20-.25	17-20	2 @ 680	7 @ 1400	2 @ 5½	9 @ 14¾
1941-42 Champ.	1GW-4154	35-38	.020	.20-.25	17-20	2 @ 680	7 @ 1400	2 @ 5½	9 @ 14¾
1941 Pres.	1GH-4029	21-30	.017	.20-.25	17-20	3 @ 630	13½ @ 1800	2 @ 5	6 @ 12
1942-46 Champ.	1GC-4801	35-38	.020	.20-.25	17-20	2 @ 680	7 @ 1400	2 @ 5½	9 @ 14¾
1942-49 Com.	1GC-4802	35-38	.020	.20-.25	17-20	2 @ 600	10 @ 1400	2 @ 5	6 @ 12
1942 Pres.	1GH-4101	21-30	.017	.20-.25	17-20	3 @ 630	13½ @ 1800	2 @ 5	6 @ 12
1947-50 Champ.	1GC-4805	35-38	.020	.20-.25	17-20	2 @ 680	7 @ 1400	2 @ 5½	9 @ 14¾
1950-51 Champ.	1AT-4001	35-38	.020	.21-.25	17-20	2 @ 680	7 @ 1400	1 @ 4⅞	9 @ 12
1952 Champ.	1AT-4010	36-42	.020	.21-.25	17-20	2 @ 680	7 @ 1400	1 @ 4⅞	9 @ 12

be ignited, burn, and give up its power to the piston.

Lower compression means a slower rate of flame spread in the cylinder as the spark occurs. If the spark occurs earlier in the cycle, that is, if there is some additional spark advance, full burning of the fuel and maximum economy is achieved. This additional advance is obtained by a vacuum advance mechanism—about which see below.

In servicing the distributor, all weights should be removed from the hinge pins, cleaned and checked for excessive wear, either in the weights or pins, or the plate which is slotted for the movement of the pins on top of the governor weights. Replacement should be made if there is any appreciable wear in the slots, as any wear at this point would change the characteristic of the spark advance.

If these parts are in good condition, the hinge pins should be lubricated before being reassembled, by greasing the hinge pins and filling the pockets in the governor weights with grease. Do not use vaseline for this purpose as its melting point is comparatively low.

When installing new centrifugal governor assemblies, it is important that the spacer washers between the housing and shaft be installed correctly. If incorrectly installed, the governor assembly will be too high, causing it to rub against the bottom of the breaker plate.

Governor weight springs should always be replaced with new springs as there is no way of measuring the calibration of these springs in the field. Auto-Lite and Delco-Remy supply new springs in sets for individual units to insure the correct use.

On some distributors, both springs are alike, while on others there is one heavy and one light spring, as in Fig. 20. Another combination that may be found is an additional flat spring on the outside of the outer spring posts, Fig. 21. As the governor speed is increased, the flat springs are first pulled against the posts by the eyes of the coil springs to provide a rapid spark advance of a few degrees before the coil springs pull against the spring posts.

VACUUM ADVANCE MECHANISMS —The two types of vacuum advance mechanisms used on Auto-Lite and Delco-Remy distributors are illustrated in Figs. 22 and 23. Both types make use of a spring-loaded diapraghm which is connected through linkage to the distributor. The spring loaded side of the diaphragm is air tight and is connected through a vacuum line to the carburetor *above* the throttle plate so that idling performance will not be affected.

When the throttle is open, vacuum from the intake manifold is introduced into the vacuum advance mechanism and the diaphragm is pulled against the spring, causing the distributor to advance.

In Fig. 22 the mechanism is attached to the distributor breaker plate so that the breaker plate rotates. In Fig. 23 the mechanism is connected to the distributor body so that the entire distributor moves. In both cases, the rotational movement carries the contact points around to an advanced position so that the breaker cam closes and opens the

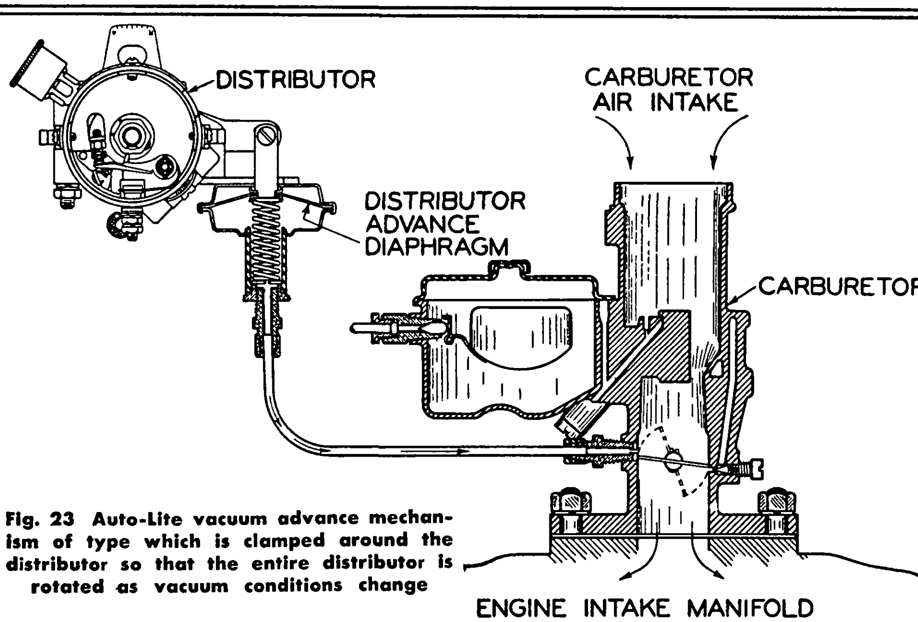


Fig. 23 Auto-Lite vacuum advance mechanism of type which is clamped around the distributor so that the entire distributor is rotated as vacuum conditions change

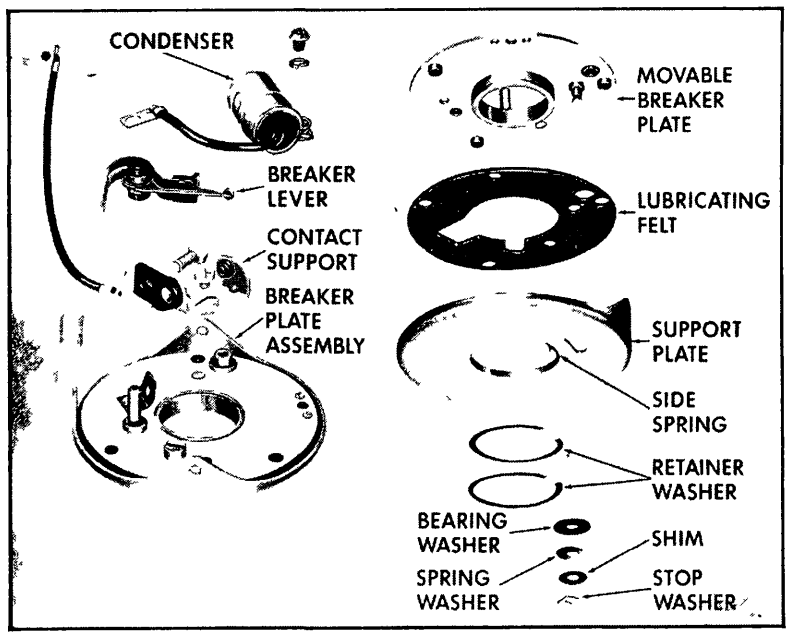


Fig. 24A Delco-Remy 1949 and later distributor showing construction of support and breaker plate. This type does not rotate on steel balls as do previous types

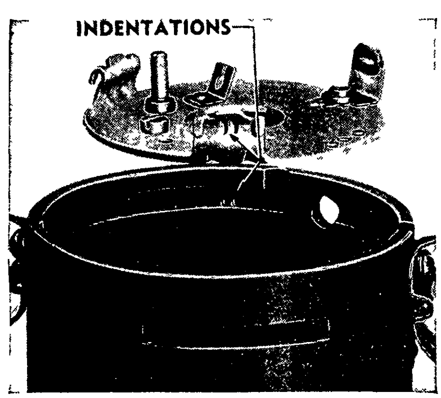


Fig. 24 Delc -Remy breaker plate and housing sh wing w rn places

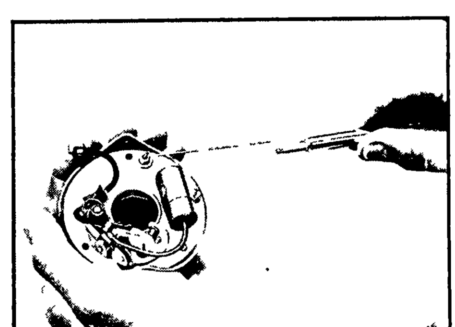


Fig. 24B Checking breaker plate friction with ounc scale. Delc -R my 1949 and later distribut rs

AUTO-LITE DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch Note E	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data Dist. Degrees @ In. of Mercury	
						Advance Starts	Full Advance	Advance Starts	Full Advance
WILLYS									
1935	1GB-4078	47	.020	.20-.25	17-20	3 @ 630	12½ @ 1700	None	None
1936-38	1GS-4007	47	.020	.20-.25	17-20	4½ @ 420	14 @ 1700	2 @ 5¾	10 @ 15
1939	1GS-4007B	47	.020	.20-.25	17-20	2 @ 550	9½ @ 1500	1 @ 6½	7 @ 15
1939-50 Four	1GW-4129	41	.020	.20-.25	17-20	2 @ 550	9½ @ 1500	2 @ 5¾	10 @ 15
1946-49 Four	1GW-4189	41	.020	.20-.25	17-20	2 @ 560	11 @ 1500	C	D
1948-49 Six	1GC-4513	39	.020	.18-.26	17-20	1 @ 380	12 @ 1500	1 @ 5½	6 @ 15
1948-50 Six	1GC-4514	39	.020	.18-.26	17-20	1 @ 380	12 @ 1500	1 @ 5½	6 @ 15
1950 Four	IGW-4189A	47	.020	.20-.25	17-20	1 @ 400	11 @ 2000	1 @ 5⅜	5 @ 8
1950-52 Four	IAT-4008	47	.020	.21-.25	17-20	1 @ 400	11 @ 2000	1 @ 5⅜	5 @ 8
1950-52 Six	IAT-4007-A	39	.020	.21-.25	17-20	1 @ 380	12 @ 1500	1 @ 5½	6 @ 15

A—Distributor number stamped on plate riveted to side of housing.
B—Microfarads—as indicated on a condenser tester.
C—With vacuum unit VC-4007, 2 @ 6⅞; with vacuum unit VC-4010, 2 @ 5¾
D—With vacuum unit VC-4007, 7 @ 15; with vacuum unit VC-4010, 10 @ 15.
E—Plus or minus .002".

DELCO-REMY DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data		
						Advance Starts	Full Advance	Inches of Vacuum to Start Plunger Movement	Inches of Vacuum for Full Plunger Travel	Maximum Vacuum Advance, Dist. Degrees
BUICK										
1935, 40	663-E	21-30	.016	.20-.25	19-23	1¾ @ 250	15 @ 1300	5-7	10-13	6
1935, 50	663-C	21-30	.016	.20-.25	19-23	1¾ @ 250	10½ @ 800	5-7	10-13	6
1936, 40	663-F	21-30	.016	.20-.25	19-23	1½ @ 250	13½ @ 1200	5-7	10-13	6
1936, 60, 80, 90	663-E	21-30	.016	.20-.25	19-23	1¾ @ 250	15 @ 1300	5-7	10-13	6
1937, 40	663-Y	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1650	5-7	10-13	5½
1937, 60, 80, 90	663-Z	21-30	.016	.20-.25	19-23	1 @ 250	8 @ 825	5-7	10-13	5½
1937, 60, 80, 90	663-ZX	21-30	.016	.20-.25	19-23	1 @ 250	10 @ 1140	5-7	10-13	5½
1938-48, All	1110801	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1500	5-7	10-13	5½
1939-40, 60, 70, 80, 90	1110805	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1500	5-7	10-13	5½
1949, 40	1110801	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1500	5-7	10-13	5½
1949, 50, 70	1110815	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1500	5-7	10-12	5½
1950-51	1110815	21-30	.016	.20-.25	19-23	1 @ 250	13 @ 1500	5-7	10-12	5½
1952	1110832	21-30	.016	.20-.25	19-23	0 @ 225	12 @ 1675	5-7	12-13	6-8
CADILLAC AND LA SALLE										
1935, 50	662-P	31-37	.022	.20-.25	17-21	½ @ 500	14 @ 1850	None	None	None
1935-37, V12	667-C	31-37	.022	.20-.25	17-21	1 @ 250	19 @ 1300	None	None	None
1935-37, V16	4118	21-30	.016	.20-.25	17-21	1¼ @ 200	17 @ 1100	None	None	None
1936, 50	663-J	21-30	.016	.20-.25	17-21	½ @ 500	14 @ 1850	7-10	15-19	9
1936, V8	663-G	21-30	.016	.20-.25	19-23	½ @ 500	12 @ 2000	9-11	16-18	7½
1937, V8	665-G	21-30	.016	.20-.25	19-23	½ @ 500	12 @ 2000	None	None	None
1938-39, V8	1110604	21-30	.016	.20-.25	19-23	½ @ 500	12 @ 2000	None	None	None
1938-40, V16	1110601	21-30	.016	.20-.25	19-23	1 @ 800	10 @ 2000	None	None	None
1940, V8	1110806	21-30	.016	.20-.25	19-23	½ @ 500	12 @ 2000	5-7	15-18	9
1941-48	1110807	21-30	.016	.20-.25	19-23	½ @ 500	12 @ 2000	5-7	15-18	9
1949	1110812	21-30	.016	.20-.25	19-23	¾ @ 300	18¾ @ 1800	6-8	14	9
1950	1110819	21-30	.016	.20-.25	19-23	¾ @ 300	16 @ 1800	4-6	12-16	10
1951	1110820	21-30	.016	.20-.25	19-23	¾ @ 300	16 @ 1800	4-6	13-15	10
1952	1110829	29.5-32.5	.0125	....	19-23	¾ @ 340	17 @ 1850	7-9	16½	11

DELCO-REMY DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data		
						Advance Starts	Full Advance	Inches of Vacuum to Start Plunger Movement	Inches of Vacuum for Full Plunger Travel	Maximum Vacuum Advance Dist., Degrees
CHEVROLET										
1935	645-G	31-37	.022	.20-.25	17-21	¾ @ 300	16 @ 1500	4½	9-11	C
1936	645-T	31-37	.022	.20-.25	17-21	1⅛ @ 300	14 @ 1500	4½	9-11	8½
1937	649-G	31-37	.022	.20-.25	17-21	⅞ @ 300	25 @ 1800	4½	8-10	7½
1937-39	1110008	31-37	.022	.20-.25	17-21	⅞ @ 300	25 @ 1800	4½	8-10	7½
1940	1110052	31-37	.022	.20-.25	17-21	2 @ 400	18½ @ 1550	6	12-15	8
1941-48	1110090	31-37	.022	.28-.32	17-21	1½ @ 350	19 @ 1700	7-8½	16½-18½	10
1949-50	1112353	31-37	.022	.28-.32	17-21	1½ @ 350	19 @ 1700	7-8½	16½-18½	10
1950	1112358	31-37	.022	.28-.32	17-21	1 @ 300	16½ @ 1850	7-8½	16½-18½	10
1951-52	1112362	31-37	.022	.28-.32	17-21	1½ @ 350	19 @ 1700	7-8½	16½-18½	10
1951-52	1112363	31-37	.022	.28-.32	17-21	1 @ 300	16½ @ 1850	7-8½	16½-18½	10
KAISER										
1951-52	1110224	31-37	.022	.18-.23	17-21	¾ @ 300	10 @ 1600	9-11	14-18	5
NASH										
1941-42, 40	1110512	31-37	.022	.20-.25	17-21	1 @ 400	10 @ 1200	3-5	14-17	8½
1948-49, 40	1112351	31-37	.022	.18-.23	17-21	1 @ 300	11 @ 1400	3-5	13-17	7½
1949-50, 60	1110216	31-37	.022	.18-.23	17-21	1 @ 300	15 @ 1350	4-6	14-16	6
1950-51, 10, 40	1112351	31-37	.022	.18-.23	17-21	1 @ 300	11 @ 1400	3-5	13-17	7½
1950, 60	1110223	31-37	.022	.18-.23	17-21	1 @ 300	15 @ 1350	4-6	14-16	6
1951, 60	1110225	31-37	.022	.18-.23	17-21	1 @ 300	15 @ 1350	4-6	14-16	6
1952, 10, 40	1112382	31-37	.022	.18-.23	17-21					
1952, 60	1110227	31-37	.022	.18-.23	17-21					
OLDSMOBILE										
1935 Six	622-Y	31-37	.022	.20-.25	17-21	1 @ 400	10½ @ 1350	None	None	None
1935 Eight	622-R	21-30	.016	.20-.25	19-23	1 @ 350	7 @ 1300	None	None	None
1936 Six	647-C	31-37	.022	.20-.25	17-21	½ @ 250	13 @ 1450	5-10	15-18	7½
1936 Eight	663-K	21-30	.016	.20-.25	19-23	2¼ @ 300	15 @ 1900	5-7	13-16	5
1937-41 Six	647-F	31-37	.022	.20-.25	17-21	1½ @ 250	14 @ 1850	5-7	15-18	10
1937-38 Eight	663-W	21-30	.016	.20-.25	19-23	1¼ @ 300	15 @ 2000	5-7	14-17	7½
1938 Eight	1110802	21-30	.016	.20-.25	19-23	1¼ @ 300	15 @ 2000	5-7	14-17	7½
1939 Eight	1110803	21-30	.016	.20-.25	19-23	1¼ @ 300	15 @ 2000	5-7	14-17	7½
1940-41 Eight	1110802	21-30	.016	.20-.25	19-23	1¼ @ 300	15 @ 2000	5-7	14-17	7½
1942-47 Six	1110213	31-37	.022	.20-.25	17-21	1½ @ 250	12 @ 1600	7½-9½	14½-16½	6
1942-48 Eight	1110808	21-30	.016	.20-.25	19-23	1½ @ 250	12 @ 1600	6½-8½	14-16	6
1948-49 Six	1110214	31-37	.022	.20-.25	17-21	1⅝ @ 250	8 @ 1200	5-7	16½-18½	8
1949-50 Eight	1110814	21-30	.016	.20-.25	19-23	1 @ 300	16 @ 1850	6½-8½	19-21	10
1949-50 Six	1110221	31-37	.022	.20-.25	17-21	1 @ 250	12 @ 1600	5-7	16-20	8
1951-52 V8	1110824	21-30	.016	.20-.25	19-23	1 @ 300	16 @ 1850	4½-6½	18-22	8½
PACKARD										
1935 Eight	662-W	33	.020	.20-.25	19-23	¾ @ 300	10 @ 1800	None	None	None
1936 Super 8	662-T	33	.020	.20-.25	19-23	¾ @ 300	10 @ 1800	None	None	None
1937 Six	647-E	35	.020	.20-.25	17-21	¾ @ 300	10¾ @ 2000	5-7	15-19	7½
1937 Super 8	663-L	25	.015	.20-.25	19-23	¾ @ 300	9¾ @ 2000	None	None	None
1938 Six	1110203	31-37	.022	.20-.25	17-21	¾ @ 300	9½ @ 2000	5-7	15-19	7½
1941 Six	1110092	31-37	.022	.20-.25	17-21	¾ @ 300	10¼ @ 1600	5-7	15-19	7½
1942-47 Six	1110132	31-37	.022	.20-.25	17-21	¾ @ 300	10¼ @ 1600	5-7	15-19	7½
1948-50 Except Custom	1110811	21-30	.016	.20-.25	17-21	1 @ 300	9 @ 1600	5-7	13-15	7
1951-52	1110825	21-30	.016	.20-.25	17-21	1 @ 300	9 @ 1600	5-7	19	10

DELCO-REMY DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch	Condenser Capacity, Mfds. Note B	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist. Advance Starts	Centrifugal Advance Data Full Advance	Vacuum Advance Data Inches of Vacuum to Start Plunger Movement	Vacuum Advance Data Inches of Vacuum for Full Plunger Travel	Vacuum Advance Data Maximum Vacuum Advance, Dist. Degrees
PIERCE-ARROW										
1935–36 Eight	662-J	33	.020	.20–.25	17–21	1 @ 300	9 @ 1550	None	None	None
1935–36 Twelve	4105	38	.020	.20–.25	17–21	1 @ 400	7 @ 1400	None	None	None
1937–38 Eight	663-M	25	.015	.20–.25	17–21	1 @ 300	10 @ 1750	5–7	14–17	7½
1937–38 Twelve	4160	38	.020	.20–.25	19–23	1 @ 400	7 @ 1400	None	None	None
PONTIAC										
1935 Six	647-A	31–37	.022	.18–.23	17–21	1 @ 275	11 @ 1900	9–11	16–18	7½
1935 Eight	663-B	21–30	.016	.18–.23	19–23	1½ @ 300	11 @ 1700	4–6	16–21	10
1936 Six	647-B	31–37	.022	.18–.23	17–21	1 @ 275	11 @ 1900	9–11	16–18	7½
1936 Eight	663-H	21–30	.016	.18–.23	19–23	1½ @ 300	11 @ 1700	4–6	16–21	10
1937–48 Six	647-D	31–37	.022	.18–.23	17–21	2 @ 400	14¼ @ 2000	5–7	10–15	7½
1937–39 Eight	663-X	21–30	.016	.18–.23	19–23	2 @ 400	14 @ 2100	7 Min.	9–13	5
1940–48 Eight	1110804	21–30	.016	.18–.23	19–23	1 @ 300	13½ @ 2100	7–9	16–21	10
1949 Six	1110219	31–37	.022	.18–.23	17–21	1 @ 300	14 @ 2050	7–9	14½–16½	7½
1949 Eight	1110816	21–30	.016	.18–.23	19–23	1 @ 250	13½ @ 2100	7–9	17½–19½	10
1950–52 Six	1110222	31–37	.022	.18–.23	17–21	1 @ 300	14 @ 2050	7–9	14½–16½	7½
1950–51 Eight	1110818	21–30	.016	.18–.23	19–23	¾ @ 200	13½ @ 2100	7–9	17½–19½	10
1952 Eight	1110831	21–30	.016	.18–.23	19–23	1 @ 500	22 @ 3760	7–9	20	22
STUDEBAKER										
1935–40 Pres.	662-M	33	.020	.20–.25	19–23	1 @ 250	14½ @ 1800	5–7	11–14	6
1950 Comm.	1110220	31–37	.022	.20–.25	17–21	1 @ 400	11 @ 1400	3–5	9–14	6
1951 Comm.	1110822	21–30	.016	.20–.25	17–21	¼ @ 250	15 @ 1300	4–6	12½	8
1952 Comm.	1110826	21–30	.016	.20–.25	17–21	¼ @ 250	15 @ 1600	4–6	11½	16

A—Distributor number stamped on plate riveted to side of housing.

B—Microfarads—as indicated on a condenser tester.

C—680L, 8½°; 680V, 6°.

points earlier in the cycle.

On Auto-Lite distributors, the movable breaker base is mounted on a ball bearing. This bearing should be checked before being installed to see that there is no friction in any part of its rotation, due to worn balls or races. If the bearing inner race is loose where it is attached to the breaker plate, no attempt should be made to swedge it in place, as this requires special tools to do the job properly. In such cases, replace the breaker plate and bearing assembly.

On some Delco-Remy distributors, the movable breaker plate rotates on three balls located between the outside diameter of the plate and distributor housing. The housing should be inspected for excessive wear in the groove where the balls roll. Fig. 24 shows the indentations in the housing and breaker plate caused by the balls pressing against them. The remedy is to replace the parts.

On some 1949 and later Delco-Remy distributors, a new method is used in mounting the movable breaker plate in the distributor which eliminates the balls previously used to support this plate in the housing. Fig. 24A illustrates the new distributor construction. Note that the breaker plate to which the vacuum advance mechanism link is fastened has three bakelite buttons which rest on a support plate which is screwed to the distributor housing. An oil saturated felt between the breaker and support plates assures lubrication for the feet as they move in the support plate with changes in the amount of vacuum advance. A post fastened to the movable breaker plate extends through a slot in the support plate and carries a bearing washer, spring washer, shim washer and stop washer. These together with one or two retainer washers which snap into a groove in the movable breaker plate hub hold the two plates together as an assembly. Production tolerances determine if one or two retainer washers are used. The number of shim washers on the post is very important since they must furnish enough pressure against the spring washer so it will bear against the support plate with sufficient tension to prevent tipping of the movable breaker plate, but not exert so much pressure as to cause excessive friction between the two plates. A check for correct friction between the two plates is made by using the ounce spring scale, Fig. 24B, used to check breaker point arm tension. The correct pull to move the breaker plate while holding the support plate is 8 to 16 ounces.

On both Auto-Lite and Delco-Remy vacuum advance mechanisms, the basic principle of operation is that the spring retards the spark and the vacuum ad-

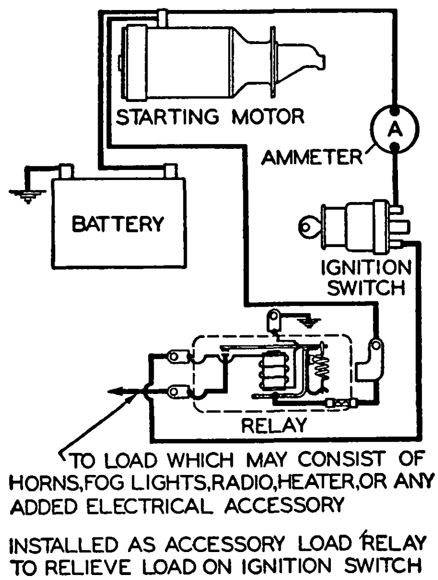


Fig. 25 Sh wing relay connected in ignition circuit to prevent overloading of igniti n switch wh n accessories are connected thr ugh the switch

vances it. The calibration of this unit is accomplished by changing the spring tension. On Auto-Lite units, a combination of flat washers of various thicknesses is used between the end of the spring and the brass retainer fitting which is screwed into the outer end of the vacuum diaphragm housing. On Delco-Remy units, any alteration necessary is accomplished by changing the spring to one having a greater or lesser tension depending upon the result desired.

IGNITION WIRING—The current carrying capacity of all ignition wiring should not be less than that specified by the car manufacturers. All terminals should be securely soldered to the wires and all joints and connections should be clean and tightened with lock washers. The connecting leads in the distributor should be installed so that the terminals are screwed down tight and in such a manner that they will not interfere with the cap or rotor.

When testing the leads for open circuits, a slight tension should be placed on them, or they should be moved back and forth to find broken wires inside the insulation, which may make contact temporarily during the test.

All leads inside the distributor should be bent away from contact with the housing or other moving parts so that the insulation will not chafe and cause failure due to rubbing or vibration.

The high tension wiring is subjected to high voltage and, therefore, insulation is important. Leakage may exist without being visible, causing poor engine performance. See the *Tune Up* chapter for inspecting and testing data. Special attention should be given to any part of the cables surrounded by metal manifolds or brackets, as any weakness of the insulation inside the metal would cause current leakage and cross-firing, resulting in poor engine performance,

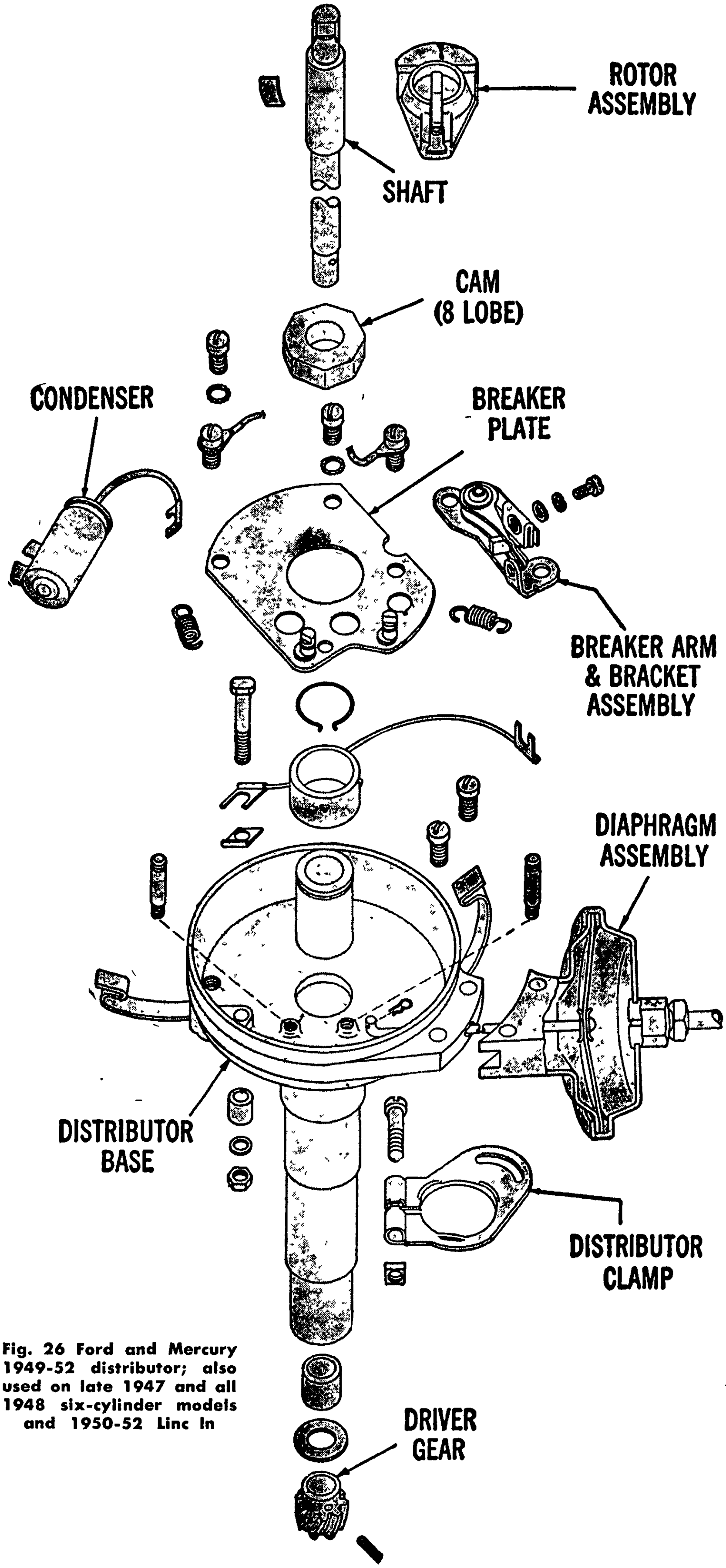


Fig. 26 Ford and Mercury 1949-52 distributor; also used on late 1947 and all 1948 six-cylinder models and 1950-52 Linc ln

FORD, MERCURY, LINCOLN DISTRIBUTOR SPECIFICATIONS

Year	Part Number	Initial Advance, Crankshaft Degrees BTC	Distributor Advance NOTE A			Total Advance, Crankshaft Degrees NOTE A		Breaker Arm Spring Tension, Ounces	Contact Spacing (Inches)	Dwell Contact (Percent) at Idle Speed		
			Crankshaft Degrees		Engine R.P.M.							
			Min.	Max.		Min.	Max.			L.H.	R.H.	Total
1935-36	40-12127B	4	15	17	3000	19	21	20-24	0.012-0 014	60	55-65	77-82
1937-41 V8	11A-12127	4	21	24	3450	25	28	20-24	0.014-0 016	50	45-55	78-85
1941-42 Six	1GA-12127	1	17	19	2500	18	20	20-24	0.014-0.016			57-62
1942 V8	21A-12127	4	21	24	3450	25	28	20-24	0.014-0.016	50	45-55	78-85
1946-47 Six	5GA-12127	1	17	19	2500	18	20	20-24	0.014-0.016			57-62
1946-48 V8	59A-12127	4	21	24	3450	25	28	20-24	0.014-0.016	50	45-55	78-85
1948-51 Six	7HA-12127	0	21	23	4000	21	23	17-20	0.024-0.026			58-63
1949-50 V8	7RA-12127	2	15	17	4000	17	19	17-20	0.014-0.016			58-63
1936-48 Lincoln	16H-12127	2	22	24	3400	24	26	20-24	0.014-0 016	57-62	57-62	
1949 Lincoln	8EL-12100	4	22	26	4000	26	30	17-20	0.015-0.018			58-63
1950-51 Ford	OBA-12127	2	15	17	4000	17	19	17-20	0 014-0 016			58-63
1950-51 Mercury	OCM-12127	2	15	17	4000	17	19	17-20	0.014-0.016			58-63
1950-51 Lincoln	OEL-12127	4	19	21	4000			17-20	0.014-0.016			

A—Wide Open Throttle

especially in wet weather

Metal manifolds and metal cable brackets should be grounded to the engine Troublesome engine missing has sometimes been corrected by a good ground connection for these metal parts

IGNITION SWITCH—Ignition switches are usually designed to carry the ignition circuit only When accessories such as heater, radio, fan, defroster, etc are connected through the ignition switch, the switch is overloaded, causing overheating of the switch, which results in the reduction of the energy delivered to the ignition circuit

When it is desirable to connect accessories to the ignition switch to prevent their being accidentally left on—which would discharge the battery — they should be connected through a relay, Fig 25, to prevent overloading and consequent ignition switch trouble

FORD PRESSURE TYPE DISTRIBUTORS

1949-51 Ford & Mercury V8, 1948-51 Ford Six, 1950-51 Lincoln—These distributors, Fig 26, do not have any centrifugal advance mechanism They are entirely vacuum controlled, the vacuum being taken from two openings in the carburetor One vacuum opening is at the carburetor venturi and the other is at a point just above the throttle plate The distributor breaker plate is linked to the diaphragm in the vacuum chamber As the vacuum in the chamber increases the breaker plate is rotated to advance the spark Two adjustable springs retard the spark as the vacuum decreases These springs, Fig 27, are precision set at the factory with special stroboscopic equipment This equipment is available for adjustment purposes in the field Shops having conventional type distributor testing fixtures can include a mercury column to take care of the setting of these springs as the ordinary vacuum gauge will not provide the required accuracy

In checking the vacuum advance, it should be done at all points of distributor R P M listed in the following table. The springs may then be adjusted to give the amount of vacuum listed for each point

Taking the Lincoln distributor as an example, set the distributor speed at 500 R P M and apply a vacuum of 0 5" Then turn one spring clockwise until the spark falls within ½ to 1½ degrees advance With one spring adjusted thus, increase distributor speed to 1000 R P M and apply a vacuum of 2 0" Tighten the second spring until the spark occurs at 5 to 6 degrees advance

Since the two springs are identical, either spring may be adjusted first With both springs adjusted, check all points of advance and readjust the spring tension if necessary The following table gives the specifications for all units

FORD 1948-51 SIX

Dist RPM	Adv Dist Deg	Vacuum, In
200	0 -	0
500	1¾- 3	0 4
1000	5½- 6¾	1 4
1500	8½- 9¾	2 9
2000	10½-11½	4 1

FORD 1949 and Early 1950 V8

Dist RPM	Adv Dist Deg	Vacuum, In.
200	0	0
500	1¼- 2¼	0 4
1000	4¼- 5¼	1 7
1500	6¼- 7¼	2 85
2000	7½- 8½	3 7

FORD Late 1950 and All 1951 V8

Dist RPM	Adv Dist Deg	Vacuum, In.
200	0	0
500	0- 1	0 3
1000	5¼- 6¼	1 32
1500	8¾-10	2 85
2000	10 -11¼	3 7

LINCOLN 1950-51

Dist RPM	Adv Dist Deg	Vacuum, In.
200	0	0
500	½- 1½	0 5
1000	5 - 6	2 0
2000	9¾-10¾	5 8

MERCURY 1949-51

Dist RPM	Adv Dist Deg	Vacuum, In.
200	0	0
400	¾- 1¾	0 28
1200	5¾- 6¼	2 1
2000	7½- 8½	3 7

DISTRIBUTOR REMOVAL—Before removing distributors from engines that are timed correctly, be sure to scribe a mark on the distributor housing indicating the position of the rotor The distributor can then be reinstalled when the rotor is in line with the mark without rotating the engine to obtain the proper timing

To remove the distributor, remove the cap and disconnect the primary wire and vacuum line Loosen the distributor lock screw or hold-down bolt and lift the distributor from the engine

DISTRIBUTOR INSTALLATION — If the timing was correct before the distributor was removed and the instructions given above were followed, merely install the distributor so the scribed mark on the housing is in line with the rotor

If timing is necessary, however, turn over the engine until No 1 piston is moving up on its compression stroke and stop when the timing mark on the vibration damper is in line with the pointer on the timing case cover Install the distributor in the engine with the rotor in the No 1 firing position Then time the engine as outlined below

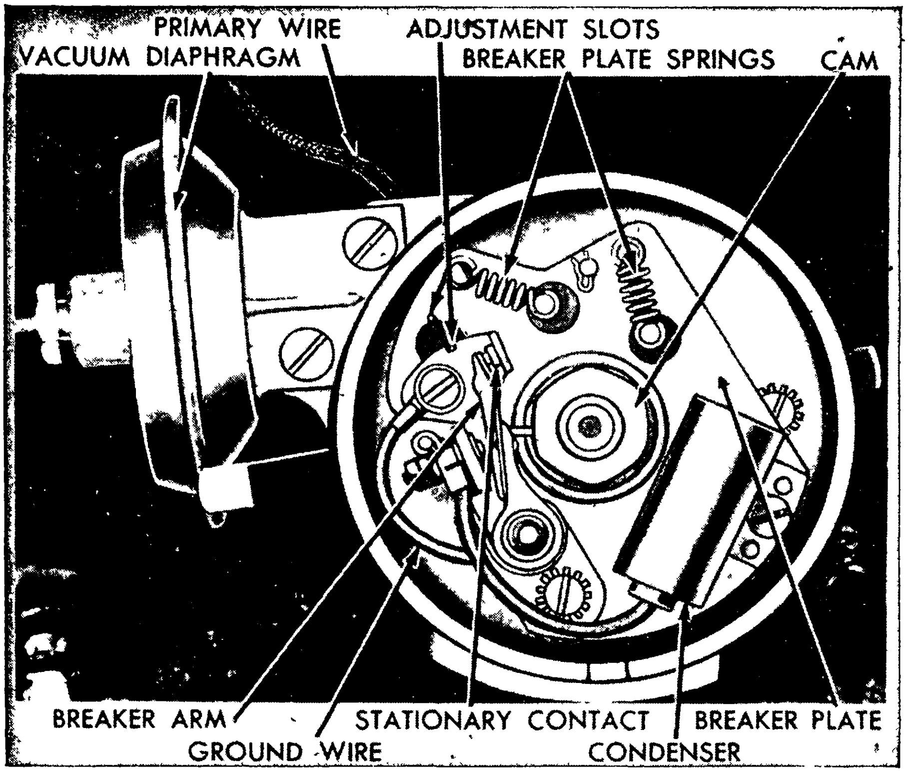


Fig. 27 Breaker plate details of 1949-51 Ford Six distributor

IGNITION TIMING — The six-cylinder engine is equipped with either a viscous or rubber type vibration damper. The viscous type provides a groove timing mark and the rubber type has a spherical timing mark. Because of the difference in diameter between the two types of dampers, two timing pointers are located on the front engine cover. The pointer nearest to the outer circumference of the damper should be used to time the engine correctly.

The V8 engines incorporate a single timing pointer on the front engine cover.

When timing the distributor to the engine, set the damper timing mark in line with the pointer, and be sure that No. 1 piston is on the compression stroke. Mark the distributor housing to indicate the position of the rotor when it is in line with the No. 1 spark plug terminal on the distributor cap. When the pointer is in the correct position, the breaker points should just start to open.

If the rotor is not in the proper position, loosen the distributor housing clamp and rotate the distributor until the points just open as the rotor approaches the position to fire No. 1 cylinder.

USING TIMING LIGHT—When checking ignition timing with a timing light, be sure to disconnect the vacuum line on the pressure type distributors. This is necessary to eliminate the possibility of any vacuum advance.

Connect the timing light on the engine with the high tension lead on No. 1 spark plug and the other two leads to the proper battery terminals. Clean the grease and dirt from the timing mark and, if necessary, cover the timing mark and pointer with white chalk.

Start the engine and operate it at idle speed. Turn the light on the timing mark. It should flash just as the timing mark lines up with the pointer. If the mark and pointer do not line up when the light flashes, rotate the distributor to correct the timing.

CONTACT POINT SPACING — To adjust the point gap, slightly loosen the contact lock screws, Fig. 27, and insert a screw driver blade in the adjusting slot. Turn the screw driver to move the contacts to the desired spacing and tighten the lock screws.

Always re-time the ignition after changing the contact spacing.

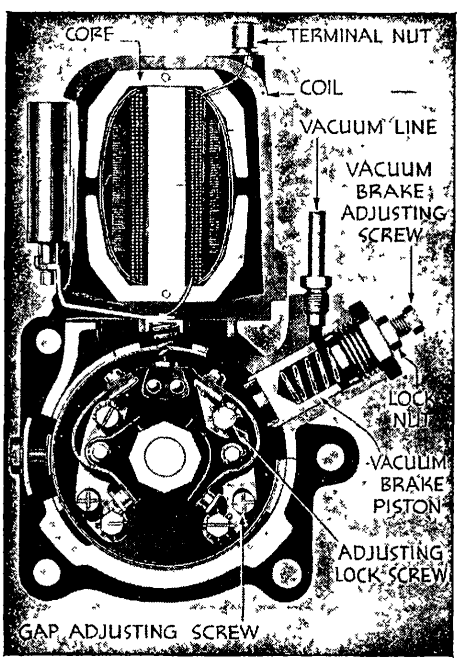


Fig. 31 F rd vacuum brak typ distribu- t r, 1937-41 V8

DISTRIBUTOR LUBRICATION — An oiler on the distributor body is provided for lubrication of the distributor drive shaft.

Wear on the distributor rubbing block can be reduced by applying a light film of Ford distributor grease on the distributor cam when contacts are serviced.

IGNITION COILS—The metal can type ignition coil has replaced the plastic case type coil used on previous ignition systems. This permits the coil primary to be wound on the outside of the secondary winding, and incorporates the correct primary resistance, eliminating the series resistor formerly used in the primary circuit.

FORD VACUUM BRAKE DISTRIBUTORS

1935-48 FORD, MERCURY & LINCOLN —Figs. 31 through 33 show the details of the vacuum brake type distributors used on these cars. Except for the vacuum brake, these units function in the same manner as a conventional type distributor employing a centrifugal governor advance.

The vacuum brake consists of a plunger or piston which is held against the braking surface of the governor plate by a spring of adjustable tension. As the rapidity of combustion is dependent upon the degree of compression, the need of a retarded spark for quick acceleration or power is not dependent entirely on engine speed.

The requirements for retarded spark at any speed are when the vacuum in the carburetor throat is extremely low. As an example, if the car is traveling at a speed of 20 to 25 M.P.H., the throttle valve would be partially open and would restrict the passage of air into the manifold which would result in a comparatively high vacuum in the intake manifold causing the air in the distributor suction line to be drawn into the manifold.

The suction draws the vacuum brake piston upward, compressing the vacuum brake operating spring. When the brake piston is in this position, the brake is inoperative and the timing is automatically advanced by the centrifugal governor weights.

However, if the throttle valve is fully opened suddenly, the restriction to the air entering through the carburetor throat would be removed and the vacuum in the intake manifold would immediately drop. The operating spring then pushes the piston downward against the governor plate, retarding the spark.

As the engine speed increases to the speed required by throttle valve position, its increased demand for air again

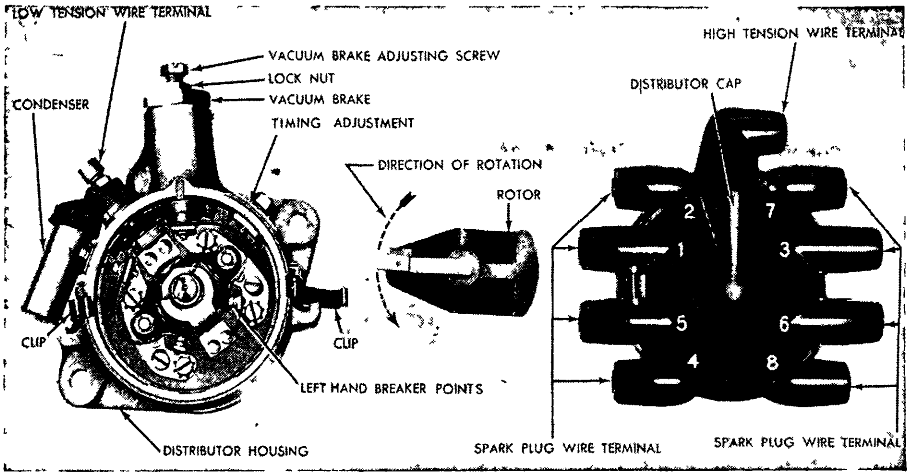


Fig. 32 Ford vacuum brake type distributor, 1942-48 V8

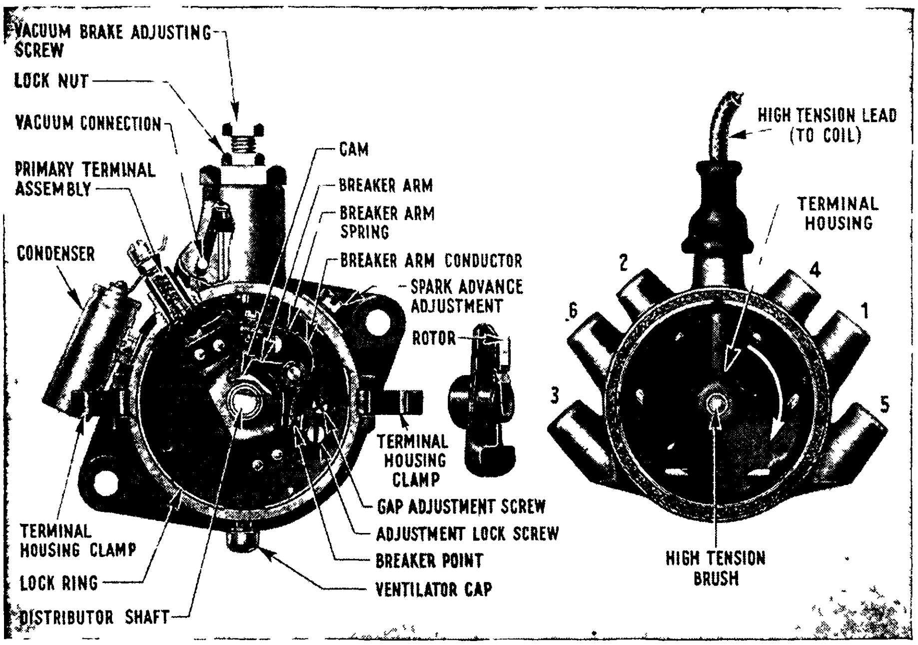
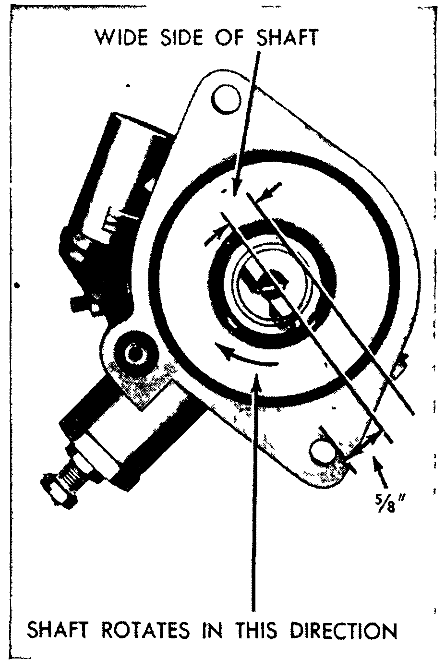


Fig. 33 Ford vacuum brake type distributor, 1941-47 six-cylinder



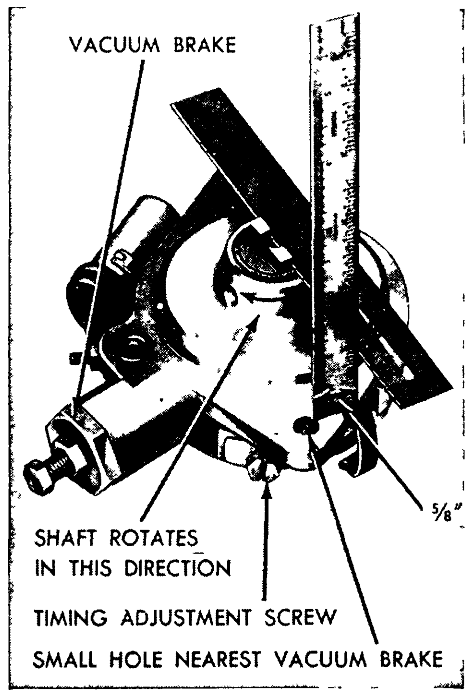


Fig. 35 Timing distribut r n Ford six-cylinder engines using vacuum brake type distributors when distribut r fixture is n t available

causes a partial vacuum to be formed, and the air is again drawn from the suction line and the vacuum brake is again inoperative.

The vacuum brake setting can be accurately set while the distributor is off the car by means of a distributor stroboscope. However, if this equipment is not available, the vacuum brake may be set as follows:

1. Inspect the brake piston for any indication of its binding in the distributor body. Apply a few drops of engine oil to the piston.
2. Set the vacuum brake so that the engine pings under load.
3. Next adjust until the ping is removed. Avoid screwing the adjusting nut down more than is actually required to remove the ping or the spark will not advance correctly.

If satisfactory results cannot be obtained after the above procedure is followed, the distributor should be removed, checked and timed.

DISTRIBUTOR REMOVAL—Disconnect the battery ground strap as a safety measure to prevent the possibility of injury from the fan or belt in case someone else should attempt to start the engine.

To remove the distributor, disconnect the low tension wire, unsnap the clips and remove the cap (or caps). Unfasten the unit from the timing gear cover and remove the distributor.

DISTRIBUTOR DISASSEMBLY—After the cap or caps are removed, disconnect the condenser and coil. Remove the breaker plate locking bolt and vacuum advance mechanism. Pry out the snap ring from the underside of the distributor so that the breaker plate and governor mechanism can be removed from the housing. Separate the governor mechanism from the breaker plate.

If the points are removed from the breaker plate, note the relationship of the insulators and leads. The stationary contact assembly has insulators on which the spring of the breaker arm is attached with a screw, lock washer and flat washer.

DISTRIBUTOR INSTALLATION — Place the distributor and gasket in position on the timing gear cover, making sure the tang on the distributor shaft is entered in the slot in the camshaft, and that the distributor is against the cover. Fasten the distributor to the cover, replace the cap (or caps), low tension wire and battery ground strap.

Road test the car and adjust the vacuum brake as outlined above.

IGNITION TIMING VACUUM BRAKE DISTRIBUTORS

1942-48 Ford & Mercury—The construction of these distributors is such that the ignition is usually set with a special timing fixture with the distributor off the engine. In the absence of such a fixture, however, timing can be set as follows:

Adjust the breaker gap to .014 to .016 inch. Then place a scale, Figs. 35 and 36, against the tang on the wide side of the distributor shaft and rotate the shaft until the scale is positioned to the dimension shown. Always work from the mounting hole nearest to the vacuum brake.

On the V8's, with the distributor shaft in the position shown in Fig. 36, the left-hand breaker points should be just starting to open. (Timing is controlled by the left breaker points only.) If these points are not just starting to open, move the adjustment on the right side of the distributor up to advance the timing or down to retard it.

On the sixes, the breaker points should be just starting to open when the distributor shaft is in the position shown in Fig. 35. If not, move the adjustment on the left side of the distributor down to advance the timing or up to retard it, and recheck the timing.

On all models, if proper timing is not obtained on the first attempt, turn the distributor shaft back at least ¼ turn to eliminate backlash and repeat the check.

Any difference in timing, made necessary by the grade of fuel being used, can be established by adjusting the vacuum brake. Adjustment of the vacuum brake does not change the basic timing of the distributor Any change in the spacing of the breaker points will change the timing. However, ordinarily the timing will be re-established when the points are correctly spaced.

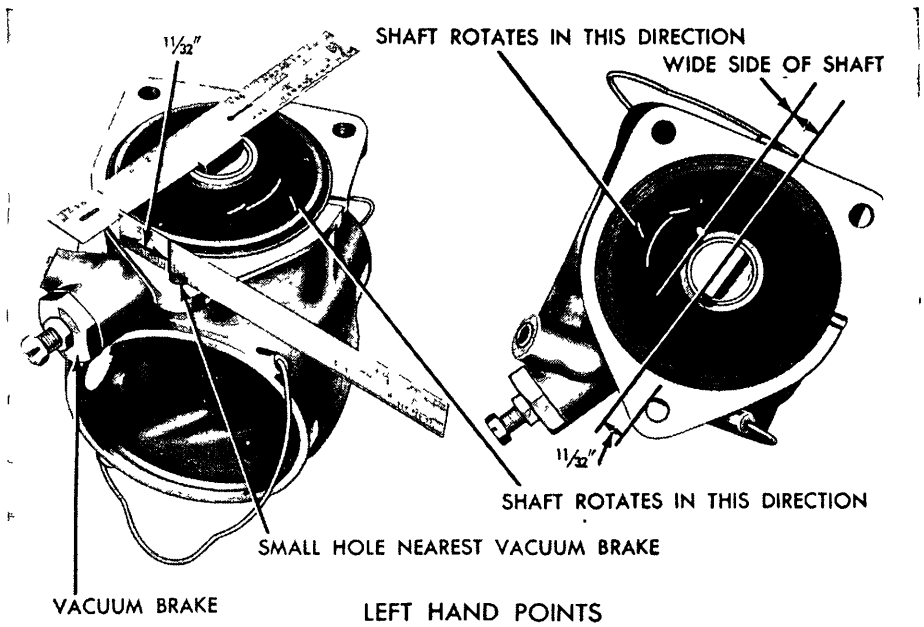


Fig. 37 Timing distributor on Lincoln cars having vacuum brake type distribut rs when distributor fixture is not available. For right-hand points →

To adjust the vacuum brake, back off the screw until the engine pings on a road test under load. Then turn the adjusting screw in just enough to remove the ping. Tighten the adjusting screw lock nut.

1936-48 LINCOLN—If a special distributor fixture is not available to set the basic ignition timing of the distributor, proceed as follows:

Adjust the breaker points from .014 to .016 inch. Then, as shown in Fig. 37, place a scale against the tang on the wide side of the distributor shaft and rotate the shaft until this scale is 11/32 inch from the near side of the small mounting hole nearest to the vacuum brake (left view). With the distributor shaft in this position, the left-hand breaker points should be just starting to open. If they are not, move the adjustment on the right side of the distributor up to advance the timing or down to retard it, and recheck. If proper timing is not obtained on the first attempt, turn the distributor shaft back at least ¼ turn to eliminate backlash and repeat the check.

Remove the timing adjustment screw and plate to gain access to the synchronizing screw. Then place the scale against the tang on the wide side of the distributor shaft and rotate the shaft until the scale is 27/32 inch (right view) to the left-hand side of the hole. With the shaft in this position, the right-hand breaker points should be just starting to open. If not, turn the synchronizing screw in either direction until the points are just opening, and recheck the timing. If correct timing of the right-hand points is not obtained on the first attempt, turn back the shaft to eliminate backlash and try again.

Install the timing adjustment screw and plate and recheck the timing of both sets of points.

After the distributor is installed on the car, adjust the vacuum brake as previously described.

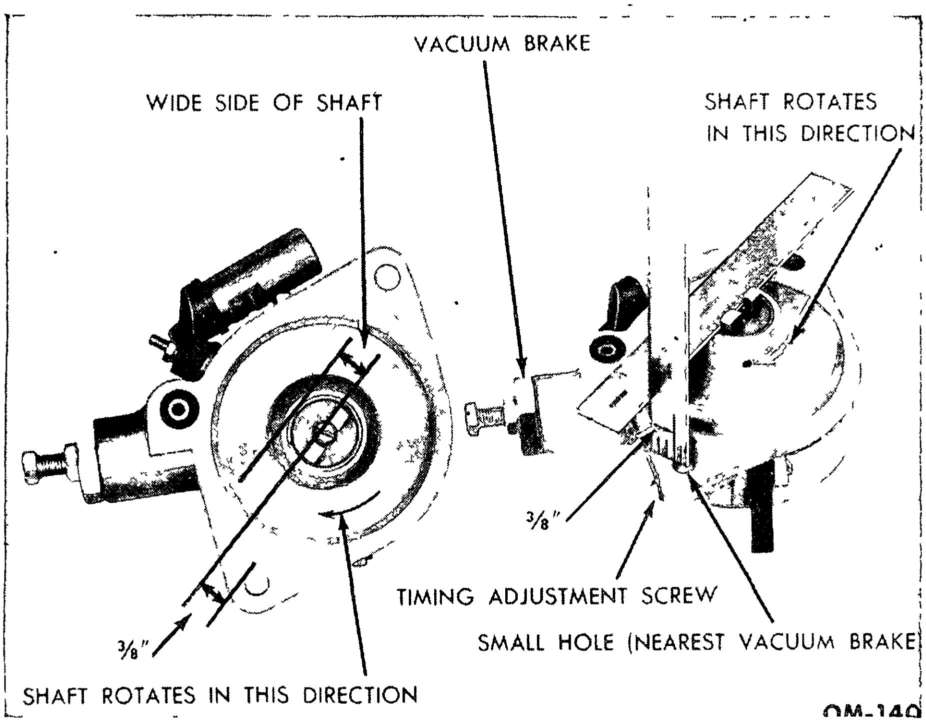
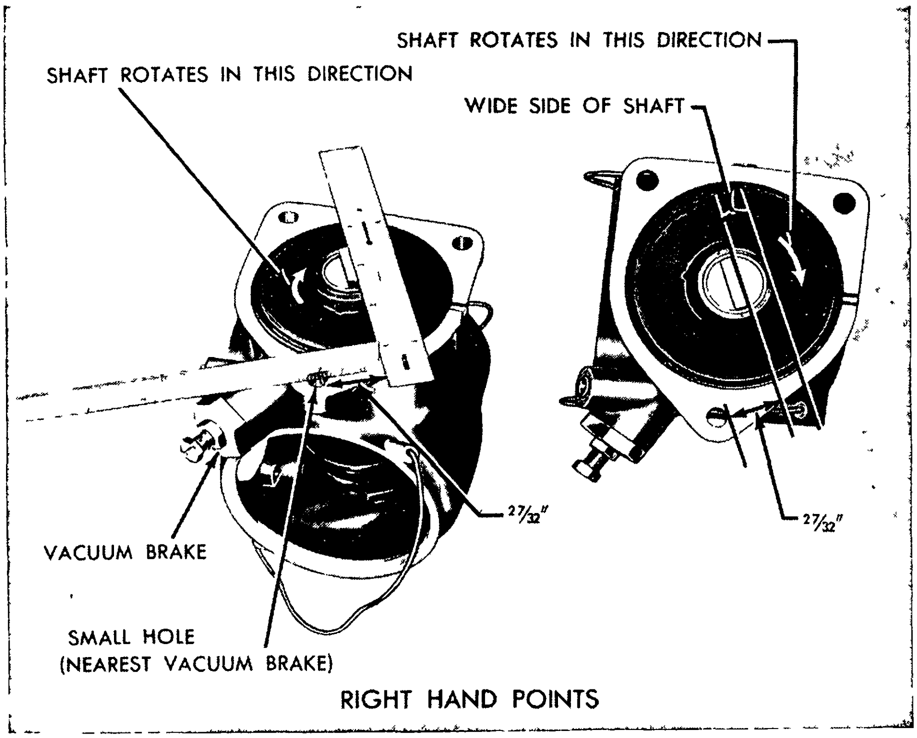


Fig. 36 Timing distribut r n 1942-48 F rd and Mercury V8s using vacuum brak typ distribut rs when distribut r fixtur is not available



GENERATORS

GENERATORS are much alike in general construction, regardless of make and, for the most part, are serviced in a similar manner. There are certain variations in detail, however, between the different models and makes, and special attention should be paid to these variations, since they make some difference in the servicing procedure. Fig. 1 is a section view of a typical generator.

GENERATOR TYPES

A number of different wiring circuits are used in automotive type generators, four of which are shown in Fig. 2.

The diagram marked "GAR" is a two-pole third brush type with two field coils. One armature brush is grounded to the frame, the other is connected to an insulated terminal marked "A" (armature circuit). The third (regulating) brush is insulated and connected to one end of the field circuit and the other end of the field circuit is carried through the frame by an insulated terminal marked "F".

The diagram marked CO is a larger four-pole third brush generator of the Owen-Dyneto type. Note that in this generator the two main brushes are spaced 90 degrees apart on the commutator, instead of 180 degrees as in two-pole generators.

The diagram marked GBW is a two-brush, two-pole generator of the shunt type. One brush is grounded to the frame and the other is connected to the "A" terminal on the outside of the frame. One end of the field circuit is connected to the ungrounded brush and the other end of the field circuit is connected to the "F" terminal on the outside of the frame.

The diagram marked GCH is a four-pole shunt type generator. On this generator there are four brushes, one for each pole. Two brushes, 180 degrees apart, are grounded to the frame. The other two brushes are connected to the "A" terminal on the outside of the frame. One end of the field circuit is connected to one of the grounded brushes and the other end is connected to the "F" terminal on the outside of the frame.

TROUBLE SHOOTING

The following information is given as a guide for locating trouble in the generator and charging circuit. Bear in mind that the ammeter on the vehicle's instrument panel is merely an indicator for current flow in and out of the battery—it does not indicate generator output. Therefore, a suitable test ammeter and voltmeter should be connected to the circuit for testing generator output.

FULLY CHARGED BATTERY AND LOW CHARGING RATE—If the battery is fully charged and the generator output is 2 or 3 amperes, it indicates that the generator and regulator are working properly. A check can be made by cranking the engine with the starting motor (ignition off) for about 10 seconds to partially discharge the battery. Then run the engine at a speed which equals about 20 M.P.H. vehicle speed. The ampere charging rate to the battery should increase for a short period of time and then trickle down to a few amperes as the battery again becomes fully charged.

FULLY CHARGED BATTERY AND HIGH CHARGING RATE — This condition indicates that the voltage regulator is not reducing the generator output as it should. A high charging rate with a fully charged battery will cause the battery to overheat and gas excessively, and the battery will be destroyed within a short time. Under this condition the electrical system voltage is usually higher than normal, which would cause damage or failure to the distributor contacts, ignition coil, lamp bulbs and other electrical units on the vehicle.

A high charging rate with a fully charged battery may be caused by any of the following conditions:

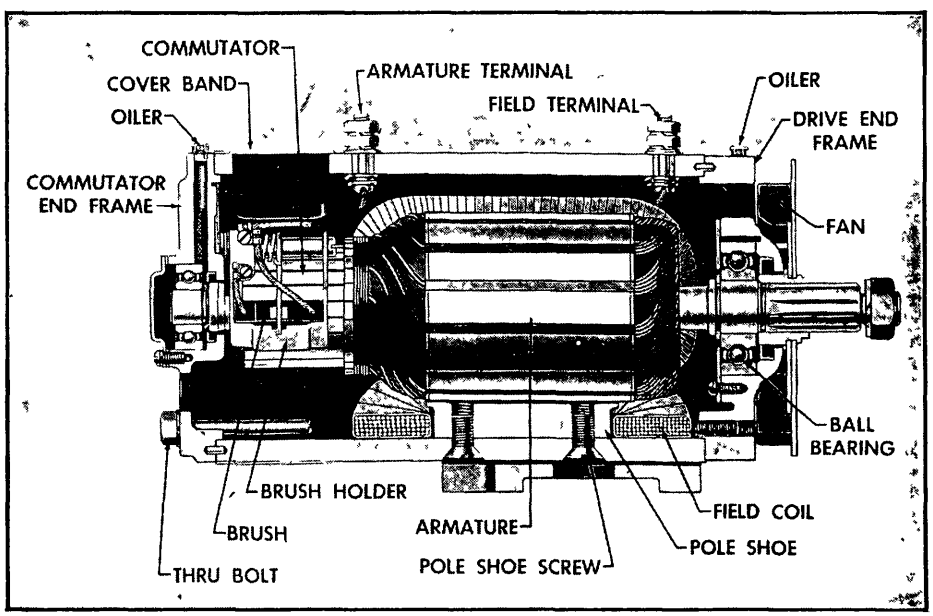


Fig. 1 Secti nal view f a typical Delc -Remy gen rat r

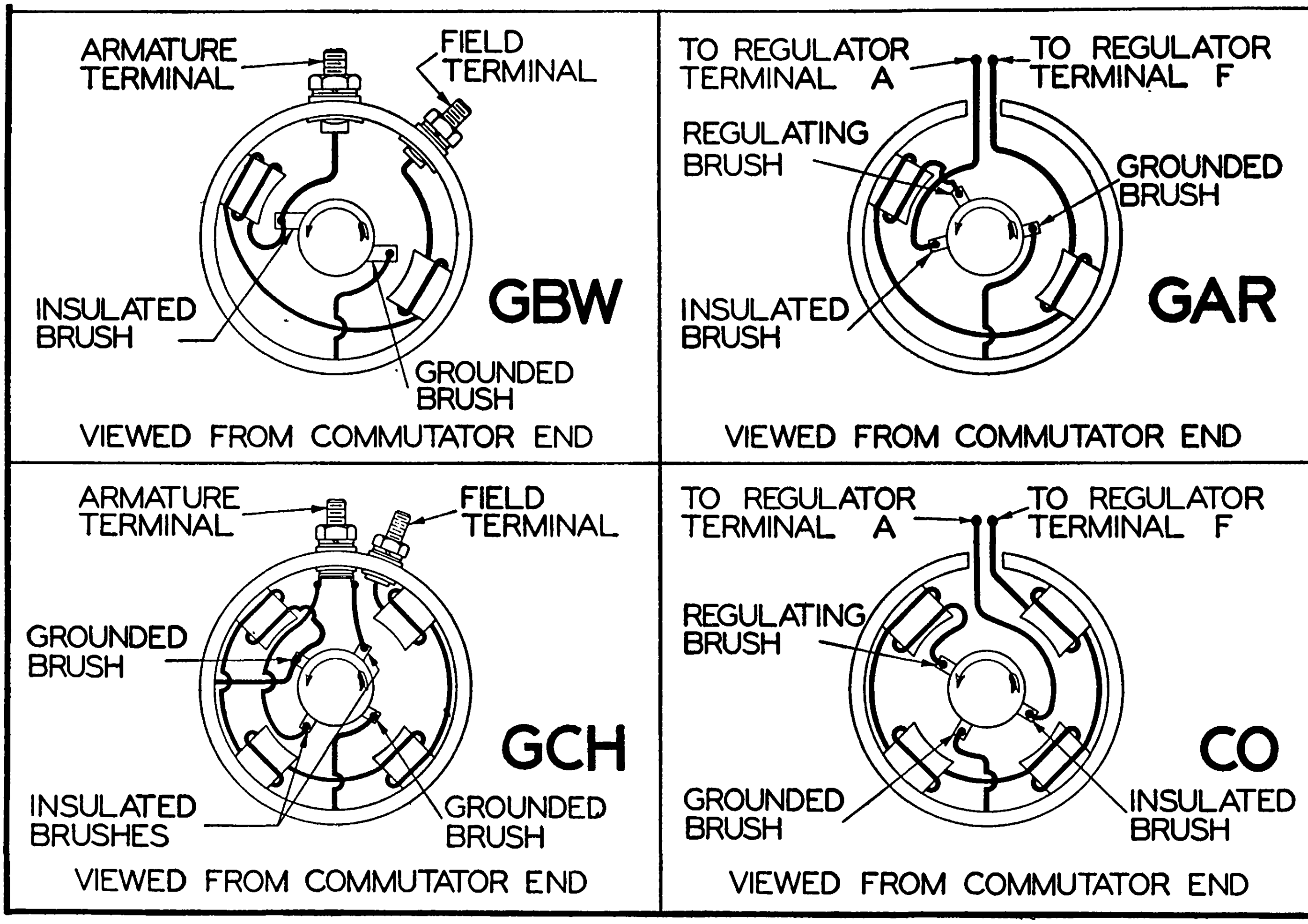


Fig. 2 Wiring circuits of four series of Auto-Lite generators

1. Voltage regulator out of adjustment.
2. Defective winding of voltage regulator unit.
3. Short circuit between generator charging circuit and generator field circuit, either in the regulator or generator, which would prevent resistance being inserted in the generator field circuit when the regulator contacts open.
4. High resistance connections between generator ground and regulator ground.

The above trouble may be located in the following manner: Hold the voltage regulator contacts open. If generator output is reduced, it indicates that the resistance is being inserted into the field circuit. If output continues high when voltage regulator contacts are opened, a short circuit exists between the charging circuit and the generator field circuit. This can be checked as follows:

Remove the wire from the field terminal of the regulator. If the generator output is reduced, the short circuit is in the regulator. Check for burnt leads, charred insulation or short circuit in winding.

If the generator output is not reduced with the field lead removed from the regulator, the short circuit is in the wiring or generator.

Remove the lead from the field terminal of the generator. If generator output is reduced, the short circuit is in the wiring. If output is not reduced, the trouble is in the generator.

BATTERY DISCHARGED AND LOW OR NO CHARGING RATE—Check the circuit for loose connections, damaged cables or frayed insulation of the cables. Abnormally high resistance in any part of the charging circuit will cause the voltage regulator to operate as though the battery were fully charged. Thus the generator output would be reduced even though the battery is discharged or partially discharged. If the trouble is not in the wiring, make the following checks.

Reduce the engine speed to idle. Then if the generator is one with the field circuit grounded inside the generator, connect a temporary jumper wire between the regulator armature terminal and regulator field terminal. If the generator is one with the field circuit grounded externally through the regulator, connect a temporary jumper wire between the regulator field terminal and regulator base.

CAUTION—Be sure to make the jumper wire connection as described above. On generators with internally grounded fields, such as the GCH type shown in Fig. 2, no current would be produced if the jumper connection was made between the regulator field terminal and regulator base. The GBW type generator, Fig. 2, is an example where the field circuit is grounded externally at the regulator.

With the jumper wire properly connected, slowly increase engine speed. Note the voltage output of the generator, being careful not to exceed normal voltage as the jumper connection removed all external regulation of the generator, which allows an excessive increase in voltage and current output.

With the above jumper in place, the generator output should increase to specifications. This indicates that the voltage regulator unit is adjusted too low or that the current regulator is set too low. It could be, also, that voltage or current regulator contacts are burned or oxidized and must be cleaned, or the generator field circuit is open at some place within the regulator, either at the connections or in the voltage regulator winding.

If with the jumper in place the generator output does not increase to specifications, the generator is at fault and should be removed for servicing.

If the generator produces no current, either with or without the jumper wire in place, it indicates that either the generator or circuit breaker is at fault, and

Continued on page 35

Car and Model	Generator Number Note A	Brush Spring Tension, Ounces		Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	L w Output Test			Maximum Output Note D		
		Main	Third			Amperes	R.P.M. Note C	Volts	Amperes	R.P.M.	Volts
AMERICAN BANTAM AND AUSTIN											
1935-39	GAS-4104B	15-20	15-20	CL	4.09—4.52	4	1100	7.2	12.5		8
1938-41	GAS-4139B	15-20	15-20	CL	4.09—4.52	4	1100	7.2	12.5		8
CHRYSLER											
1935 Six	GAR-4608-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
CZ, C7, C8	GAR-4608A-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1935-36 Eight	GAR-4608B-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1937 Six	GBW-4803A	53 Max.	None	CL	1.66—1.84	8	1125	7	22	1800	8
C17	GCO-4801B	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
C18, 1939	GDA-4801A	53 Max.	None	CL	1.66—1.84	8	1195	7.6	28	2025	8
1940-48	GDZ-4801A	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
C33, C37	GEG-4818C	64-68	None	CL	1.60—1.78	8	1000	7.6	40	1550	8
1942 Six	GDZ-4801B	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1947-48	GDZ-4801R	35-53	None	CL	1.6—1.8	0	970	6 4	35	2000	8
1949 C45	GDZ-4801R	35-53	None	CL	1 6—1.8	0	970	6.4	35	2000	8
1949-50	GGW-6001A	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1949-50	GGU-6001A	35-53	None	CL	1.7—1.8	0	850	6.4	45	1650	8
1949-50	GGJ-6001A	30-37	None	CL	1.7—1.9	8	700	6.4	50	1600	8
1950-52	GGW-6001J	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950-52	GGU-6001G	35-53	None	CL	1.7—1.8	0	850	6.4	45	1650	8
1950-52	GGJ-6001F	30-37	None	CL	1.7—1.9	0	700	6.4	50	1600	8
1951-52	GGU-6001T	35-53	None	CL	1.4-1.6(E)	0	750	6.4	45	1650	8
1951-52	GGU-6001R	35-53	None	CL	1.4-1.6(E)	0	750	6.4	45	1650	8
1951-52	GGJ-6003A	30-37	None	CL	1.4-1.6(E)	0	600	6.4	45	1550	8
CROSLEY											
1939-42	GBM-4619-5	50-60	50-60	CCL	3.80—4.20	8	1300	7.6	16		8
1946-48	GAS-4190	15-20	15-20	CL	4.09—4.52	4	1100	7.2	12.5		8
1946-52	GDZ-4806B	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
DE SOTO											
1935	GAR-4608-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1935-36	GAR-4608A-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1937	GBW-4803A	53 Max.	None	CL	1.66—1.84	8	1225	7	22	1800	8
1938-39	GDA-4801A	53 Max.	None	CL	1.66—1.84	8	1195	7.6	28	2025	8
1940-49	GDZ-4801A	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1942	GDZ-4801B	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1947-49	GDZ-4801R	35-53	None	CL	1 6—1 8	0	970	6 4	35	2000	8
1949-50	GGW-6001A	35-53	None	CL	1.3-1.5(E)	0	970	6 4	45	2125	8
1949-50	GGW-6001B	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950-52	GGW-6001J	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950-52	GGW-6001K	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
DODGE											
1935-36	GAR-4608-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1936	GAR-4608E-5	50-60	50-60	CL	3.51—3.89	8	1100	8	22.4		8
1937	GBW-4803A	53 Max.	None	CL	1.66—1.84	8	1125	7	22	1800	8
1938-39	GDA-4801A	53 Max.	None	CL	1.66—1.84	8	1195	7.6	28	2025	8
1939	GDF-4801A	53 Max.	53 Max.	CL	1.90—2.10	8	1270	7.6	32		8
1940	GDZ-4801A	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941-42	GDZ-4801B	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941	GBM-4610A-5	50-60	50-60	CL	3.80—4.20	8	1300	7.6	16		8
1946-50	GDZ-4801A	35-53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1949	GDZ-4801R	35-53	None	CL	1 6—1 8	0	970	6 4	35	2000	8
1949-50	GGW-6001A	35-53	None	CL	1.3-1.5(E)	0	970	6 4	45	2125	8
1949-50	GGW-6001D	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950	GGW-6001J	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950	GGW-6001L	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950	GGW-6001B	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8
1950-52	GGW-6001K	35-53	None	CL	1.3-1.5(E)	0	970	6.4	45	2125	8

AUTO-LITE GENERATOR INDEX & SPECIFICATIONS

Car and Model	Generator Number Note A	Brush Spring Tension, Ounces Main	Brush Spring Tension, Ounces Third	Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	Low Output Test Amperes	Low Output Test R.P.M. Note C	Low Output Test Volts	Maximum Output Note D Amperes	Maximum Output Note D R.P.M.	Maximum Output Note D Volts
FRAZER											
1947–51	GDZ-4818A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1951	GGU-6001B	35–53	None	CL	1.7—1.8	0	850	6.4	45	1650	8
HENRY J											
1951–52	GDZ-6001E	35–53	None	CL	1.3–1.5(E)	0	970	6.4	35	2250	8
HUDSON AND TERRAPLANE											
1935	GBK-4602-1	18–22	18–22	CL	3.94—4.36	8	1140	8	23		8
1935, G	GBK-4601-2	18–22	18–22	CL	4.08—4.52	8	1235	8	17.5		8
1936, 61	GAR-4702	18–22	18–22	CL	3.51—3.89	8	1165	8	17		8
1936	GAR-4701-6	18–22	18–22	CL	3.51—3.89	8	1090	8	22.5		8
1937, 71	GCJ-4804A-1	53 Max.	53 Max.	CL	1.90—2.10	8	1160	8	19		8
1937	GCJ-4803A	53 Max.	53 Max.	CL	1.90—2.10	8	1135	8	26		8
1938, 81	GDF-4803A-1	53 Max.	53 Max.	CL	1.90—2.10	8	1460	7.6	19		8
1938	GDF-4802A	53 Max.	53 Max.	CL	1.90—2.10	8	1270	7.6	32		8
89, 90	GBM-4609A	50–60	50–60	CL	3.80—4.20	8	1250	7.6	21		8
1939	GDS-4801A	53 Max.	53 Max.	CL	1.65—1.82	8	1210	8	34		8
40, 10, 20	GDS-4801A	53 Max.	53 Max.	CL	1.65—1.82	8	1210	8	34		8
1940–50	GEC-4801A	53 Max.	53 Max.	CL	1.60—1.78	8	1200	7	43		8
1950–52	GDZ-6001B	35–53	None	CL	1.6—1 8	0	970	6.4	35	2000	8
KAISER											
1947–50	GDZ-4818A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
LINCOLN											
1935–40, K	GBC-4103	22–27	22–27	CL	2.47—2.73	8	600	8	23		8
NASH AND LAFAYETTE											
1935–36	GAR-4601-5	50–60	50–60	CL	3.51—3.89	8	1100	8	22.4		8
1936, 20, 80	GBR-4602-4	50–60	50–60	CL	4.13—4.57	8	925	7	27		8
1936, 40, 40A	GAR-4618-2	50–60	50–60	CL	3.70—4.10	8	1140	8	19		8
1936, 40A	GAR-4634	50–60	50–60	CL	3.70—4.10	8	1140	8	19		8
1937, 10, 20	GCM-4803-4	53 Max.	53 Max.	CL	3.51—3.89	8	1090	7.6	23		8
1937, 10, 20	GCM-4803A-4	53 Max.	53 Max.	CL	3.51—3.89	8	1090	7.6	23		8
1937, 80	GCO-4802	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1937, 80	GCO-4802A	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1938, 10, 20	GCM-4803B-4	53 Max.	53 Max.	CL	3.51—3.89	8	1090	7.6	23		8
1938, 80	GCO-4802B	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1939, 10	GCM-4825A-4	53 Max.	53 Max.	CL	3.51—3.89	8	1090	7.6	23		8
1939, 10,20	GDS-4802A	53 Max.	53 Max.	CL	1.65—1.82	8	1210	8	34		8
1939, 10, 20	GCO-4802C	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1939, 80	GDS-4802B	53 Max.	53 Max.	CL	1.65—1.82	8	1210	8	34		8
1940, 10, 20	GDZ-4803A	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8
1940–42, 80	GDZ-4803B	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8
1941–42, 60	GDZ-4806A	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8
1946–48, 40, 60	GDZ-4806A	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8

Car and Model	Generator Number Note A	Brush Spring Tension, Ounces: Main	Brush Spring Tension, Ounces: Third	Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	Low Output Test: Amperes	Low Output Test: R.P.M. Note C	Low Output Test: Volts	Maximum Output Note D: Amperes	Maximum Output Note D: R.P.M.	Maximum Output Note D: V lts
PACKARD											
1935 Eight	CO-1240	20–22	12–14	CL	1.90—2.10	8	805	7	33		8
1935 Twelve	CO-1271	20–22	12–14	CL	1.90—2.10	8	805	7	33		8
1936 Eight	GBR-4601-5	50–60	50–60	CL	4.18—4.62	8	965	7	23		8
1936 Eight	GAR-4611-5	50–60	50–60	CL	3.51—3.89	8	1100	8	22.4		8
1936 Super 8	CO-1300	20–22	20–22	CL	3.50—3.70	8	750	7	33		8
1936 Twelve	CO-1304	20–22	20–22	CL	3.50—3.70	8	750	7	33		8
1937, 6 and 8	GCJ-4801A	53 Max.	53 Max.	CL	1.90—2.10	8	1135	8	26		8
1937–39 Super 8	GCO-4803A	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1937–39 Twelve	GCE-4803A	64–68	None	CL	1.66—1.84	8	1000	8	30	1500	8
1938–39 Eight	GCJ-4807A-2	53 Max.	53 Max.	CL	1.90—2.10	8	1050	8	32		8
1939 Six	GCJ-4807A-2	53 Max.	53 Max.	CL	1.90—2.10	8	1050	8	32		8
1939 Super 8	GCO-4807A	53 Max.	None	CL	1.47—1.63	8	1125	8	28	1850	8
1940, 6 and 8	GEA-4801A	53 Max.	None	CL	1.57—1.75	8	915	7.6	35	1500	8
1940 Super 8	GEA-4802A	53 Max.	None	CL	1.57—1.75	8	1060	7.6	35	1700	8
1941–47, 6 and 8	GDZ-4801F	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941, 6 and 8	GDZ-4801G	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941–42 Super 8	GEA-4802A-1	53 Max.	None	CL	1.57—1.75	8	1060	7.6	35	1700	8
1942 Super 8	GEA-4802	53 Max.	None	CL	1.57—1.75	8	1060	7.6	35	1700	8
1946–47 Super 8	GEA-4802A	53 Max.	None	CL	1.57—1.75	8	1060	7.6	35	1700	8
1948, Except Custom	GDZ-4801F	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8
1948-50, Except Custom	GDZ-4801T	35–53	None	CL	1 6–1 8	0	970	6 4	35	2000	8
1948, Custom 8	GDZ-4801G	35–53	None	CL	1.60—1.78	8	1250	7.6	35		8
1948–50, Custom 8	GDZ-4801V	35–53	None	CL	1 6—1 8	0	970	6 4	35	2000	8
1949–50, Except Custom	GGW-6001E	35–53	None	CL	1.3–1.5(E)	0	970	6 4	40	2000	8
1949–50, Except Custom	GGU-6001C	35–53	None	CL	1.7—1.8	0	850	6.4	45	1650	8
1949–50, Custom 8	GGW-6001F	35–53	None	CL	1.3–1.5(E)	0	970	40	40	2000	8
1949–50, Custom 8	GGU-6001D	35–53	None	CL	1.7—1.8	0	850	6.4	45	1650	8
1949–50, Custom 8	GEG–4823F	64–68	None	CL	1.60—1.78	8	1000	7.6	40	1575	8
1951–52	GGW-6003A	35–53	None	CL	1.3–1.5(E)	6	870	6.4	40	2250	8
PLYMOUTH											
1935 Std.	GBM-4603-1	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1935 Deluxe	GAR-4608-5	50–60	50–60	CL	3.51—3.89	8	1100	8	22.4		8
1936, P1	GBM-4603B-1	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1936, P2	GAR-4608E-5	50–60	50–60	CL	3.51—3.89	8	1100	8	22.4		8
P3, P5, P7	GBM-4606C-1	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1937, P4	GCJ-4802A	53 Max.	53 Max.	CL	1.90—2.10	8	1135	8	26		8
P6, P8	GDF-4801A	53 Max.	53 Max.	CL	1.90—2.10	8	1270	7.6	32		8
1940	GDZ-4801A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941-42	GDZ-4801B	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1946-50	GDZ-4801A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1949-50	GGW-6001B	35–53	None	CL	1.3–1.5(E)	0	970	6 4	45	2125	8
1950-52	GGW-6001K	35–53	None	CL	1.3–1.5(E)	0	970	6.4	45	2125	8
STUDEBAKER											
1935 Dic	GBM-4604-2	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1935–36 Dic.	GBM-4604A-2	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1935 Dic.	GAR-4609-4	50–60	50–60	CL	3.75—4.15	8	1075	8	26		8.5
1935–36 Dic.	GAR-4609A-4	50–60	50–60	CL	3.75—4.15	8	1075	8	26		8.5
1937 Dic.	GBM-4607A-2	50–60	50–60	CL	3.80—4.20	8	1300	7.6	19		8
1937 Dic.	GCM-4802A-4	53 Max.	53 Max.	CL	3.51—3.89	8	1090	7.6	23		8
1938 Com.	GCJ-4808A	53 Max.	53 Max.	CL	1.90—2.10	8	1135	8	26		8
1938 Com.	GDF-4804B	53 Max.	53 Max.	CL	1.90—2.10	8	1270	7.6	32		8
1939 Champ.	GDF-4812A	53 Max.	53 Max.	CL	1.90—2.10	8	1270	7.6	32		8
1939 Com.	GDA-4804A	53 Max.	None	CL	1.66—1.84	8	1195	7.6	28	2025	8
1940 Champ.	GEA-4804A	53 Max.	None	CL	1.57—1.75	8	915	7.6	35	1500	8
1940 Com.	GEA-4803A	53 Max.	None	CL	1.57—1.75	8	915	7.6	35	1500	8
1941–50 Champ.	GDZ-4804A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1941–49 Com & Pres.	GDZ-4805A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1950–51 Champ.	GDZ-6001A	35–53	None	CL	1 6—1 8	0	970	6 4	35	2000	8
1952 Champ.	GGW-4801A	35–53	None	CL					45	2500	7.7

AUTO-LITE GENERATOR INDEX & SPECIFICATIONS

Car and Model	Generator Number Note A	Brush Spring Tension, Ounces		Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	Low Output Test			Maximum Output Note D		
		Main	Third			Amperes	R.P.M. Note C	Volts	Amperes	R.P.M.	Volts
WILLYS											
1935–37	GAM-4504	18–22	18–22	CL	3.89—4.31	8	1070	8	17.5		8
1938–39	GAM-4504A	18–22	18–22	CL	3.89—4.31	8	1070	8	17.5		8
1938–39	GAM-4504B	18–22	18–22	CL	3.89—4.31	8	1070	8	17.5		8
1939	GBM-4612A	50–60	50–60	CL	3.80—4.20	8	1250	7.6	21		8
1939–42	GCJ-4811A	53 Max.	53 Max.	CL	1.90—2.10	8	1135	8	26		8
1946–50, Four	GDZ-4817A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1948–50, Six	GDZ-4817A	35–53	None	CL	1.60—1.78	8	1250	7.6	35	2000	8
1950–52	GDZ-6001D	35–53	None	CL	1.3-1.5(E)	0	970	6.4	35	2250	8

A—Generator number stamped on plate riveted to housing.
B—CL: Clockwise. CCL: Counterclockwise. Viewed from drive end in each case.
C—Look for trouble if the generator charges 8 amperes at a greater R.P.M. (revolutions per minute) than that given.
D—Do not run generator for any length of time in excess of the figures given as to do so may result in burnt armature and fields. Maximum output readings taken at 70 degrees Fahrenheit; for each 15 degree change in temperature, add one ampere if below 70 degrees, and subtract one ampere if above 70 degrees.
E—At 5 volts.

DELCO-REMY GENERATOR INDEX & SPECIFICATIONS

Car and Model	Generator Number Note A	Brush Spring Tension		Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	Maximum Cold Output Note C			Maximum Hot Output		
		Main	Third			Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
BUICK											
1935–36, 40	936-C	25	17	CL	2.3 —2.6	23	8.8	2800	20	8.5	3400
1935, 50, 60, 90	956-H	25	17	CL	2.1 —2.5	22	8.7	2000	14	7.8	2500
1936, 60, 80, 90	936-P	25	17	CL	2.3— 2.6	27	9.0	3000	23	8.7	3200
1937, 40	918-B	25	17	CL	D	31	8.0	4000	28	8.0	4200
1937, 40	918-G	25	17	CL	D	31	8.0	4000	28	8.0	4200
1937, 60, 80, 90	918-A	25	17	CL	D	31	8.0	4000	28	8.0	4200
1937, 60, 80, 90	918-F	25	17	CL	D	31	8.0	4000	28	8.0	4200
1937	918-E	25	17	CL	D	31	8.0	4000	28	8.0	4200
1938–39, 40	1101052	25	17	CL	D	31	8.0	4000	28	8.0	4200
1938–39, 60	1101053	25	17	CL	D	31	8.0	4000	28	8.0	4200
1938–39, 80, 90	1101055	25	17	CL	D	31	8.0	4000	28	8.0	4200
1940, 40	1102663	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1940, 40, 50	1102662	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1940–48 60, 70, 80, 90	1102668	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1940, 90	1102669	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1941–49, 40, 50	1102679	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1949, 50	1102709	28	None	CL	1.75–1.9	30	8.0	1750	E	E	E
1949, 70	1102708	28	None	CL	1.75–1.9	30	8.0	1750	E	E	E
1950 All	1102709	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1951	1102754	28	None	CL	1.90–2.05	40	8.0	1950	E	E	E
1952	1102779		None	CL		51	7.7	2400	E	E	E
CADILLAC AND LA SALLE											
1935, 50	961-C	25	17	CL	1.7 —1.9	16	8.0	1300	11	7.5	1400
1935, V8	933-B	25	17	CL	1.7 —2.0	16	8.1	1200	11	7.5	1200
1935, V12, V16	933-C	25	17	CL	1.7 —2.0	16	8.1	1200	11	7.5	1200
1936, 50	961-D	25	None	CL	1.7 —1.9	22	8.0	1650	E	E	E
1936, V8	961-E	25	None	CL	1.7 —1.9	22	8.0	1650	E	E	E
1936–37, V12, V16	933-M	25	None	CL	1.7 —2.0	26	8.0	1600	E	E	E

Car and Model	Generator Number Note A	Brush Spring Tension Main	Brush Spring Tension Third	Direction of Rotation Note B	Field Current at 6 Volts (Amperes)	Maximum Cold Output Note C Amperes	Maximum Cold Output Note C Volts	Maximum Cold Output Note C R.P.M.	Maximum Hot Output Amperes	Maximum Hot Output Volts	Maximum Hot Output R.P.M.
CADILLAC AND LA SALLE—(Continued)											
1937, 50, 60, 65	918-C	25	17	CL	D	29	8.0	4000	28	8.0	4200
1937, 70, 75	961-K	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1938, 50, 60, 60S	1101051	25	17	CL	D	29	8.0	4000	28	8.0	4200
1938, 65	1101054	25	17	CL	D	31	8.0	4000	28	8.0	4200
1938, 75	1102652	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1938, 90	1102651	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1939, 50, 60S, 61	1101056	25	17	CL	D	29	8.0	4000	28	8.0	4200
1939, 75	1102654	25	None	CL	2.0—2.2	30	8.0	1700	E	E	E
1939, 90	1102655	25	None	CL	2.0—2.2	30	8.0	1700	E	E	E
1940-41, V8	1102661	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1940, 90	1102666	25	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1941	1102686	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1942-48	1102693	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1942-48	1102694	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1949-51	1102700	28	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1952	1102781		None	CL		47	7.4	3500	E	E	E
CHEVROLET											
1935, EC	943-J	16	17	CL	3.5 —4.5	17	8.2	2000	13	7.7	2200
1935, EA, ED	935-V	25	17	CL	2.3 —2.6	23	8.8	2800	20	8.5	3400
1936, FC	946-C	16	17	CL	3.5 —4.5	17	8.2	2000	13	7.7	2200
1936, FA, FD	935-V	25	17	CL	2.3 —2.6	23	8.8	2800	20	8.5	3400
1937	948-R	25	17	CL	2.3 —2.6	23	8.8	2800	20	8.5	3400
1938-39	1100004	25	25	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
1940-48	1102667	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1949	1102710	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1950	1102719	28	None	CL	1.75—1 9	30	8 0	1750	E	E	E
1951-52	1102749	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
GRAHAM											
1936-37, 90, 95, 110, 116	948-B	25	17	CL	2.3 —2.6	21	8.5	2600	15	7.9	2800
1937, 120	948-Z	25	17	CL	2.3 —2.6	27	9.0	3000	23	8.7	3200
1938-39, 96	1100455	25	17	CL	2.3 —2.6	21	8.5	2600	15	7.9	2800
1938-41, 97, 107, 108	1100007	25	17	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
KAISER											
1951	1102733	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1952	1102782	28	None	CL							
NASH											
1941-42, 40	1102684	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1948-49, 40, 60	1102702	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1950, 40, 60	1102712	28	None	CL	1 75—1.90	30	8 0	1750	E	E	E
1950-51 All	1102730	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1952, 10	1102776	28	None	CL							
1952, 40, 60	1102777	28	None	CL							
OLDSMOBILE											
1935	935-X	25	17	CL	2.3 —2.6	20	8.5	2400	17	8.1	3000
1936-37	936-T	25	17	CL	2.3 —2.6	27	9.0	3000	23	8.7	3200
1937	918-H	25	17	CL	D	29	8.0	4000	28	8.0	4200
1937-38	1100002	25	17	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
1939	1100009	25	17	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
1940-48	1102664	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1941-48	1102680	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1949-50 Six	1102706	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1949-50 Six	1102707	28	None	CL	1.90—2.05	40	8.0	1900	E	E	E
1949-51 Eight	1102704	28	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1952	1102780	28	None	CL							

DELCO-REMY GENERATOR INDEX & SPECIFICATIONS

Car and Model	Generator Number Note A	Brush Spring Tension Main	Brush Spring Tension Third	Direction f Rotation Note B	Field Current at 6 Volts (Amperes)	Maximum Cold Output Note C Amperes	Maximum Cold Output Volts	Maximum Cold Output R.P.M.	Maximum Hot Output Amperes	Maximum Hot Output Volts	Maximum Hot Output R.P.M.
PACKARD											
1937 Six	948-U	25	17	CL	2.3 —2.6	27	9.0	3000	23	8.7	3200
1937 Super 8	961-J	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1937 Twelve	930-F	25	None	CL	1.8 —2.3	28	8.0	1450	E	E	E
1938 Six	1100005	25	17	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
1941-47 Six	1102682	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1948 8 and Super 8	1102699	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1948 8 and Super 8	1102705	25	None	CL	1 75—1 9	30	8 0	1750	E	E	E
1949-50 8 and Super 8	1102715	28	None	CL	1 90—2 05	40	8 0	1900	E	E	E
1951	1102745	28	None	CL	1.90—2.05	40	8.0	1950	E	E	E
1952	1102778	28	None	CL		45			45	7.4	2440
PONTIAC											
1935-36	935-W	25	17	CL	2.3 —2.6	27	9.0	3000	23	8.7	3200
1937	948-S	25	17	CL	2.3 —2.6	27	9.0	3000	23	8.7	3200
1937-39	1100003	25	17	CL	2.3 —2.6	30	8.0	3400	28	8.0	3600
1940-47	1102665	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1948	1102701	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1949-50	1102711	28	None	CL	1 75—1 9	30	8 0	1750	E	E	E
1951	1102750	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1951	1102775	28	None	CL	1.90—2.05	45	8.0	2350	E	E	E
1952	1102769	28	None	CL					45	7.4	2160
STUDEBAKER											
1935, 1B, 1C	935-Y	25	17	CL	2.3 —2.6	23	8.8	2800	20	8.5	3400
1936 Pres.	936-X	25	17	CL	2.3 —2.6	25	9.1	3000	20	8.5	3200
1937 Pres.	961-H	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1938 Pres.	1102653	25	None	CL	2.0 —2.2	25	8.0	1650	E	E	E
1939 Pres.	1102656	25	None	CL	2.0 —2.2	30	8.0	1700	E	E	E
1940 Pres.	1102671	25	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1950 Comm.	1102728	28	None	CL	1.75—1.9	30	8.0	1750	E	E	E
1951 Comm.	1102700	28	None	CL	1.75—1.9	30	8.0	1825	E	E	E
1952 Comm.	1102778	28	None	CL					45	8	2400

A—Generator number stamped on plate riveted to housing.
B—CL: Clockwise. CCL: Counterclockwise. Viewed from drive end in each case.
C—Do not run generator for any length of time in excess of the figures given as to do so may result in burnt armature and fields.
D—Shunt 1.44 to 1.56; third brush .89 to .94.
E—Maximum output controlled by current regulator.

FORD, MERCURY AND LINCOLN GENERATOR SPECIFICATIONS

Car Model	Generator Number	Watts	Maximum Rate Amperes	Maximum Rate Engine RPM	Number of Brushes	Field Resistance Ohms at 70° F.	Field Resistance Ohms at 140° F.	Armature Resistance Ohms at 70° F.	Armature Resistance Ohms at 140° F.
1936-38 90 H.P.; 91A	81A-10000A	119	17	1300	3	1.0	1.22	0.29	0.36
1937-39 60 H.P.	82A-10000A	119	17	1300	3	1.0	1.22	0.29	0.36
82A, 922A (Radio Cars)	82A-10000D	196	28	1250	2	2.7	3.3	0.18	0.20
1938 Lincoln (3 Brush)	81A-10000B	182	26	1250	3	1.44	1.75	0.19	0.23
1938 Lincoln (2 Brush)	81A-10000D	196	28	1250	2	2.70	3.30	0.18	0.20
1939-40 90 and 100 H.P.	21A-10000	220	30	1060	2	2.88	3.34	0.16	0.18
022A	21A-10000	220	30	1060	2	2.88	3.34	0.16	0.18
1939-48 Lincoln	21A-10000	220	30	1060	2	2.88	3.34	0.16	0.18
1941 Six	1GA-10000A	220	30	1160	2	2.88	3.34	0.16	0.18
1942-48 Six	2GA-10000A	220	30	1160	2	2.88	3.34	0.16	0.18
1947-48 Six (H Series)	7HA-10001B	220	30	1650	2	4.00	4.65	0.10	0.12
1949-51 Ford, Mercury	8BA-10002A	250	35	1700	2	3.2	3.8		
1949-51 Lincoln	8EL-10002	285	40	1675	2	3.1	3.5		

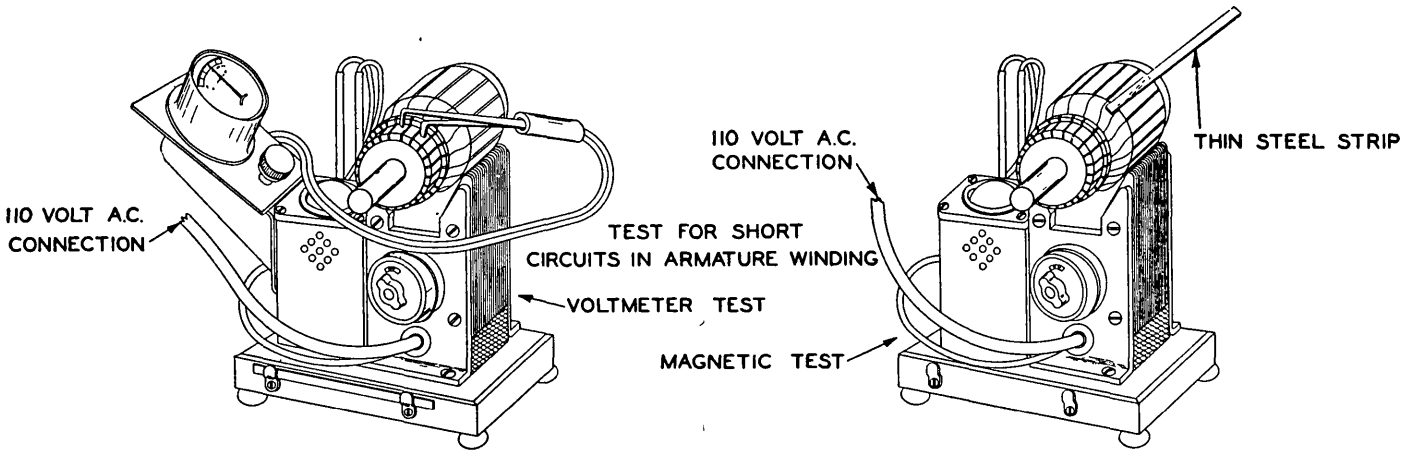


Fig. 3 Testing armature for short circuits with a growler

Continued from page 28
in this case, check the following:

With the jumper in place, and generator running at a speed which equals about 30 M.P.H. vehicle speed, if the circuit breaker contacts are closed and there is no charging current, the charging circuit is open between the regulator and battery.

If the circuit breaker contacts do not close and the generator builds up satisfactory voltage without causing the circuit breaker contacts to close, the circuit breaker is either out of adjustment, or the circuit breaker shunt winding is open circuited.

EXCESSIVE ARCING AT CONTACTS—Excessive arcing at regulator contacts or a sluggish action of the contacts in either the voltage or current regulator unit indicates the following probable causes:

1. One of the resistance units is open circuited.
2. Windings in the regulator units are defective.
3. Contacts are pitted or oxidized.
4. Contacts are not closed with correct alignment or pressure.
5. Short circuited field in the generator.
6. High resistance ground connection between regulator and generator.

REVERSE GENERATOR POLARITY—If for some reason the generator polarity is reversed, it will cause regulator contacts and circuit breaker contacts to vibrate excessively and burn. If allowed to operate in this condition for more than a few minutes, serious damage may result.

To be sure that the polarity of the generator is correct, check the battery to see if it has been installed in the vehicle with the proper polarity. If the battery connections are correct, connect a jumper lead to the battery cable at the starting motor. Hold the other end of the jumper lead on the generator armature terminal for an instant. A momentary surge of battery current through the generator field winding will polarize the generator correctly.

ARMATURES—The armature core has two functions, (1) it serves as a carrier for the conductors of the armature wiring and (2) it completes the magnetic circuits of the fields.

Armature cores should not be filed or turned down, as such treatment would cause short circuits between core laminations, increasing its operating temperature and reducing the output of the generator.

For checking short circuits in armature windings a growler should be used, Fig. 3. When an armature is placed on a growler, there is a voltage induced in the armature winding by the alternating current in the growler winding. This voltage is equal on each side of an individual armature coil.

Since there are no brushes to carry the current away from the windings, no current is flowing through. There is, however, a voltage in the coils and if there is a short circuit in the winding, a local circuit is formed and current will flow. This condition will be indicated by a thin piece of steel such as a hacksaw blade held on the armature core, Fig. 3. By turning the armature slowly in the growler, while holding the saw blade on the core, when a short circuited coil comes under the blade, the current flowing will set up an alternating magnetic field which will cause the blade to vibrate, indicating that the coil nearest to the blade is short circuited.

The above test can be applied to the majority of the armatures used in automotive service, but some armatures are so designed and the windings are so connected that all of the coils will show short circuits. Auto-Lite GDJ armatures are of this design, and can be tested in a growler by using an A.C. milliammeter (5 amp. with 100 scale divisions) and making the test between the commutator bars, left view of Fig. 3.

To make a growler test on one of these armatures, connect the ammeter to a set of pointed copper contacts (prods), so spaced that they can be applied to one and the third commutator bars. With the ammeter connected, rotate the armature in the growler until the highest reading is shown, then hold the ammeter contacts in this spot in relation to the growler, and rotate the armature to test between all bars. The meter indications should be approximately uniform around the commutator. If a short circuit exists in the armature winding, the meter indication will be low or zero between the bars tested.

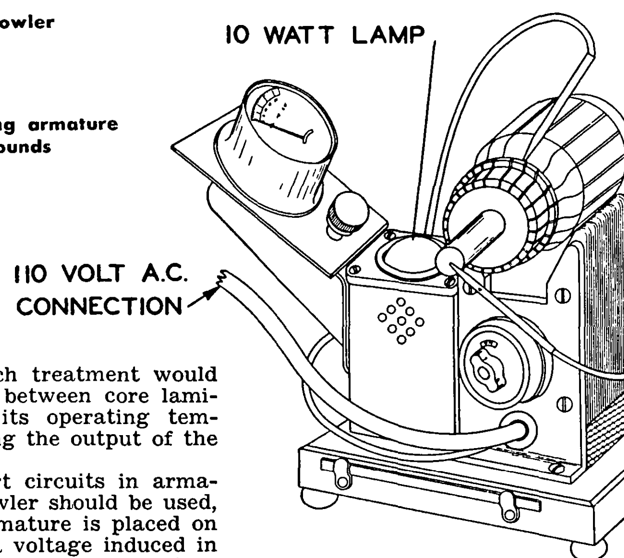


Fig. 4 Testing armature for grounds

For testing armatures for grounds, use a 10 watt, 110 volt lamp connected between the armature shaft and commutator bars, Fig. 4.

CAUTION—Do not connect to the bearing surface on the shaft or the brush surface on the commutator, as the test circuit may cause a burned spot to mar these surfaces. If the lamp lights, it indicates the winding is grounded.

Examine the armature for damage to the core or windings. Note particularly the core and slot fillers for indications of the amature rubbing the pole pieces. If the core fillers only have been rubbing, drive them into the slots with a narrow piece of copper or fibre. Then coat the fillers with shellac or insulating varnish to hold them in place.

If the armature core has been rubbed, filed or turned down so that the laminations are short circuited, the armature should be replaced.

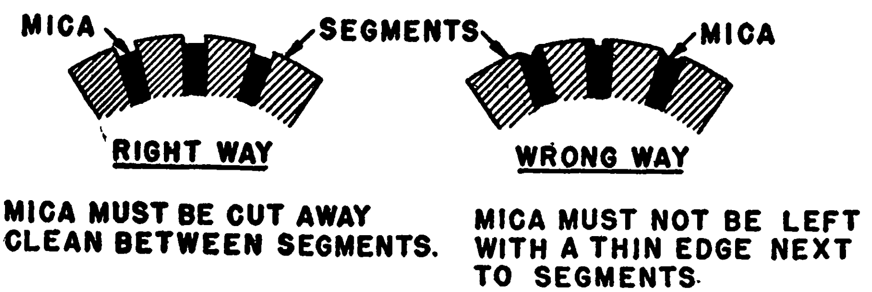


Fig. 5 Insulation between commutator bars should be undercut 1/32"

COMMUTATORS—For a two-pole generator, the ends of each armature circuit are connected to opposite commutator bars. Therefore, each brush is connected first to one end and then to the other end of the revolving coils, making the change from alternating current to direct current just at the instant the voltage in the coils is reversing, causing the voltage supplied to the external armature circuit always to be in the same direction. The commutator changes the alternating current generated within the armature to direct current after it leaves the brushes. Therefore, commutators are reverse switches made up of many segments of copper, rigidly held together and separated by insulation made of mica.

It is important that commutators be turned down so they are concentric with the armature shaft bearing surfaces. In manufacturing armatures, a tolerance of .0003" concentricity is usually maintained for the commutator brush surface in relation to the shaft bearing surface. In order to maintain this degree of concentricity, it is recommended that when an armature is turned down, mount it in a lathe on the shaft bearing surfaces and not by the shaft centers. The centers are provided for turning the shaft only, and after the armature core and commutator have been assembled, the commutator brush surface may not be concentric with the shaft centers. They do not run on the shaft centers when assembled in the generator.

Commutator risers should not be turned down as the brushes do not run on this surface. Any turning reduces the current carrying capacity of the risers. The outer end of commutator bars should not be turned either as it may affect the balance of the armature and reduce the brush surface.

Commutators should be turned at a speed approximately 700 r.p.m. with a sharp tool set exactly on center so that a dead smooth surface can be produced with very little sandpapering

When sandpaper is applied to a commutator, a strip of No. 00, about 10" long should be used. While holding the end of the sandpaper, let that part of the paper that rubs on the commutator conform to the commutator surface. It is not good practice to hold the sandpaper directly against the commutator with the fingers.

After turning down a commutator, its concentricity can be checked with a dial gauge attached to the lathe tool post.

The insulation between commutator bars should be undercut $\frac{1}{32}$" measured depth, Fig. 5. Do not permit the undercutting shaft to rub on the commutator bars, as this would produce flat spots on the commutator, reducing the contact area of the brushes.

The saw used for undercutting should be approximately .002" wider than the insulation between bars to insure a complete cutting of the insulation. After undercutting, any burrs left on the edges of the bars should be cleaned off with a narrow scraper that can be drawn for the full length of the undercut groove. When this is done, the armature should be checked for short circuits and open circuits in a growler.

COMMUTATOR BRUSHES—The seating of brushes is extremely important and it is recommended that brushes be fitted to the commutator with No. 00 sandpaper, drawing between the brush and commutator, against the brush holder, as shown in Fig. 6.

The general practice of placing a band of sandpaper on the commutator and turning the commutator in the direction of rotation is not recommended, as in some generators the brush holders are mounted so that some may operate against rotation and others with rotation. In this case, one brush would be properly seated and the other would have a rounded contact surface, causing arcing. Usually a strip of sandpaper, about 10" long, pulled through once results in a satisfactory brush seat.

Brushes should be carefully sandpapered to obtain as nearly as possible a full area of contact between the brush and commutator; otherwise it may be difficult to obtain normal output of the generator. The brushes should be free to move in the brush holder so that they will follow the commutator with uniform pressure as the brushes wear.

Brush spring tension should be measured with a good spring scale and adjusted according to the specifications of the generator manufacturer. If a minimum and maximum pressure is given, they should be adjusted to the maximum pressure, so that as the brush wears, any reduction of pressure will be within limits for a long period of time.

The brush spring tension arm should rest on top of the brush. If new brushes are too long, the commutator end should be sandpapered until the brush is shortened sufficiently for the spring tension arm to rest on the top beveled surface. Any filing or notching of the top of the brush is not recommended.

The proper alignment of brush holders is important to obtain maximum gen-

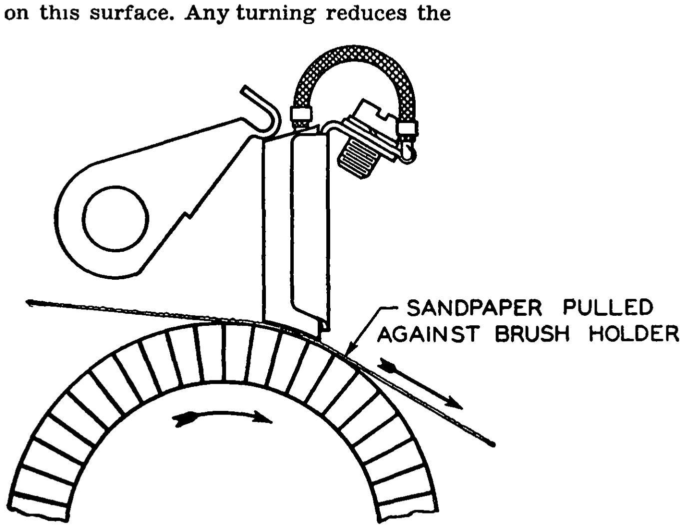


Fig. 6 Pr p3r meth d f seating c mmutator brushes

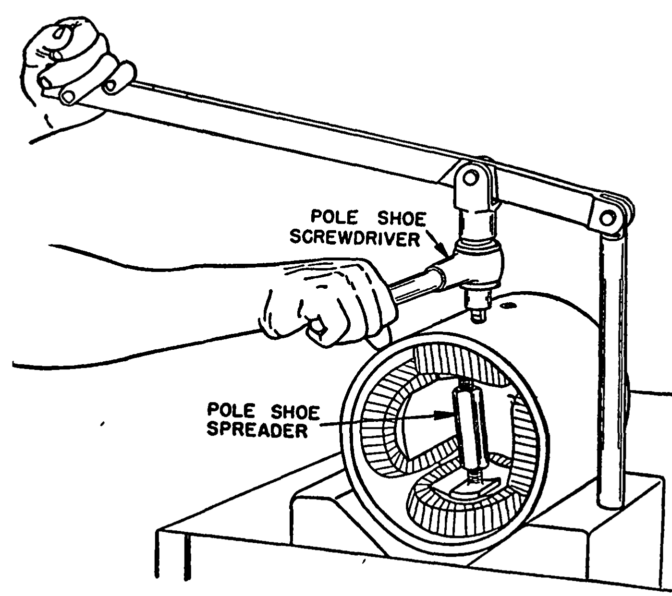


Fig. 7 Rec mm nd d m th d of installing p le pieces r sho s

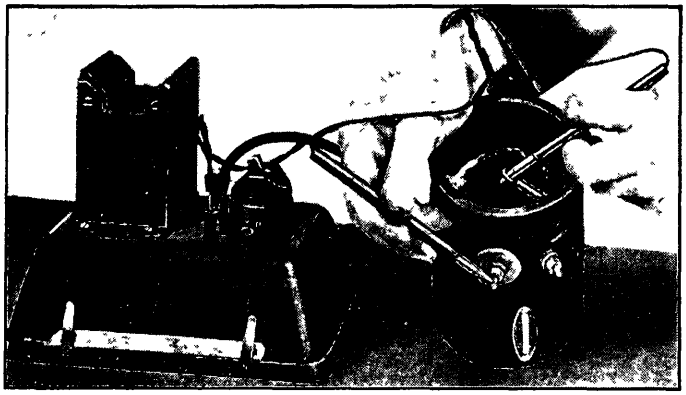


Fig. 8 Field coil test for continuous circuit

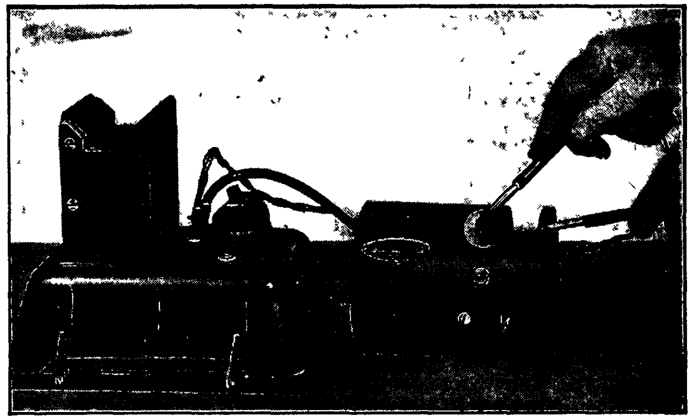


Fig. 9 Field coil test for gr und

erator output with minimum arcing of the brushes. An easy way of checking the alignment of opposite brush holders is to place a flexible straight edge, approximately ½" wide, across both brush holders. Press down on the center of the straight edge and note if both sides of both holders touch the straight edge. Correction can be made by bending the holder with a screwdriver between the end head and the holder. Be sure to check the rivets and tighten if necessary after this operation.

Place the commutator end head on the armature and install new brushes; the edge of the brushes should be parallel with the commutator bars.

For a two-pole generator with one brush edge parallel with one commutator bar, the opposite brush should be parallel with the edge of the commutator bar exactly 180 degrees around the commutator. For a four-pole generator, the brushes should be exactly 90 degrees apart, and for a six-pole generator, 60 degrees apart.

FIELD POLES & COILS—The field pole pieces, which may number 2, 4, 6 or more, depending upon the design and capacity of the generator, are made of soft steel machined very accurately to fit the inner circumference of the frame. The soft steel is of such a composition that after they have once been magnetized, they will retain a small amount of magnetism and act as very weak permanent magnets. It is important that these pole pieces be rigidly attached to the field frame as they are subjected to considerable vibration when the generator is in operation. A large bench type ratchet screwdriver should be used for this purpose, Fig. 7.

The joint between the pole pieces and the frame should be clean and have a full area of contact to the frame in order to reduce resistance to the passage of magnetic lines in the field magnetic circuit.

Sometimes when the generator is completely disassembled, the pole pieces are not replaced in their original location. In such cases, it may be necessary to excite the fields with a battery in order to give the pole pieces the proper polarity in relation to each other.

Field coils are connected in series with each other so that the polarity of the coils alternate. In other words, the first one would have a north pole, the next one would have a south pole, and so on, continuing around the armature. The field coils are held in place by the pole pieces or shoes. Field coils should never be submerged in any cleaning fluid. This also applies to armatures.

In testing the field circuits, use a 10 watt lamp connected in series with a 110 volt circuit.

Field Coil Test for Continuous Circuit—Place the test prods on the field coil leads as shown in Fig. 8. If the test lamp lights, the field coils are OK. If the lamp does not light, the field coils are open-circuited and should be replaced.

Field Coil Test for Ground—Place test prod leads, one to the ground and the other to the field coil terminal, Fig. 9. If the test lamp lights, field coils are grounded and should be replaced. If lamp does not light, field coils are OK.

Field Coil Balancing Test—Slide the insulation off the soldered connection between the field coils. This test is made with a battery, an ammeter and two leads. Place one test lead on the soldered connection and the other on one end of the field coil, Fig. 10. Take a reading on the ammeter. Remove the lead from the end of the field coil and place it on the end of the other field coil and take a reading. If one field coil draws more current than the other, there is an internal short in the field coil and the coil that draws the most current should be replaced.

GENERATOR BEARINGS — Generator bearings usually consist of a radial ball bearing on the drive end and an absorbent bronze bearing on the commutator end, although ball bearings are sometimes used at both ends, Fig. 1.

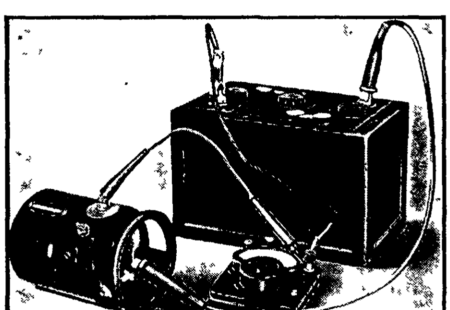


Fig. 10 Fi ld c il balancing t st

Ball bearings should not have in excess of .001" clearance between the outer race and housing in which it is installed, and not more than .001" play between the balls and races. The balls should be round and there should not be tight spots when the outer race is held stationary and the inner race is rotated.

Plain bearings should not have in excess of .002" clearance between the armature shaft and bearing. When assembling absorbent bronze bearings, always use the proper arbor as these arbors are designed to give the proper bearing fit. Do not ream or scrape absorbent bronze bearings.

When assembling bearings or end heads that are equipped with oil wicks, always remove the wick and replace it with a new wick after the armature and end heads are assembled.

LUBRICATION — When a generator is disassembled and cleaned, the absorbent bronze bearings should be soaked in oil before assembling. Ball bearings should be packed half full with high melting point grease. Care must be taken not to over lubricate any of the bearings, as the surplus oil may deposit on the commutator or brushes, allowing them to become oil soaked and seriously affect the operation of the generator.

Nearly all generators are provided with oilers at both ends. These oilers are usually of the following types:

Hinged Top—These are located over the bearing and should be given 5 to 10 drops of SAE 20 engine oil every 5000 miles.

Swinging Type—This type is used only on the commutator end cap cover and should be filled with SAE 20 engine oil every 5000 miles.

Cup & Wick Oilers—This type is found under the bearing. The cup should be removed and filled with SAE 20 engine oil every 5000 miles.

Grease Cups — These are usually located at the side of the end plates. The cups should be given one turn over 5000 miles. When refilling cups, use a high melting point grease.

Cup Oilers—This type of oiler has a spring cover and is found at the side of the end plates. They should be filled with SAE 20 engine oil every 5000 miles.

GENERATOR REGULATORS

ALL Auto-Lite, Delco-Remy and Ford generator regulators used on automotive vehicles for the past decade or so are of the vibrating type. The operating principle is the vibration of a set of contacts which alternately cut a resistance in and out of the generator field circuit. The changes in resistance are more than necessary, but because of the time lag of the generator field windings, a steady generator voltage is maintained, depending upon the proportionate time the resistance is in and out of the circuit.

When this type of regulator is used with a third brush generator, it consists of two elements, a cutout relay (circuit breaker) and a voltage regulator. For shunt type generators, a current limit regulator is added to prevent exceeding the safe ampere output of the generator when the battery is discharged.

REGULATOR CONTACTS—Most regulator contacts have dissimilar contact metal. Therefore, it is important that the contacts be installed in their proper relation according to the grounding of the system in which they are used. Failure to observe this precaution will result in short contact life.

Contacts are usually designed to have a slight wiping action when they open and close. Therefore, when servicing contacts, a very fine file should be used and the filing should be done parallel with the length of the armature, which would be in the direction of the wipe. Cross filing causes a mechanical locking of the contacts, resulting in very erratic operation.

After filing, the contacts should be cleaned by drawing a strip of clean linen tape moistened with cleaning fluid between them and then rubbing briskly with dry tape. Oil or dirt on the contact surfaces of voltage regulators results in high operating voltage. And in a majority of cases where regulators are found to be operating at higher than specified voltage, the cleaning of the contacts is sufficient to restore their operation to normal.

RESISTANCE—In automotive electrical equipment, excessive resistance in the various parts of the electrical system causes trouble. The charging circuit is very sensitive to resistance when a shunt type generator is used.

The point of greatest trouble in resistance is the ground connection of the regulator. Most regulators are grounded by screws which attach the regulator base to the vehicle body. Resistance anywhere between the regulator base and the generator frame in excess of .01 ohm tends to increase the operating voltage of the regulator.

This condition is comparatively easy to locate without instruments. If the dash ammeter shows that the generator is operating at maximum output, connect a jumper wire of #16 gauge or larger between the regulator base and generator frame. If the ammeter indication is reduced, it indicates that excessive resistance exists somewhere between these two points. Resistance in the charging circuit of a shunt type generator results in a reduction of the generator output.

BURNED REGULATORS — Auto-Lite made a number of tests to determine under what conditions this could occur and found that the only combination which would produce this result was a ground on the armature connection between the generator and regulator. This caused a short circuit across the battery through the circuit breaker contacts, the circuit breaker series coil and the current regulator series coil, which very quickly destroyed the regulator.

Many service men are of the opinion that regulators will be burned up if the circuit breaker contacts stick. This isn't true, since the resistance of the generator and series coils in the regulator is such that with a 35 ampere 6 volt generator at normal operating temperature, approximately 16 amperes will be drawn from the battery.

For some 6 volt systems with a generator cold, 40 amperes may be drawn from the battery, but this is rapidly reduced as the generator temperature rises and the battery becomes discharged. Under these conditions, no damage will be done to the regulator that cannot be corrected by servicing the circuit breaker contacts.

RADIO INSTALLATIONS — Regulator failures have occurred in some cases because condensers have been installed across the field circuit of the generator, causing failure of the regulator contacts.

Some radio men test to see which is the armature circuit and which is the field circuit by using a screw driver to ground the terminals on the generator. A big flash indicates the armature, a small flash indicates the field. In some cases the big flash caused by grounding the armature terminal passes so much current through the circuit breaker contacts that they will fuse together or create a burned spot, which eventually causes sticking of contacts.

For generators with the regulator operating on the ground side of the field circuit, grounding the armature terminal will reverse the generator polarity, causing the circuit breaker contacts to vibrate and burn to such an extent that they will fuse together.

CALIBRATION — The calibration of some regulators is effected by the cover, as a steel cover forms part of the magnetic circuit, there being a difference of approximately .2 volt with cover off and on. Therefore, the cover should be in place when final tests are made.

The position of the regulator will affect its operation. With the width of the voltage regulator armature horizontal, the operating voltage will be approximately .2 volt lower than when it is vertical.

The safest procedure when testing and adjusting regulators is to reproduce as nearly as possible the same conditions under which they operate in service on the vehicle. These conditions include (1) normal operating temperature, (2) position of the regulator, (3) cover and gasket in place, (4) normal current flowing through the windings.

When a regulator is installed on a vehicle, the generator charging circuit and battery should be checked to insure their being in good condition. Then, with the battery that belongs on the vehicle fully charged, and the generator and regulator operated from 15 to 30 minutes to insure normal operating temperatures, the regulator should be adjusted to produce a charging rate of 3 amperes. If the battery is replaced, the regulator operation should be adjusted for the new battery if necessary. This procedure is necessary as there is a considerable variation in battery terminal charge voltage of different age, makes and classifications.

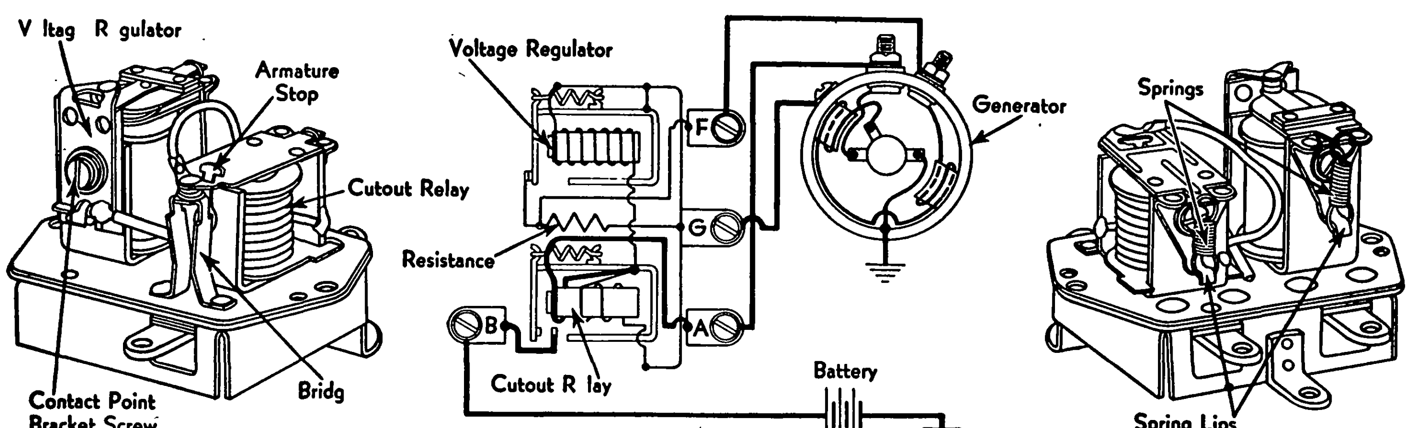


Fig. 1 Aut -Lit vibrating v ltag r gulator showing fr nt and r ar views and wiring diagram

NOTE—See tables following for settings.

Car and Model	Regulator Type	Regulator Number Note A	Ground Polarity	Voltage to Close Relay Points	Amperage to Open Relay Points (Reverse Current)	Maximum Operating Amperage	Maximum Operating Voltage @ 70° F. Note E
AMERICAN BANTAM AND AUSTIN							
1935	Note B	CB-4010 (C)		6.5—7.25	.5—2.5 (D)	15	
1936-41	Note B	CB-4014 (C)		6.5—7.25	.5—2.5 (D)	15	
AUBURN							
1935-36	Note B	CB-4012 (C)		6.5—7.25	.5—2.5 (D)	15	
1935-36	Voltage	TC-4312A		6.5—7.25	.5—2.5	......	F
CHRYSLER							
1935-36	Voltage	TC-4301A		6.5—7.25	.5—2.5	......	F
1937 Six	Volt & Cur.	VRB-4005A	Positive	6.4—7.0	.5—3.0	21-23	G
1937-39	Volt & Cur.	VRB-4004B	Positive	6.4—7.0	.5—3.0	27-29	G
1940-42	Volt & Cur.	VRP-4001A	Positive	6.4—6.6	H	34-36	7.35
C33, C37	Volt & Cur.	VRP-4001F	Positive	6.4—6.6	H	39-41	7.35
1946-48	Volt & Cur.	VRP-4401A	Positive	6.4—6.6	H	34-36	7.35
1947-48	Volt & Cur.	VRP-4501A	Positive	6.4—6.6	H	35 (L)	7.35
1947-50	Volt & Cur.	VRP-4503A	Positive	6.4—6.6	H	35 (L)	
1949 Six	Volt & Cur.	VRP-4503B	Positive	6.4—6.6	H	40 (L)	7.35
1949 Eight	Volt & Cur.	VAV-4404B	Positive	6.4—6.6	H	45 (L)	7.35
1949 Imp. 8	Volt & Cur.	VBA-4101A	Positive	6.4—6.6	H	50 L)	7.10
1950-51	Volt & Cur.	VRP-6004A	Positive	6.4—6.6	H	40 (L)	7.35
1950-51	Volt & Cur.	VAV-6001A	Positive	6.4—6.6	H	45 (L)	7.25
1950-51	Volt & Cur.	VBA-4202A	Positive	6.4—6.6	H	50 (L)	7.25
1952 Six	Volt & Cur.	VBE-6001A	Positive	6.4—7.0	H	45 (L)	7.1—7.4
1952 V8	Volt & Cur.	VAV-6001B	Positive	6.4—7.0	H	50 (L)	7.1—7.4
1952 V8	Volt & Cur.	VBF-6001	Positive	6.4—7.0	H	55 (L)	7.1—7.4
CROSLEY							
1939-48	B	CB-4025 (C)		6.5—7.25	.5—2.5 (D)	15	
1946-50	Volt & Cur.	VRP-4004F	Positive	6.4—6.6	H	34-36	7.35
1949-52	Volt & Cur.	VRP-4004F-2	Positive	6.4—6.6	H	34-36	7.35
DE SOTO							
1935-36	Voltage	TC-4301A		6.5—7.25	.5—2.5	......	F
1937	Volt & Cur.	VRB-4005A	Positive	6.4—7.0	.5—3.0	21-23	G
1938-39	Volt & Cur.	VRB-4004B	Positive	6.4—7.0	.5—3.0	27-29	G
1940-48	Volt & Cur.	VRP-4001A	Positive	6.4—6.6	H	34-36	7.35
1946-48	Volt & Cur.	VRP-4401A	Positive	6.4—6.6	H	34-36	7.35
1947-48	Volt & Cur.	VRP-4501A	Positive	6.4—6.6	H	35 (L)	7.35
1947-50	Volt & Cur.	VRP-4503A	Positive	6.4—6.6	H	35 (L)	
1949	Volt & Cur.	VRP-4503B	Positive	6.4—6.6	H	40 (L)	7.35
1950	Volt & Cur.	VRP-6004A	Positive	6.4—6.6	H	40 (L)	7.35
1951-52	Volt & Cur.	VBE-6001A	Positive	6.3—6.8	4.1—4.8	45	7.25
DODGE							
1935-36	Voltage	TC-4301A		6.5—7.25	.5—2.5	......	F
1937	Volt & Cur.	VRB-4005A	Positive	6.4—7.0	.5—3.0	21-23	G
1938-39	Volt & Cur.	VRB-4004B	Positive	6.4—7.0	.5—3.0	27-29	G
1939	Voltage	VRD-4002B	Positive	6.4—7.0	.5—3.0	......	G
1940-42	Volt & Cur.	VRP-4001A	Positive	6.4—6.6	H	34-36	7.35
1946-48	Volt & Cur.	VRP-4401A	Positive	6.4—6.6	H	34-36	7.35
1947-48	Volt & Cur.	VRP-4501A	Positive	6.4—6.6	H	35 (L)	7.35
1947-49	Volt & Cur.	VRP-4503A	Positive	6.4—6.6	H	35 (L)	
1949	Volt & Cur.	VRP-4503B	Positive	6.4—6.6	H	40 (L)	7.35
1950	Volt & Cur.	VRP-6004A	Positive	6.4—6.6	H	40 (L)	7.35
1951-52	Volt & Cur.	VBE-6001A	Positive	6.3—6.8	4.1—4.8	45	7.25
FRAZER							
1947-51	Volt & Cur.	VRP-4004F-2	Positive	6.4—6.6	H	34-36	7.35
1951	Volt & Cur.	VRP-6001A	Positive	6.4—6.6	H	34-36	7.35
1951	Volt & Cur.	VAV-4002C	Positive	6.4—6.6	H	44-46	7.35

TROUBLE SHOOTING

The following tests can be quickly made to determine whether or not the regulator units are operating properly. They will also indicate whether the generator or regulator is at fault so that proper corrective steps may be taken.

LOW CHARGING RATE WITH FULLY CHARGED BATTERY — This indicates normal voltage regulator operation.

To test the current regulator (if regulator includes one) insert a test ammeter at the battery terminal of the regulator, disconnect the high tension lead from and distributor and crank the engine for about 15 seconds.

Then reconnect the ignition wire, start the engine and run it at a medium speed, turn on lights, radio and other accessories and note quickly the generator output, which will be the value for which the current regulator is set.

Now turn off the lights, radio and accessories and allow the engine to continue running at medium speed. As soon as the generator has replaced in the battery the current used in cranking, the regulator will taper the output down to a few amperes.

LOW CHARGING RATE WITH LOW BATTERY—With this condition, check the circuit for loose connections and frayed or damaged wires. High resistance resulting from these conditions will in itself prevent normal charge from reaching battery.

After wiring is known to be in good condition, either generator or regulator is at fault. To determine which unit needs attention, ground the field terminal of the regulator temporarily and slowly increase engine speed.

If output does increase, the regulator needs attention. Check for dirty or oxidized contacts, or a low voltage setting.

If output remains low, the generator is at fault and should be checked further as outlined in the "Generators" chapter.

FAILURE TO CHARGE — In cases where the generator does not show any output at all, either with or without the field terminal of the regulator grounded, very quickly disconnect the lead from the generator terminal of the regulator and strike it against a convenient ground while the generator is operating at medium speed.

If a spark does not occur the trouble has been definitely isolated in the generator and repairs are indicated.

If a spark does occur, the circuit breaker is not operating to permit current to flow to the battery. This may be due to burned contacts not closing, open shunt winding, ground, high voltage setting, or other causes.

CAUTION — Do not operate generator for any length of time with the generator lead disconnected since this is open circuit operation and units would be damaged. A burned resistance unit, regulator winding or fused contacts can result only from open circuit operation or extreme resistance in the charging circuit. With these conditions, check vehicle wiring before reinstalling regulator.

HIGH CHARGING RATE WITH FULLY CHARGED BATTERY—In analyzing complaints of this nature, remember that the charging rate at any given voltage depends as much on battery temperature as on the specific gravity of the battery. The charging rate to a fully charged hot battery may be greater than that obtained with a cool battery that has a lower specific gravity. If charging rate is excessive, consider battery temperature and specific gravity and proceed as follows:

Disconnect the field terminal lead from the regulator. This opens the generator field circuit so that output should normally drop off. If it does not, the generator field circuit is grounded either internally or in the wiring harness.

If the output drops to zero with the field lead disconnected, the trouble is in the regulator. Reconnect the field lead, remove generator cover and depress voltage regulator armature manually to open contacts. If output now drops off, the voltage regulator unit has been failing to reduce output as battery came up to charge, and voltage regulator adjustment is indicated.

If separating voltage regulator contacts does not cause output to drop off, inspect field circuit within regulator for shorts. Pay particular attention to bushings and insulators under contact point supports of the regulator units, and make sure that the insulators are correctly assembled.

AUTO-LITE VIBRATING REGULATORS

ADJUSTMENTS

Before making any adjustments, consult the specification charts and make the adjustments according to the data given. For test procedure, see the text which follows the adjustment section.

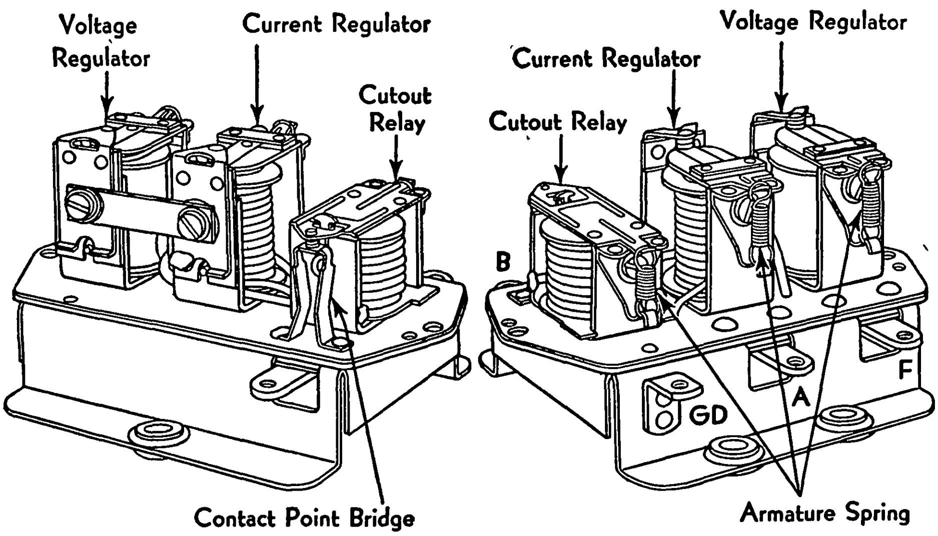


Fig. 2 Auto-Lite vibrating voltage and current regulator. VRB and VRP typ s sh wn

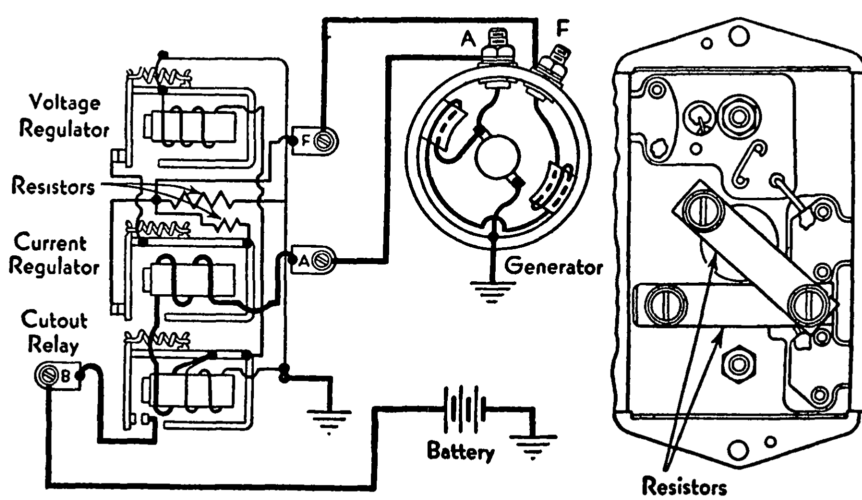


Fig. 3 Wiring diagram f Auto-Lit voltag and current r gulat r. VRB and VRP type shown

NOTE—See tables foll wing for settings.

Car and Model	Regulator Type	Regulator Number Note A	Ground Polarity	Voltage to Close Relay Points	Amperage to Open Relay Points (Reverse Current)	Maximum Operating Amperage	Maximum Operating Voltage @ 70° F. Note E
HENRY J							
1951–52	Volt & Cur.	VRP-6001A	Positive	6.4—6.6	H	34-36	7.35
HUDSON AND TERRAPLANE							
1935–39 Ter.	B	CBA-4003 (C)		6.5—7.25	1.5—4.5 (D)	15	
1935–36	Voltage	TC-4304A		6.5—7.25	.5—2.5	......	F
1937	Voltage	VRD-4003A	Positive	6.4—7.0	.5—3.0	......	J
1937	Voltage	VRD-4003B	Positive	6.4—7.0	.5—3.0	......	K
1938–39	Voltage	VRD-4008A	Positive	6.4—7.0	1.5—4.5	......	7.50
1940	Voltage	VRD-4008B	Positive	6.4—7.0	1.5—4.5	......	7.50
1940–50	Voltage	VRR-4001A	Positive	6.4—6.6	H	... .	7.50
1950	Volt & Cur.	VRP-6002A	Positive	6.4—6.6	H	34-36	7.35
1951–52 Six	Volt & Cur.	VRP-6101A	Positive	6.4—6.6	H	34-36	7.35
1951–52 Eight	Volt & Cur.	VRP-6002A	Positive	6.4—6.6	H	34-36	7.35
KAISER							
1947–50	Volt & Cur.	VRP-4004F-2	Positive	6.4—6.6	H	34-36	7.35
NASH AND LAFAYETTE							
1935	B	CB-4021 (C)		6.5—7.25	.5—2.5 (D)	15	
1936, 20, 80	Voltage	TC-4313A		6.5—7.25	.5—2.5	......	F
1936–38, 10, 20, 40	B	CB-4014 (C)		6.5—7.25	.5—2.5 (D)	15	
1937, 80	Volt & Cur.	VRB-4002D	Positive	6.4—7.0	.5—3.0	27-29	G
1938–39	Volt & Cur.	VRB-4010A	Positive	6.4—7.0	.5—3.0	27-29	7.45
1939	Voltage	VRD-4010A	Positive	6.4—7.0	.5—3.0		7.45
1940	Volt & Cur.	VRP-4004A	Positive	6.4—6.6	H	34-36	7.35
1941	Volt & Cur.	VRP-4004F	Positive	6.4—6.6	H	34-36	7.35
1941–46	Volt & Cur.	VRP-4004F-1	Positive	6.4—6.6	H	34-36	7.35
1947–48	Volt & Cur.	VRP-4004F	Positive	6.4—6.6	H	34-36	7.35
PACKARD							
1936 Eight	Voltage	TC-4302A		6.5—7.25	.5—2.5	......	F
1936 Eight	Voltage	TC-4302B		6.5—7.25	.5—2.5	......	F
1937, 6 and 8	Voltage	VRD-4001A	Positive	6.4—7.0	.5—3.0	......	G
1937 Super 8	Volt & Cur.	VRB-4002D	Positive	6.4—7.0	.5—3.0	27-29	G
1937–39 Twelve	Volt & Cur.	VRB-4008AP	Positive	6.4—7.0	.5—3.0	29-31	G
1938 Eight	Voltage	VRD-4001B	Positive	6.4—7.0	.5—3.0	..	G
1938 Super 8	Volt & Cur.	VRB-4008C	Positive	6.4—7.0	.5—3.0	27-29	7.45
1939, 6 and 8	Voltage	VRD-4001B	Positive	6.4—7.0	.5—3.0	......	G
1939 Super 8	Volt & Cur.	VRB-4012A-1	Positive	6.4—7.0	.5—3.0	27-29	7.45
1940, 6 and 8	Volt & Cur.	VRB-4012B-1	Positive	6.4—7.0	.5—3.0	34-36	7.45
1940, 6 and 8	Volt & Cu..	VRP-4002A	Positive	6.4—6.6	H	34-36	7.35
1940, 6 and 8	Volt & Cur.	VRP-4201A-1	Positive	6.4—6.6	H	34-36	7.35
1940 Super 8	Volt & Cur.	VRP-4003A	Positive	6.4—6.6	H	34-36	7.35
1940 Super 8	Volt & Cur.	VRP-4202A-1	Positive	6.4—6.6	H	34-36	7.35
1941–47	Volt & Cur.	VRP-4002C	Positive	6.4—6.6	H	34-36	7.35
1948–50	Volt & Cur.	VRP-4402A	Positive	6.4—6.6	H	34-36	7.35
1949–50	Volt & Cur.	VRP-4402B	Positive	6.4—6.6	H	39-41	7.35
1949–50	Volt & Cur.	VRP-4402C	Positive	6.4—6.6	H	39-41	7.35
1949–50	Volt & Cur.	VAV-4401B	Positive	6.4—6.6	H	44-46	7.35
1951	Volt & Cur.	VRP-4402C	Positive	6.4—6.6	H	39-41	7.35
1952	Volt & Cur.	VBE-6102A	Positive	6.5—7.0	3	45	7.4

CUTOUT RELAY

ARMATURE AIR GAP—Disconnect the regulator and adjust the cutout relay as follows (see Figs. 1 to 4).

Armature air gap should be measured with the contacts open. Use a flat gauge between the winding core and armature as close to the armature hinge as possible. Adjust by bending the upper armature stop. The upper armature stop may be at the side, at the end, or in the center of the armature.

When the regulator has a second set of contacts, the upper contact bracket is bent to adjust air gap. Be sure the bracket does not rub against the side of the armature or touch the yoke. Contacts must align after adjustment is complete.

CONTACT GAP—Contact gap is measured with the contacts open and is adjusted by expanding or contracting the bridge supporting the stationary contact to raise or lower the contact. Be sure contacts are aligned when adjustment is completed.

CLOSING VOLTAGE — Closing voltage is adjusted by bending the lower spring bracket of the spiral spring. Bending the spring bracket down increases the closing voltage; bending it up decreases the closing voltage.

The closing voltage must always be 0.5 volt lower than the voltage regulator voltage setting.

After each adjustment, replace the cover and test the cutout relay action.

OPENING AMPERAGE — This is adjusted by raising or lowering the stationary contact, and is accomplished by expanding or contracting the bridge supporting the stationary contact. Lowering the contact lowers the opening voltage and increases the opening amperage. Raising the contact increases the opening voltage and lowers the opening amperage. After each adjustment, replace the cover and test the action of the cutout relay.

VOLTAGE REGULATOR

ARMATURE AIR GAP—Disconnect the regulator and adjust as follows:

The armature air gap should be checked with a pin gauge on the contact side of the armature stop pin in the winding core. The pin gauge should be placed as close to the armature stop pin as possible. Contacts should barely be touching as the air gap is checked.

To perform this check accurately, connect a three candlepower test lamp and a six volt battery in series with the regulator "F" terminal and the regulator base. With the points open, the light will dim or go out. With the points closed, the light will burn.

A low limit and a high limit pin gauge may be used. With low limit gauge in place, push armature down (push against armature, not the spring). Light should dim or go out.

With the high limit gauge in place, push armature down; light should stay lit.

To adjust, loosen the screw holding the upper bracket and raise or lower the bracket as required. Tighten screw after adjustment, being sure points are aligned. Recheck adjustment after tightening screw.

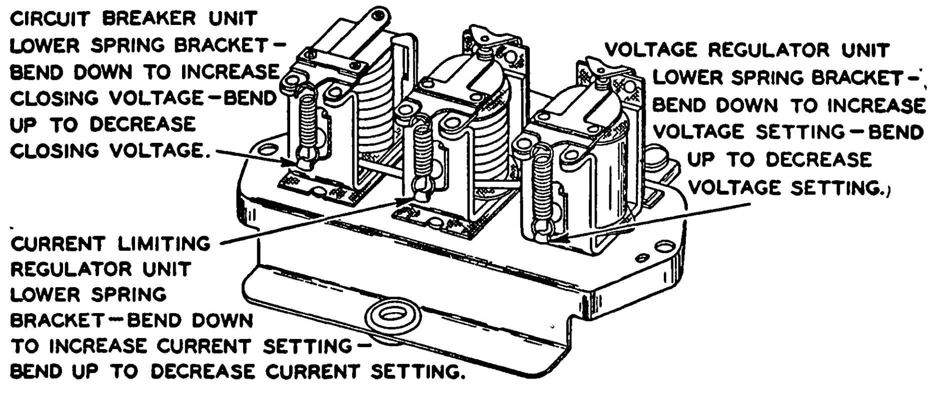


Fig. 4 Adjustments of Auto-Lite vibrating type regulators

VOLTAGE SETTING — This setting is accomplished by bending the lower spring arm to decrease or increase the spiral spring tension, Fig. 4. Increasing the tension raises the voltage setting; lowering the tension reduces the setting. After each change of adjustment, replace the cover, stop generator and bring it back to speed at which 10 amperes is produced.

CURRENT REGULATOR

ARMATURE AIR GAP—Fig. 4. This adjustment is accomplished in the same manner as outlined for the voltage regulator unit.

CONTACT GAP—Contact gap is checked with the armature held down against the stop pin in the winding core. Do not touch spring. Too much variations from the specifications indicates wrong length of armature stop pin and a new unit will be needed.

CURRENT SETTING — This setting is adjusted by bending the lower spring bracket. Bending the spring bracket down to increase the spring tension increases the current setting; bending it up lowers the current setting.

DELCO-REMY VIBRATING REGULATORS

All Delco-Remy vibrating regulators are classified as being either the single core type or two core type. The two core type of regulator can be identified by the part number which is stamped on the mounting leg. Part numbers of these units are in the 5000 group.

All single core regulators are of the 1118200 series, the last three digits of the part number being stamped on the mounting leg of the regulator. Thus, if the part number is 1118201, 201 will be found on the mounting leg.

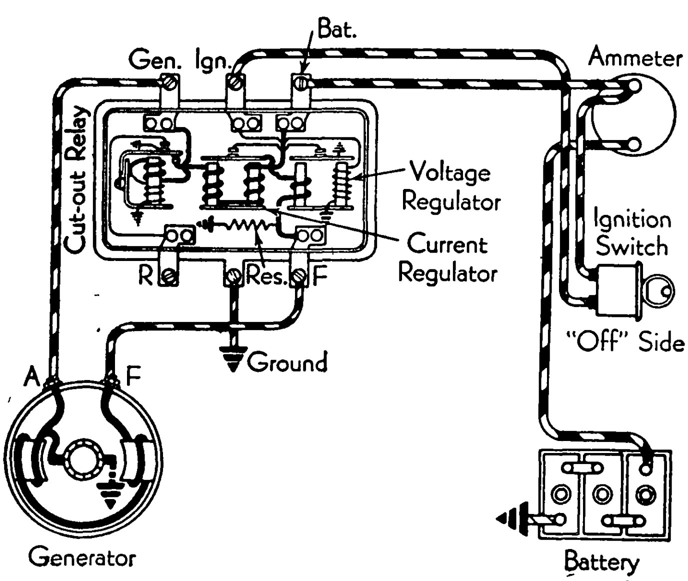
ADJUSTMENTS

Before making any adjustments, consult the specification charts and make the adjustments according to the data given. For test procedure, see the text which follows the adjustment section.

TWO CORE REGULATORS

Fig. 5 illustrates the wiring circuits of this type regulator, whereas Fig. 6 pictures front and rear views of the same unit. Adjustments are made as follows:

Fig. 5 Wiring diagram of Delco-Remy two core vibrating current and voltage regulator



AUTO-LITE REGULATOR INDEX AND SPECIFICATIONS

NOTE—See tables following for settings.

Car and Model	Regulator Type	Regulator Number Note A	Ground Polarity	Voltage to Close Relay Points	Amperage to Open Relay Points (Reverse Current)	Maximum Operating Amperage	Maximum Operating Voltage @ 70° F. Note E
PLYMOUTH							
1935-39 Std.	B	CB-4014 (C)		6.5—7.25	.5—2.5 (D)	15	
1935-36 Deluxe	Voltage	TC-4301A		6.5—7.25	.5—2.5		F
1937 Deluxe	Voltage	VRD-4002A	Positive	6.4—7.0	.5—3.0		G
1938-39 Deluxe	Voltage	VRD-4002B	Positive	6.4—7.0	.5—3.0		G
1940-48	Volt & Cur.	VRP-4001A	Positive	6.4—6.6	H	34-36	7.35
1946-48	Volt & Cur.	VRP-4401A	Positive	6.4—6.6	H	34-36	7.35
1947-48	Volt & Cur.	VRP-4501A	Positive	6.4—6.6	H	35 (L)	7.35
1947-50	Volt & Cur.	VRP-4503A	Positive	6.4—6.6	H	35 (L)	7.35
1949	Volt & Cur.	VRP-4503B	Positive	6.4—6.6	H	40 (L)	7.35
1950	Volt & Cur.	VRP-6004A	Positive	6.4—6.6	H	40 (L)	7.35
1951-52	Volt & Cur.	VBE-6001A	Positive	6.3—6.8	4.1—4.8	45	7.25
STUDEBAKER							
1935-37 Dic.	Voltage	TC-4302A		6.5—7.25	.5—2.5		F
1938 Com.	Voltage	VRD-4006A	Positive	6.4—7.0	.5—3.0		G
1938-39 Com.	Voltage	VRD-4006B	Positive	6.4—7.0	.5—3.0		7.45
1939 Champ.	Voltage	VRR-4002B	Positive	6.4—6.6	H		7.35
1939 Com.	Volt & Cur.	VRB-4012A	Positive	6.4—7.0	.5—3.0	27-29	7.45
1940 Six	Volt & Cur.	VRP-4004A	Positive	6.4—6.6	H	34-36	7.35
1941-50	Volt & Cur.	VRP-4004F	Positive	6.4—6.6	H	34-36	7.35
1950 Champ.	Volt & Cur.	VRP-6001A	Positive	6.4—6.6	H	34-36	7.35
1951 Champ.	Volt & Cur.	VRP-6005A	Positive	6.4—6.6	4.1—4.8	39-41	7.35
1952 Champ.	Volt & Cur.	VBE-6101A	Positive	6.3—6.9	4.1—4.8	45	7.7
WILLYS							
1935-36	B	CB-4008 (C)		6.5—7.25	.5—2.5 (D)	15	
1937-39	B	CB-4025 (C)		6.5—7.25	.5—2.5 (D)	15	
1939	Voltage	VRD-4004A	Negative	6.4—7.0	.5—3.0		G
1940-42	Voltage	VRR-4004A	Negative	6.4—6.6	C		7.35
1946-50, 4-63	Volt & Cur.	VRP-4007C-2	Negative	6.4—6.6	H	34-36	7.35
1948-50, 6-63	Volt & Cur.	VRP-4007C-2	Negative	6.4—6.6	H	34-36	7.35
1948-52	Volt & Cur.	VRP-6003A	Negative	6.4—6.6	H	34-36	7.35

A—On all VR type prior to 1946, number is stamped on plate riveted to cover. On 1946 and later units, as well as on TC regulators, number is stamped on plate riveted to side of base.

B—Regulated by third brush. Next column gives cutout relay number.

C—Armature air gap .010 to .030″, measured with points closed. Point gap .015 to .045″, measured with armature against stop.

D—Measure after generator charges 15 amperes.

E—See tables following this index for operating voltages at various temperatures.

F—See TC REGULATOR SETTINGS table.

G—Units before serial number 8R-000001, 7.65 volts; later units, 7.45 volts.

H—The construction of this relay differs from those used on VRB and VRD units in that the movable contact is mounted on a spring arm and the contact pressure does not vary with the amperes flowing through the coil after the armature seals. This change was made t obtain a slight wiping action between the contacts. Points open 4.1-4 8 volts from the sealed position, the discharge being approximately 4-6 amperes.

J—Units before serial number 8R-000001, 7.65 volts; later units, 7.50 volts.

K—Units before serial number 8R-000001, 7.50 volts; later units, 7.95 volts.

L—This is a temperature compensated current regulator. After 15 minutes run at 10 amperes output the current setting will be as specified in test "A" below. After an additional 15 minutes operation on current regulator (operate on current regulator by adding load to battery to give give 6.8—7.0 volts) the current setting will be as specified in Test B. If the regulator is not cold at the start of the test, the test "A" figure may be slightly less than that specified, due to the additional heat.

Nominal Setting	Temp.	40° F.	60° F.	70° F.	80° F.	100° F.
35	Test A	45 Max.	43 Max.	42 Max.	41 Max.	39 Max.
	Test B	34-38	34-38	33-37	32-36	30-34
40	Test A	49 Max.	47 Max.	46 Max.	45 Max.	43 Max.
	Test B	41-45	39-43	38-42	37-41	35-39
45	Test A	53 Max.	51 Max.	50 Max.	49 Max.	47 Max.
	Test B	46-50	44-48	43-47	42-46	40-44
50	Test A	59 Max.	57 Max.	56 Max.	55 Max.	53 Max.
	Test B	51-55	49-53	48-52	47- 51	45-49

GENERATOR REGULATORS

AUTO-LITE VOLTAGE & CURRENT REGULATOR SETTINGS

Unit Number	Cutout Relay Settings		Voltage Unit Settings			Current Unit Settings		R1 Resistor, Ohms Note D	R2 Resistor, Ohms Note D
	Armature Air Gap, Inch Note A	Point Opening, Inch Note B	Armature Air Gap, Inch Note C	Point Opening, Inch Note B	Operating Voltage	Armature Air Gap, Inch Note C	Point Opening, Inch Note B		
VAV-4002C	.031	.015	.048	R	L	.048	R	60	11
VAV-4401B	.034	.015	.048	R	L	.048	R	60	15
VAV-6001A	.034	.015	.048	R	T	.048	R	60	15
VAU-4404B	.034	.015	.048	R	L	.048	R	60	15
VBA-4101A	.034	.015	.048	R	S	.048	R	60	7
VBA-4202A	.034	.015	.048	R	T	.048	R	60	None
VBE-6001A	.031	.015	.048	R	T	.048	R	34.5	6.5
VRB-4002D	.034	.015	.0595	.010	F	.0595	.010	60	None
VRB-4004B	.034	.015	.0595	.010	F	.0595	.010	30	7
VRB-4005A	.034	.015	.0595	.010	F	.0595	.010	30	None
VRB-4008A	.034	.015	.0595	.010	F	.0595	.010	60	11
VRB-4008AP	.034	.015	.0595	.010	F	.0595	.010	60	11
VRB-4008C	.034	.015	.0595	.010	G	.0595	.010	30	7
VRB-4010A	.034	.015	.0595	.010	G	.0595	.010	30	7
VRB-4012A	.034	.015	.0595	.010	G	.0595	.010	30	7
VRB-4012A-1	.034	.015	.0595	.010	G	.0595	.010	30	7
VRB-4012B-1	.034	.015	.0595	.010	G	.0595	.010	38	7
VRD-4001A	.034	.015	.0595	.010	F	None	None	20	None
VRD-4001B	.034	.015	.0595	.010	F	None	None	20	None
VRD-4002A	.034	.015	.0595	.010	F	None	None	20	None
VRD-4002B	.034	.015	.0595	.010	F	None	None	20	None
VRD-4003A	.034	.015	.0595	.010	H	None	None	20	None
VRD-4003B	.034	.015	.0595	.010	J	None	None	20	None
VRD-4004A	.034	.015	.0595	.010	F	None	None	20	None
VRD-4006A	.034	.015	.0595	.010	F	None	None	20	None
VRD-4006B	.034	.015	.0595	.010	G	None	None	20	None
VRD-4008A	.034	.015	.0595	.010	K	None	None	20	None
VRD-4008B	.034	.015	.0595	.010	K	None	None	30	None
VRD-4009A	.034	.015	.0595	.010	F	None	None	20	None
VRD-4010A	.034	.015	.0595	.010	G	None	None	20	None
VRP-4001A	.031	.015	.048	R	L	P	R	38	7
VRP-4001F	.031	.015	.048	R	L	P	R	60	15 (E)
VRP-4002A	.031	.015	.048	R	L	P	R	38	7
VRP-4402B	.031	.015	.048	R	L	P	R	60	15
VRP-4002C	.031	.015	.048	R	L	P	R	38	7
VRP-4003A	.031	.015	.048	R	L	P	R	38	7
VRP-4004A	.031	.015	.048	R	L	P	R	38	7
VRP-4004F	.031	.015	.048	R	L	P	R	38	7
VRP-4004F-1, 2	.031	.015	.048	R	L	P	R	38	7
VRP-4007C-2	.031	.015	.048	R	L	P	R	38	7
VRP-4201A-1	.031	.015	.048	R	M	P	R	38	7
VRP-4202A-1	.031	.015	.048	R	M	P	R	38	7
VRP-4401A	.031	.015	.048	R	L	P	R	38	7
VRP-4402A	.031	.015	.048	R	L	P	R	38	7
VRP-4402C	.031	.015	.048	R	L	P	R	38	7
VRP-4402B	.031	.015	.048	R	L	P	R	60	15
VRP-4501A	.031	.015	.048	R	L	P	R	38	7
VRP-4503A	.031	.015	.048	R	L	P	R	38	7
VRP-4503B	.031	.015	.048	R	L	P	R	38	7
VRP-6001A	.031	.015	.048	R	L	P	R	38	7
VRP-6002A	.031	.015	.048	R	L	P	R	38	7
VRP-6003A	.031	.015	.048	R	L	P	R	38	7
VRP-6004A	.031	.015	.048	R	L	P	R	38	7
VRP-6005A	.031	.015	.048	R	L	P	R	38	7
VRP-6101A	.031	.015	.048	R	L	P	R	38	7
VRR-4001A	.031	.015	.048	R	N	None	None	30	None
VRR-4002B	.031	.015	.048	R	L	None	None	20	None
VRR-4004A	.031	.015	.048	R	L	None	None	20	None
VRR-4005A	.031	.015	.048	R	L	None	None	20	None

FOOTNOTES ON PAGE 45

FOOTNOTES—AUTO-LITE VR REGULATOR SETTINGS

A—With points open. A tolerance f plus .003" is permissible.

B—Minimum.

C—A tolerance of plus .003" is permissible.

D—Resistance indicated in table is marked on resistor. The marked value has a tolerance of plus or minus 5%.

E—Before serial number 6U-000001, R2 was marked 11.

F—At the temperatures given below, operating voltages given are for units before and after serial number 8R-000001. Tolerance plus or minus .15 volt.

Degrees, F.	Voltage (early)	Voltage (late)
50	7.68	7.51
60	7.66	7.48
70	7.65	7.45
80	7.63	7.42
90	7.62	7.39
100	7.61	7.36
110	7.60	7.33
120	7.59	7.30

G—Set to later figures in Note F above.

H—Test figures given are for units after serial number 8R-00001; set to earlier figures in Note F for units before 8R-000001. Tolerance plus or minus .15 volt.

Degrees, F.	Voltage
50	7.63
60	7.56
70	7.50
80	7.43
90	7.37
100	7.30
110	7.24
120	7.17

J—Test figures given are for units before serial number 8R-000001; set to figures in Note H for units after 8R-000001. Tolerance plus or minus .15 volt.

Degrees, F.	Voltage
50	7.98
60	7.96
70	7.95
80	7.93
90	7.92
100	7.91
110	7.89
120	7.88

K—

Degrees, F.	Voltage
50	7.63
60	7.56
70	7.50
80	7.43
90	7.37
100	7.30
110	7.24
120	7.17
Tolerance	.15

L—

Degrees, F.	Voltage
50	7.41
60	7.38
70	7.35
80	7.32
90	7.29
100	7.27
110	7.24
120	7.21
Tolerance	.15

M—

Degrees, F.	Voltage
50	7.44
60	7.39
70	7.35
80	7.31
90	7.27
100	7.22
110	7.18
120	7.14
Tolerance	.15

N—

Degrees, F.	Voltage
50	7.63
60	7.57
70	7.50
80	7.43
90	7.38
100	7.31
110	7.24
120	7.17
Tolerance	.15

P—If unit is stamped ST-281-7, gap should be .048—.052"; if stamped ST-281-6, air gap should be .034—038".

R—Contacts should be closed with the high limit gauge in place, and open with the low limit gauge in place on the contact side and next to the brass armature stop pin.

S—

Degrees, F.	Voltage
50	7.16
60	7.13
70	7.10
80	7.07
90	7.04
100	7.01
110	6.98
120	6.95
Tolerance	.10

T—

Degrees, F.	Voltage
50	7.34
60	7.29
70	7.25
80	7.21
90	7.16
100	7.12
110	7.08
120	7.03
Tolerance	.15

AUTO-LITE TC VOLTAGE REGULATOR SETTINGS

Unit Number	Cutout Relay Settings		Voltage Regulator Settings				
	Armature Air Gap, Inch Note A	Point Opening, Inch Note B	Armature Air Gap, Inch Note C	Point Opening, Inch Note D	Winding Resistance, Ohms Note K	Voltage to Open Points	Voltage to Close Points
TC-4101A	None	None	.030	.005	43-48	E	F
TC-4301A	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4302A	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4302B	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4304A	.010—.030	.015—.045	.045	.005	29-33	J	H
TC-4305A	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4306A	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4312A	.010—.030	.015—.045	.045	.005	29-33	G	H
TC-4313A	.010—.030	.015—.045	.045	.005	29-33	G	H

A—Measure when points are closed.

B—Measure with armature against stop.

C—Measure with points closed and spring tension n armature.

D—Minimum—with points open.

E—Points to open at following temperature and voltage:

Degrees, F.	Voltage	Degrees, F.	Voltage	Degrees, F.	Voltage
50	8.38—8.82	70	8.26—8.67	100	8.07—8.50
60	8.32—8.75	80	8.20—8.60	110	8.02—8.44
		90	8.13—8.54		

F—Points to close at following temperature and voltage:

Degrees, F.	Voltage	Degrees, F.	Voltage	Degrees, F.	Voltage
50	6.58—6.98	70	6.46—6.86	100	6.29—6.71
60	6.52—6.92	80	6.40—6.80	110	6.24—6.67
		90	6.34—6.76		

G—Points to open at following temperature and voltage:

Degrees, F.	Voltage	Degrees, F.	Voltage	Degrees, F.	Voltage
50	8.40—8.90	70	8.25—8.75	100	8.03—8.53
60	8.32—8.82	80	8.18—8.68	110	7.96—8.46
		90	8.10—8.60		

H—Closing voltage must be below opening voltage by 1.2 to 1.4 volts.

J—Points to open at following temperature and voltage:

Degrees, F.	Voltage	Degrees, F.	Voltage	Degrees, F.	Voltage
50	8.14—8.64	70	8.00—8.50	100	7.79—8.29
60	8.07—8.57	80	7.93—8.43	110	7.72—8.22
		90	7.86—8.36		

K—For TC-4100 and 4200 series, the resistance given is for the shunt winding taken at 75 degrees F. The anti-flutter winding should show resistance of 36 to 44 ohms. For TC-4300 series, test should show the resistance given at 77 degrees.

CUTOUT RELAY

ARMATURE AIR GAP—The air gap is checked with the contact points held closed, and measurements taken between the center of the core and armature. Adjust by loosening the two armature mounting screws at the back of the relay, and raising or lowering the armature as required.

POINT GAP—Point opening is checked with the points open, and is adjusted by bending the upper armature stop. Where the unit has a set of auxiliary contact points mounted above the relay contact points, bend the upper auxiliary contact support arm to adjust point opening.

CLOSING VOLTAGE—This setting is obtained by bending the spring post down to decrease the tension of the flat spring and the closing voltage. Bending the spring post up raises the spring tension and closing voltage.

VOLTAGE REGULATOR

Figs. 7 and 8 illustrate the adjustment requirements on this unit. Although two-element regulators are shown, the adjustments are the same on three-element units.

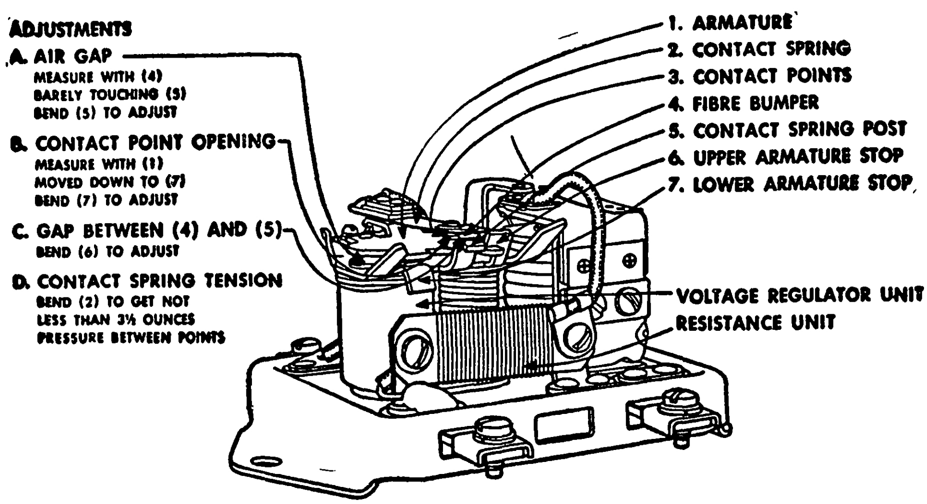


Fig. 7 Mechanical adjustments of Delco-Remy two core type voltage regulator. Two unit regulator shown

CURRENT REGULATOR

The current regulator air gap, point opening, gap between fibre bumper and contact spring post, and contact point spring tension are all made with the regulator disconnected and in the manner shown in Figs. 7 and 8 for the voltage regulator unit.

The current setting is adjusted by bending the lower spring hanger up to lower the spiral spring tension and current setting, or down to increase the current setting.

SINGLE CORE REGULATORS

Fig. 9 illustrates a typical Delco-Remy single core current and voltage regulator. Two types of these regulators are in use. The first type, a wiring diagram of which is shown in Fig. 10, is adjusted by bending the spring hangers. The second type, introduced in 1948, uses screws as a means of adjustment. A wiring diagram of this type is pictured in Fig. 11.

Parts indicated same on Current Regulator Unit

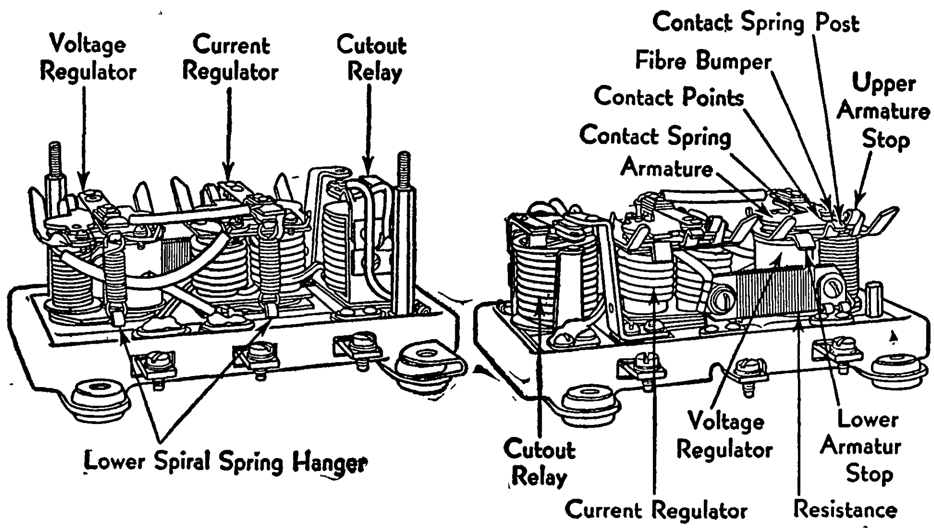


Fig. 6 Front and rear views f D lc -Remy two core vibrating voltag and curr nt regulator

SCREW ADJUSTMENT TYPE

Regulators of this type which are designed for positive grounded systems have copper plated current and voltage regulator armatures, whereas regulators designed for negative grounded systems have cadmium plated armatures. To adjust the regulator, proceed as follows:

CUTOUT RELAY

CLOSING VOLTAGE — To adjust the closing voltage, turn the adjusting screw,

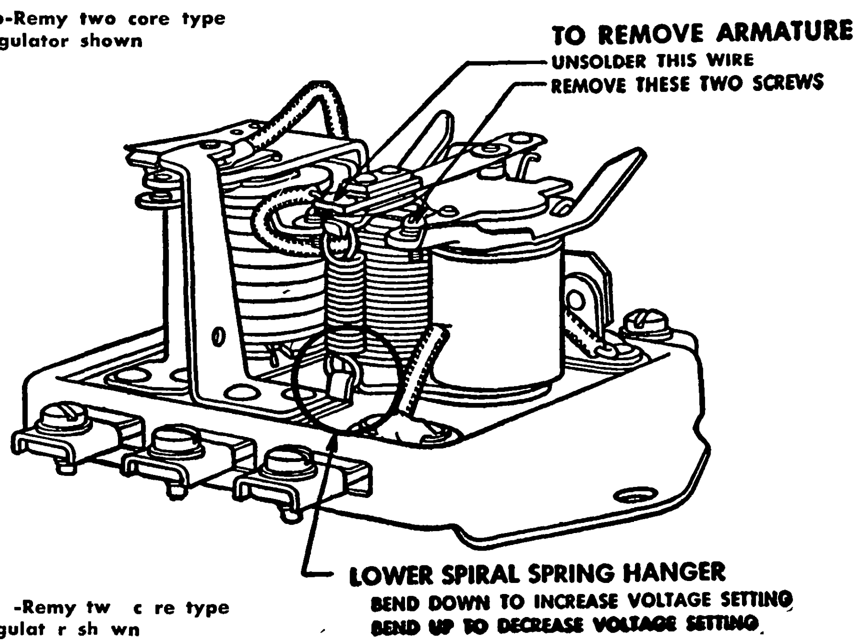


Fig. 8 Voltag regulat r s tting n Delc -Remy tw c re type v ltage r gulat r. Tw unit regulat r sh wn

DELCO-REMY REGULATOR INDEX AND SPECIFICATIONS

Car and Model	Regulator Type	Regulator Number Note A	Ground Polarity	Voltage to Close Relay Points	Amperage to Open Relay Points (Reverse Current)	Maximum Operating Amperage	Maximum Operating Voltage (Hot)
BUICK							
1935-36	Voltage	5581		6.3—6.9	0—3.0		B
1937-38	Voltage	1118213	Negative	6.3—6.6			7.0—7.1 (E)
1939	Voltage	1118203	Negative	6.3—6.6	.		7.0—7.1 (E)
1940-48	Volt. & Cur.	1118201	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1949, 40	Volt & Cur.	1118301	Negative	5.9—6.8		40-46	7.0—7.7
1949, 50, 70	Volt & Cur.	1118357	Negative	5.9—6.8		40-46	7.0—7.7
1950-51	Volt & Cur.	1118364	Negative	5.9—6.8		40-46	7.0—7.7
1952	Volt & Cur.	1118729	Negative	5.9—6.7	1—6.0	45-51	7.2—7.7
CADILLAC							
1936	Volt & Cur.	5596	Positive	6.9—7.6	0—4.0	20-22	F
1937-38, 60, 60S, 65	Voltage	5860	Positive	6.3—6.9	0—4.0		C
1937-38, 70, 75, 85, 90	Volt & Cur.	5831	Positive	6.9—7.6	0—4.0	26-28	C
1939, 60S, 61	Voltage	1118204	Positive	6.3—6.6			7.0—7.1 (E)
1939, 75, 90	Volt & Cur.	1118230	Positive	6.2—6.7		26-28	7.0—7.2 (E)
1940-42	Volt & Cur.	1118202	Positive	6.2—6.7		34-36	7.2—7.4 (E)
1946-48	Volt & Cur.	1118242	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1949	Volt & Cur.	1118300	Negative	5.9—6.8		40-46	7.0—7.7
1950-51	Volt & Cur.	1118357	Negative	5.9—6.8		40-46	7.0
1952	Volt & Cur.	1118725	Negative	5.9—6.8	0—4.0	45-51	7.0—7.5
CHEVROLET							
1935-37	D	1867781 (J)		7.0—7.4	0—3.0		
1938-39	Voltage	1118203	Negative	6.3—6.6			7.0—7.1 (E)
1940-48	Volt & Cur.	1118201	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1949-51	Volt & Cur.	1118301	Negative	5.9—6.8		40-46	7.0—7.7
1952	Volt & Cur.	1118720	Negative				
KAISER							
1951	Volt & Cur.	1118302	Positive	5.9—6.8		32-40	7.0—7.7
1952	Volt & Cur.	1118392	Positive			•	
LA SALLE							
1935-36	Volt & Cur.	5596	Positive	6.9—7.6	0—4.0	20-22	F
1937-39	Voltage	1118204	Positive	6.3—6.6			7.0—7.1 (E)
1940	Volt & Cur.	1118202	Positive	6.2—6.7		34-36	7.2—7.4 (E)
NASH							
1941-42, 40	Volt & Cur.	1118202	Positive	6.2—6.7		34-36	7.2—7.4 (E)
1948, 40, 60	Volt & Cur.	1118202	Positive	6.2—6.7		34-36	7.2—7.4 (E)
1949-51	Volt & Cur.	1118302	Positive	5.9—6.8		32-40	7.0—7.7
1952, 10	Volt & Cur.	1118731	Positive				
1952, 40, 60	Volt & Cur.	1118732	Positive				
OLDSMOBILE							
1935	Voltage	5880		6.3—6.9	0—3.0		B
1936-39	Voltage	1118203	Negative	6.3—6.6			7.0—7.1 (E)
1940-42	Volt & Cur.	1118201	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1946-48	Volt & Cur.	1118242	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1949-51	Volt & Cur.	1118300	Negative	5.9—6.8		40-46	7.0—7.7
1952	Volt & Cur.	1118725	Negative	5.9—6.8	0—4.0	45-51	7.0—7.5
PACKARD							
1937-38 Six	Voltage	1118204	Positive	6.3—6.6			7.0—7.1 (E)
1937 Super 8 and 12	Volt & Cur.	1118230	Positive	6.2—6.7		26-28	7.0—7.2 (E)
1941-47 Six	Volt & Cur.	1118202	Positive	6.2—6.7		34-36	7.2—7.4 (E)
1948, 8 and Super 8	Volt & Cur.	1118278	Positive	6.2—6.7		34-36	7.2—7.4 (E)
1949, 8 and Super 8	Volt & Cur.	1118331	Positive	5.9—6.8		40-46	7.0—7.7
1949-50, 8 and Super 8	Volt & Cur.	1118360	Positive	5.9—6.8		40-46	7.0—7 7
1951	Volt & Cur.	1118360	Positive	5.9—6.8		40-46	7.0—7.7
1952	Volt & Cur.	1118726	Positive	6.5—7.0	3	45	7.4

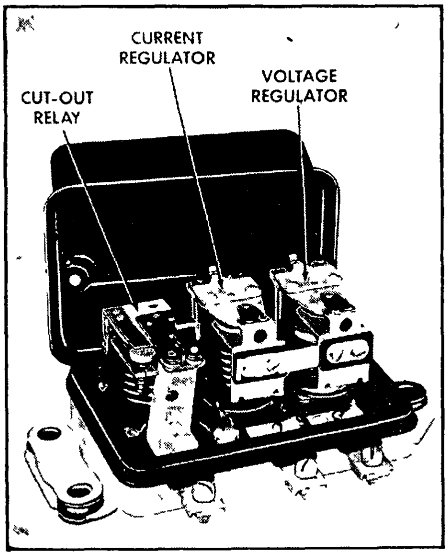


Fig. 9 Delc -Remy single core vibrating v ltag and current regulator

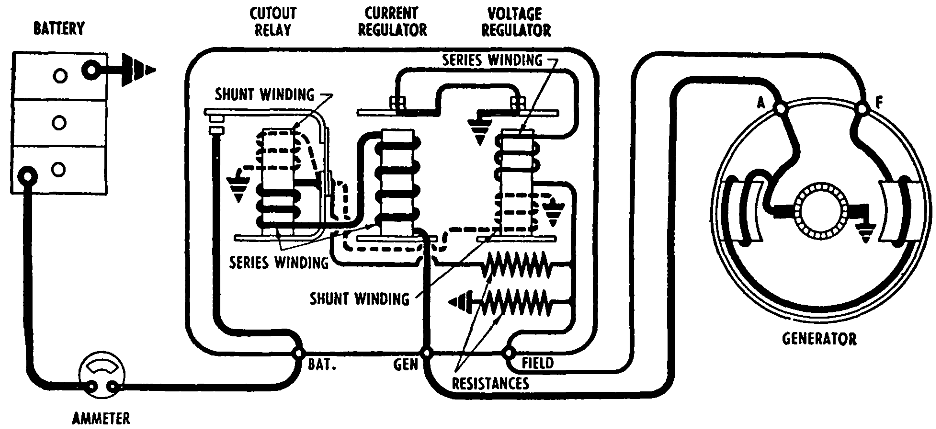


Fig. 11 Wiring diagram of Delco-Remy single core vibrating voltage and current regulator using screws as a means of adjustment

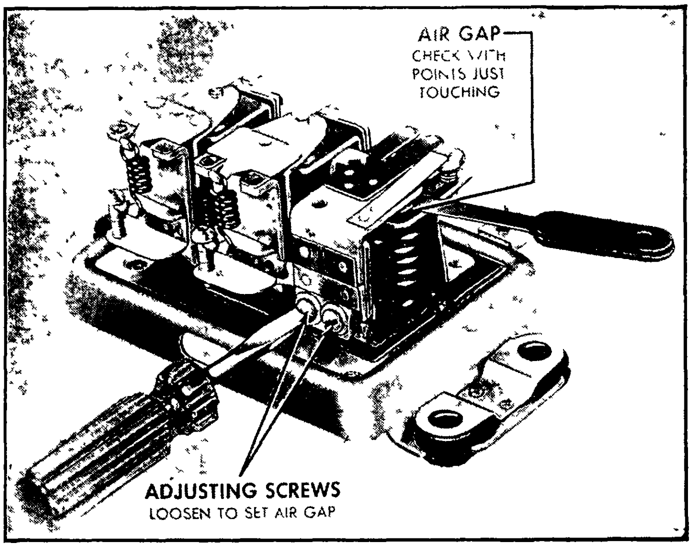


Fig. 13 Adjusting armature air gap of cutout relay on Delc -Remy singl core regulators with screw adjustment

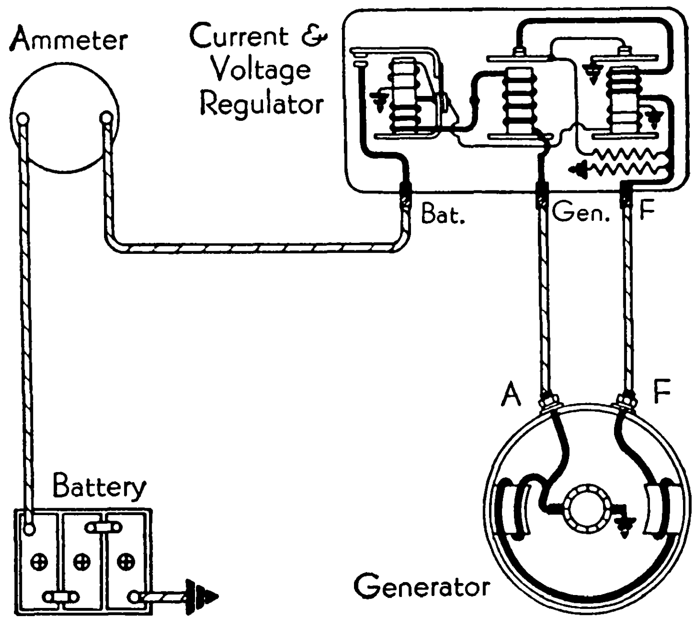


Fig. 10 Wiring diagram of Delco-Remy single core vibrating voltage and current regulator of the type which is adjust d by bending spring hangers

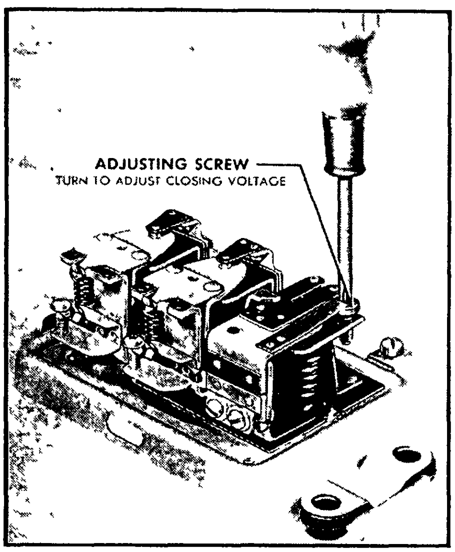


Fig. 12 Adjusting cl sing v ltag f cut ut relay n Delc -Remy single cor r gulators with scr w adjustment

Fig. 12, until the preferred setting is obtained. Turn screw clockwise to increase spring tension and closing voltage, and counterclockwise to decrease spring tension and closing voltage.

With the closing voltage adjusted, increase engine speed to close points. Then slowly decrease engine speed and note discharge current necessary to open relay points. If the reverse current necessary to open the points is not within the specified limits, the armature air gap and point opening should be checked and adjusted.

ARMATURE AIR GAP—Place finger on armature directly above core and move armature down until points just close. Measure air gap between armature and center of core, Fig. 13. If both sets of points do not close simultaneously, bend spring fingers so they do.

To adjust air gap, loosen two screws at back of relay and raise or lower armature as required. Tighten screws securely after adjustment.

POINT OPENING—Adjust point opening by bending upper armature stop, Fig. 14. After making air gap and point opening adjustments, recheck closing voltage and opening amperage and make any necessary readjustments.

VOLTAGE REGULATOR

VOLTAGE SETTING—To adjust, turn the adjusting screw, Fig. 15, clockwise to increase voltage setting, or counterclockwise to decrease it.

CAUTION—If adjusting screw is turned down (clockwise) beyond the normal

DELCO-REMY REGULATOR INDEX AND SPECIFICATIONS

Car and Model	Regulator Type	Regulator, Number Note A	Ground Polarity	Voltage to Close Relay Points	Amperage to Open Relay Points (Reverse Current)	Maximum Operating Amperage	Maximum Operating Voltage (Hot)
PONTIAC							
1935-37 All	Voltage	1118213	Negative	6.3—6.6			7.0—7.1 (E)
1938 Eight	Voltage	1118213	Negative	6.3—6.6			7.0—7.1 (E)
1938 Six, 1939 All	Voltage	1118203	Negative	6.3—6.6			7.0—7.1 (E)
1940-42	Volt & Cur.	1118201	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1946-48	Volt & Cur.	1118242	Negative	6.2—6.7		34-36	7.2—7.4 (E)
1949-51	Volt & Cur.	1118301	Negative	5.9—6.8		32-40	7.0—7.7
1951-52	Volt & Cur.	1118725	Negative	5.9—6.7		45-51	7.0—7.7
STUDEBAKER							
1935-36 Pres.	Voltage	5546		6.3—6.9	0—3.0		B
1937-40 Pres	Volt & Cur	1118230	Positive	6.2—6.7		26-28	7.0—7.2 (E)
1950 Commander	Volt & Cur.	1118302	Positive	5.9—6.8		32-40	7.0—7.7
1951 Commander	Volt & Cur	1118392	Positive	6.05—6.98		40	7.2—7.6
1952 Commander	Volt & Cur.	1118730	Positive	6.05—6.98	1	45	7.15—8.05

A—Stamped on mounting leg. On 1118 series, last three numbers are marked.
B—Consult the STEP-VOLTAGE REGULATOR table following this index.
C—Setting must be made on closed circuit. Voltage 7.5 to 7.9 at 70 degrees F.; 7.4 to 7.6 at 150 degrees F. Operate generator at 25% above speed at which it first reaches rated output and adjust current to 8 to 10 amperes.
D—Controlled by third brush. Next column gives cutout relay number.
E—Setting must be made on closed circuit. Operate generator at speed at which it will produce rated output and adjust current to 8 to 10 amperes
F—Setting must be made on closed circuit. Voltage 7.0 to 7.4 at 70 degrees F ; 6.95 to 7.15 at 150 degrees F. Operate generator at 25% above speed at which it first reaches rated output and adjust current to 8 to 10 amperes.
J—Armature air gap with points closed, .015″; point opening .020″; armature spring tension, 3.5 ounces.
K—Setting at 70 degrees 13 to 16 amperes, at 200 degrees 9 to 11 amperes.

DELCO-REMY SINGLE AND TWO CORE REGULATOR SETTINGS

Unit No.	Cutout Armature Air Gap, Inch	Cutout Point Opening, Inch	Voltage Unit Armature Air Gap, Inch	Current Unit Armature Air Gap, Inch
5596	.020	.020	.063	.075
5831	.020	.020	.063	.075
5860	.040	.020	.063	None
1118201	.020	.020	.070	.080
1118202	.020	.020	.070	.080
1118203	.020	.020	.070	None
1118204	.020	.020	.070	None
1118213	.020	.020	.070	None
1118230	.020	.020	.070	.080
1118242	.020	.020	.070	.080
1118278	.020	.020	.070	.080
1118300	.020	.020	.075	.075
1118301	.020	.020	.075	.075
1118302	.020	.020	.075	.075
1118331	.020	.020	.075	.075
1118357	.020	.020	.075	.075
1118360	.020	.020	.075	.075
1118364	.020	.020	.075	.075
1118392	.020	.020	.075	.075
1118725	.020	.020	.075	.075

range required for adjustment, the spring support may be bent beyond its elastic limit and fail to return when pressure is relieved In such a case, turn the screw counterclockwise until sufficient clearance develops between the screw head and the spring support, then bend spring support up carefully with small pliers until contact is made with the screw head The final setting of the unit should always be approached by increasing the spring tension, never by reducing it. In other words, if the setting is found to be too high, the unit should be adjusted below the required value and then raised to the exact setting by increasing the spring tension

After each adjustment and before taking voltage, replace the regulator cover, reduce engine speed until the relay points open and then slowly increase the engine speed again.

AIR GAP—Place fingers on armature directly above core and move armature down to the core and release it until the contact points just touch. Measure the air gap between the armature and the center of the core, Fig. 16. If not within the specified limits, loosen the contact mounting screws and raise or lower the contacts brackets as required. Tighten contact mounting screws securely, making sure points are lined up

After making air gap adjustment, recheck voltage setting and make any necessary readjustments.

CURRENT REGULATOR

The armature air gap on the current regulator is adjusted in the same manner outlined for the voltage regulator.

To adjust the current setting, turn the adjusting screw clockwise to increase current setting, or counterclockwise to decrease it. See the "Caution Note" under voltage regulator setting of voltage regulator.

STOP SPRING ADJUSTMENT TYPE

The cutout relay is adjusted in the same manner outlined for the screw adjustment type regulator. The armature air gap on both the current and voltage regulator is adjusted in the same manner described for the screw adjustment type See Fig 17 for method of adjusting electrical settings.

FORD REGULATORS

Ford vibrating regulators are either of the two or three element type The two element type, of course, consists of a cutout relay and voltage regulator and is designed for use with a third brush generator. The three element type, consisting of a cutout relay, voltage regulator and current regulator, is designed for use with a shunt type generator. To adjust, proceed as follows:

REGULATOR AIR GAP—The following applies to either the voltage or current

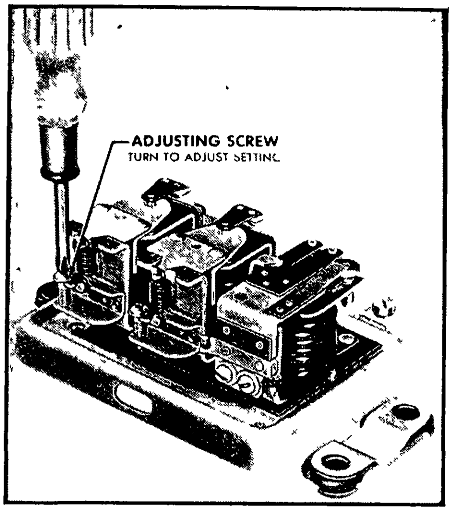


Fig. 15 Adjusting voltage setting of voltage regulat r on Delco-Remy single core regulators with screw adjustment

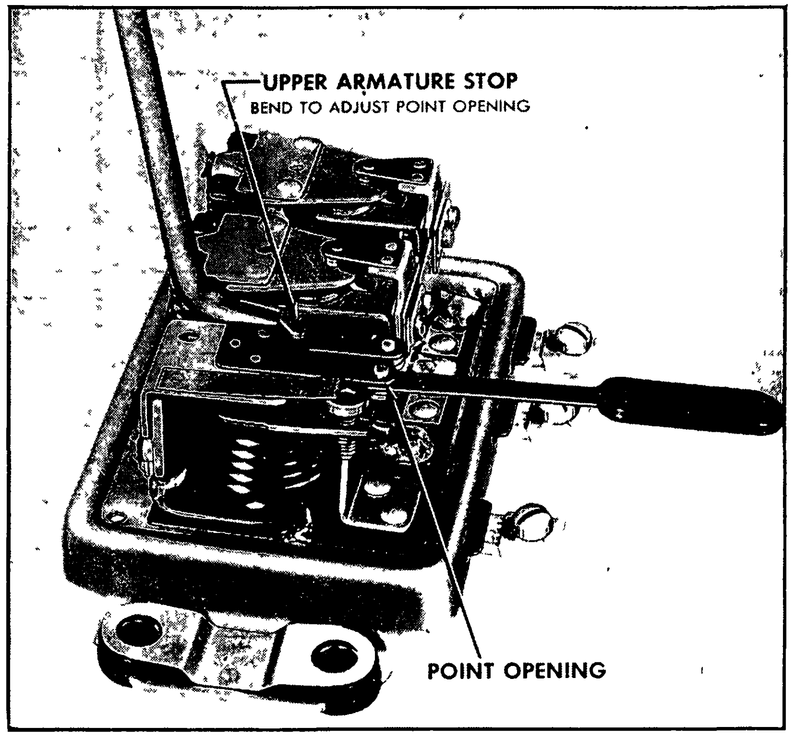


Fig. 14 Adjusting cutout relay point opening on Delc -Remy single core regulators

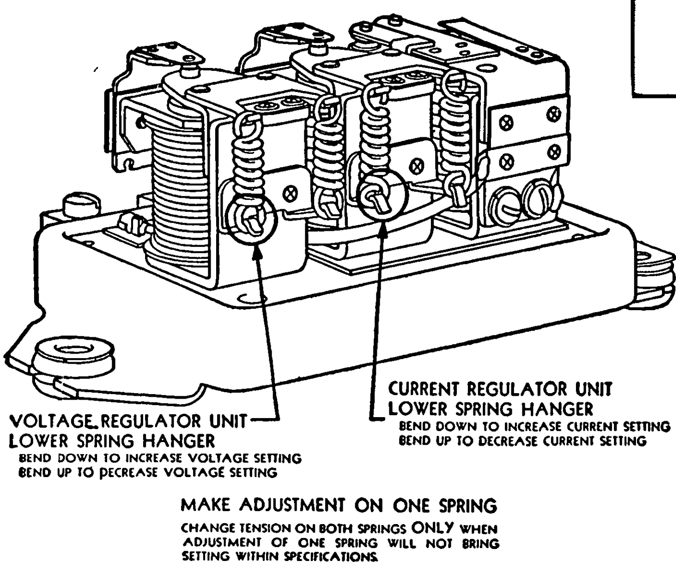


Fig. 17 Electrical settings of Delco-Remy single core regulators which are adjusted by bending spring hangers

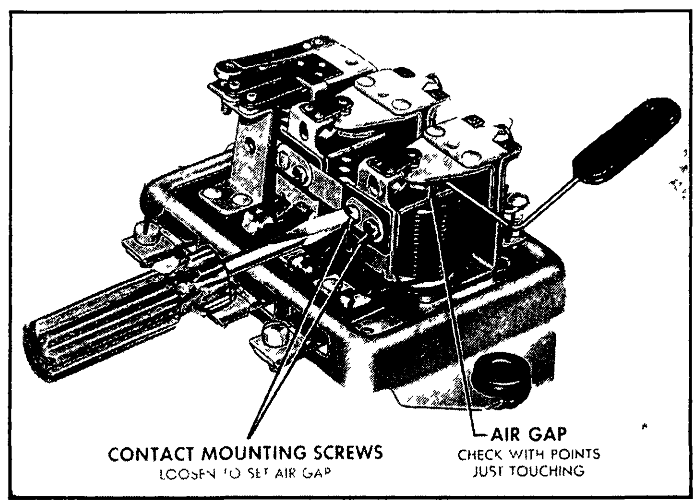


Fig. 16 Adjusting voltage regulator armatur air gap on Delco-Remy single core regulators with screw adjustment

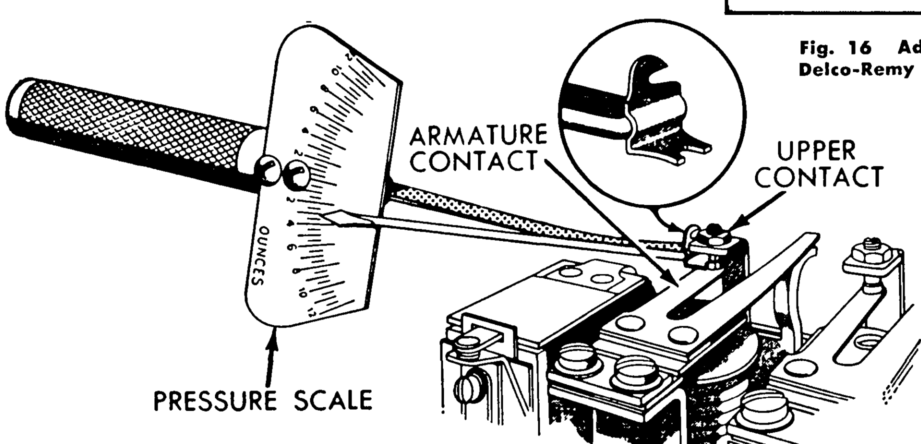


Fig. 19 Checking c ntact p int pr ssur n F rd vibrating regulators

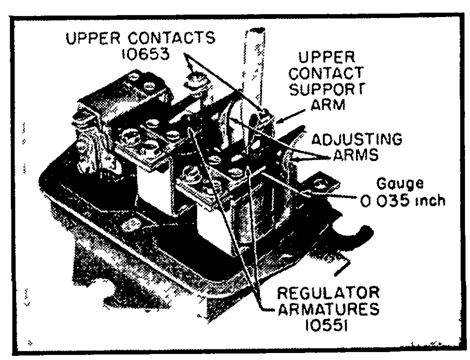


Fig. 18 S tting air gap on F rd vibrating r gulat rs

DELCO-REMY STEP-VOLTAGE REGULATOR SETTINGS

Unit Number	Cutout Relay Settings		Voltage Control Settings				Voltage to Open Points		Voltage to Close Points	
	Armature Air Gap, Inch	Point Opening, Inch	Armature Air Gap, Inch	Point Opening, Inch	Contact Spring Tension, Ounce	Armature Travel, Inch	70° F.	180° F.	70° F.	180° F.
5546	.015	.020	.035	.010	.7-.9	.035	8.3—8.7	7.75—8.2	7.25—7.75	6.55—7.1
5581	.015	.020	.035	.010	.7-.9	.035	8.3—8.7	7.75—8.2	7.25—7.75	6.55—7.1
5880	.020	.020	.035	.010	.7-.9	.035	8.3—8.7	7.75—8.2A	7.25—7.75	6.55—7.1A

A—At 150 degrees.

FORD, MERCURY, LINCOLN REGULATOR INDEX AND SPECIFICATIONS

Year and Model	Unit Number	Type	Cut in Voltage		Voltage Regulation at 70 Degrees F.		Amperage Regulation at 70 Degrees F.	
			Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1938-39	B10505	Cutout	6.1	6.3				
1939-48	01A-10505C	Volt and Cur.	6.1	6.3	7.0	7.2	30	33
1949-50 Ford and Mercury	51A-10505A	Volt and Cur.	6.6	7.0	7.2	7.6	30	34
1949-50 Ford and Mercury	51A-10505C	Volt and Cur.	6.6	7.0	7.2	7.6	30	34
1949-50 Lincoln	5EH-10505C	Volt and Cur.	6.6	7.0	7.2	7.6	38	42
1949-50 Lincoln	5EH-10505E	Volt and Cur.	6.6	7.0	7.2	7.6	38	42
1949-51	8M-10505A	Volt and Cur.	6.0	6.4	7.2	7.6	34	38
1949-51	8L-10505	Volt and Cur.	6.0	6.4	7.2	7.6	38	42

control. To set the air gap, bend the adjusting arm down until the armature spring is clear of the adjusting arm. Place a piece of round stock .035" in diameter between the armature and core, Fig. 18. Press down on the armature with a pencil. Lower the upper contact until it just touches the lower contact, and tighten the lock nut.

NOTE—The armature on the voltage control is provided with a brass rivet to prevent the armature from actually contacting the core. When setting the air gap on the voltage control unit, be sure the gauge is not under the rivet.

After setting the air gap, check the alignment of the contacts. If they are not breaking or contacting squarely, bend or twist the arm supporting the upper contact in the direction required, and again check the alignment.

When the above results are obtained, check the pressure of the contacts. Using an armature pressure scale, check the pressure of the contacts as shown in Fig. 19. The minimum pressure at the contacts, just as they break, must not be less than 5 ounces for either the voltage or current control contacts. If the pressure is less than specified, adjust the upper contact screw until the proper pressure is obtained. Tighten the lock nut after the adjustment is made, and adjust the regulator setting according to the specifications given in the Ford chart.

CUTOUT RELAY—To set the air gap and contact opening, place a .017" thickness gauge between the armature and core, Fig. 20. Lower the armature stop until it is resting on top of the armature, and at the same time, raise the lower contact until the point gap is .010". After the adjustment is made, tighten the two screws.

After the above adjustments have been established, check the alignment of the contacts. Note the angle at which the contacts break. If they are not breaking or contacting squarely, bend the lower contact, Fig. 20, either up or down and again check the alignment.

If the lower contact was bent to obtain alignment, recheck and adjust, if necessary, the air gap and point opening.

ELECTRICAL SETTINGS—To adjust the cut-in voltage, remove the cover and if the setting is lower than specified, increase the spring tension by bending the bimetal downward, Fig. 21. To decrease the setting, bend the bimetal upward.

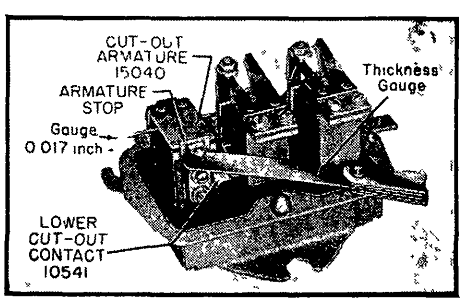


Fig. 20 Setting air gap of cutout relay contacts on Ford vibrating regulators

To adjust the current or voltage setting, bend the adjusting arm upward to increase current or voltage, Fig. 22, or downward to decrease current or voltage.

AUTO-LITE TESTS

CIRCUIT BREAKER—There are two types of circuit breakers in use. One type has the upper contact mounted on a spring; the second type has the upper contact mounted directly on the armature.

To check the first type, connect a voltmeter as shown in Fig. 23. Then slowly increase the speed of the generator, noting the voltage at which the circuit breaker points close. As soon as the points close, reduce the speed of the generator until the points open, noting the voltage at which they have opened.

To check the second type, connect an ammeter and voltmeter as shown in Fig. 24. Slowly increase generator speed, noting the voltage at which the points close. Speed up the generator until the charging rate is 15 amperes, then reduce the charging rate until the points open, noting the reverse current (amperes) at which points open.

An accurate way to tell the exact instant the points close is to connect a headphone as shown in the illustrations. Then take the voltage readings just as the click of the points closing is heard.

VOLTAGE REGULATOR — With a meter connected as shown in Fig. 25,

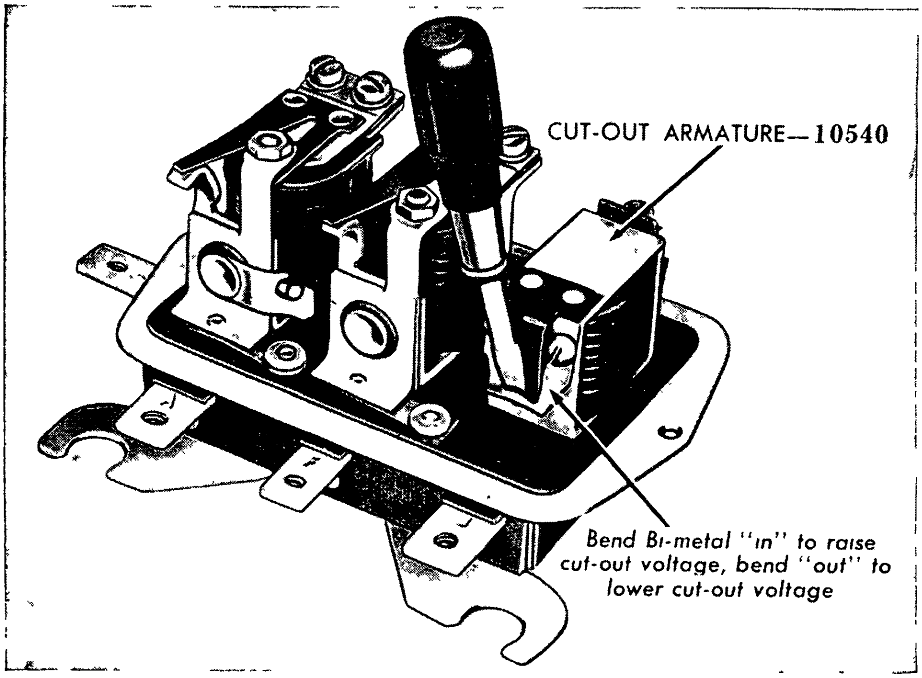


Fig. 21 Adjusting cut-in voltage of cutout relay contacts on Ford vibrating regulators

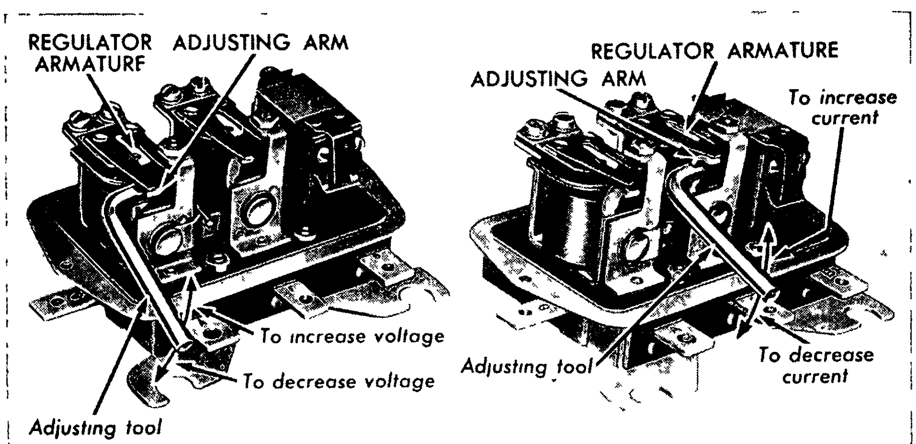


Fig. 22 Adjusting current and voltage regulators on Ford vibrating regulators

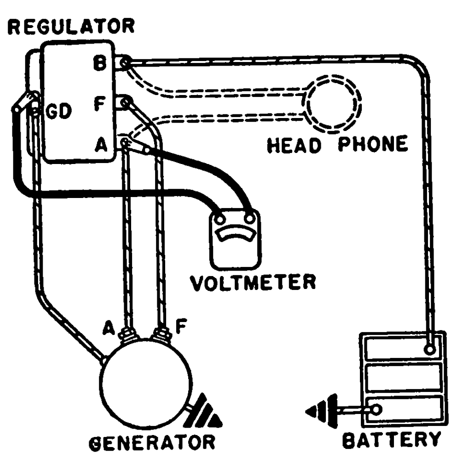


Fig. 23 Met r c nnecti ns t check cut ut relay c ntacts n Aut -Lite regulat rs

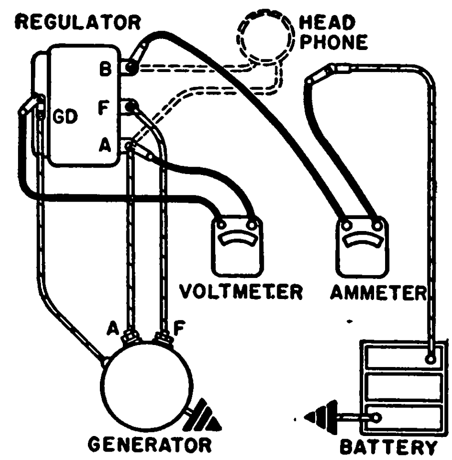


Fig. 24 Meter c nn cti ns t check closing voltag and reverse curr nt t p n cut ut relay c ntacts n Aut -Lite regulat rs

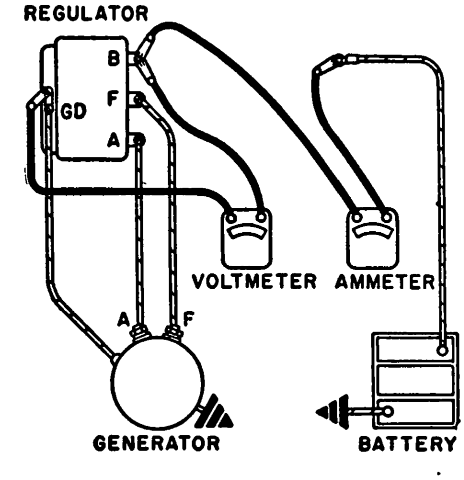


Fig. 25 Meter connections t check v ltag and current settings on Aut -Lit r gulat rs

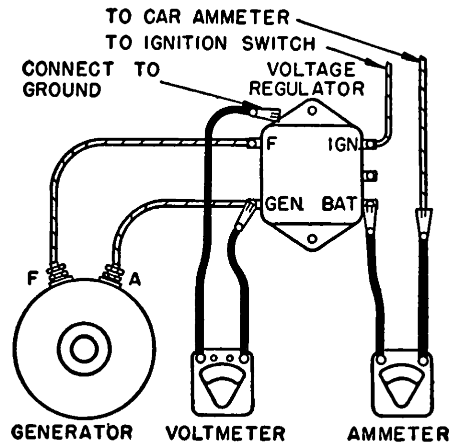


Fig. 26 Meter conections t check cut ut relay on Delco-Remy tw c re regulat rs

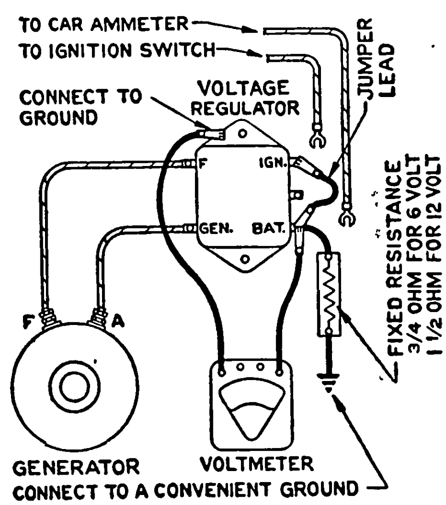


Fig. 27 M ter c nnecti ns f r ch cking v lt-ag setting by fixed resistanc meth d n Delc -R my tw c r r gulat rs. If r gu-lat r has n "IGN" terminal, jumper lead is n t n c ssary

increase generator speed until the output is 10 amperes. Note the voltage setting. Regulator must be at operating temperature with cover in place.

CURRENT REGULATOR — Use the same meter connections for checking this unit as for the voltage regulator, Fig. 25. In addition, turn on all lights, radio and other electrical accessories to prevent battery overcharge. Speed up the generator slowly until the generator output remains constant. The regulator cover must be in place and at operating temperature before making the test.

DELCO-REMY TESTS

TWO CORE UNITS

CIRCUIT BREAKER — Connect test leads as shown in Fig. 26. Then slowly increase generator speed and note the voltage at which the circuit breaker points close. Slowly decrease the speed of the generator and note the discharge current necessary to open the points.

VOLTAGE REGULATOR—Two methods of checking the voltage regulator setting may be used, the fixed resistance method and variable resistance method.

With the fixed resistance method, connect test leads as shown in Fig. 27. Then increase generator speed until generator output remains constant, and note voltage setting. Regulator must be at operating temperature with cover in place.

With the variable resistance method, Fig. 28, increase generator speed until generator output remains constant. Voltage reading must be taken at 8 to 10 amperes generator output. Cut in the resistance until this output is attained. If less than 8 amperes is obtained without resistance, turn on lights, then cut in resistance to obtain 8 to 10 amperes. Note voltage setting. Regulator must be at operating temperature and cover in place.

CURRENT REGULATOR—Connect test leads as shown in Figs. 29 and 30. Regulator must be at operating temperature and cover in place before making test. Turn on all lights and other electrical accessories to prevent battery overcharge. Speed up generator slowly until output remains constant and note current setting.

SINGLE CORE TYPE

These units are tested in the same manner as outlined for the two core type. The same connections, Fig. 26, are used for the circuit breaker. However, make connections as shown in Figs. 31 and 32 when testing the voltage regulator. Fig. 33 shows the connections to be used for testing the current regulator.

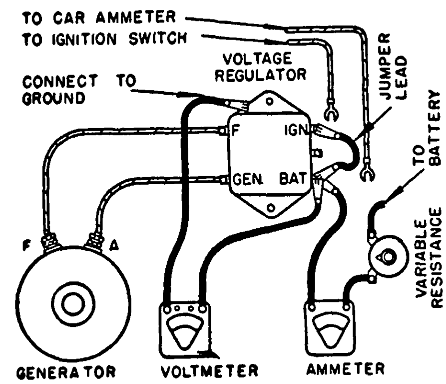


Fig. 28 Meter connections for checking voltage setting by variable resistance method on Delco-Remy two core regulators. If regulator has no "IGN" terminal, jumper lead is not necessary

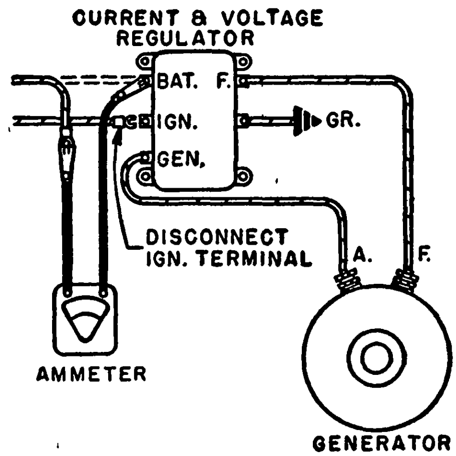


Fig. 29 Meter connections for checking current regulator setting on Delco-Remy two core regulators. "IGN" lead is disconnected to prevent voltage from operating

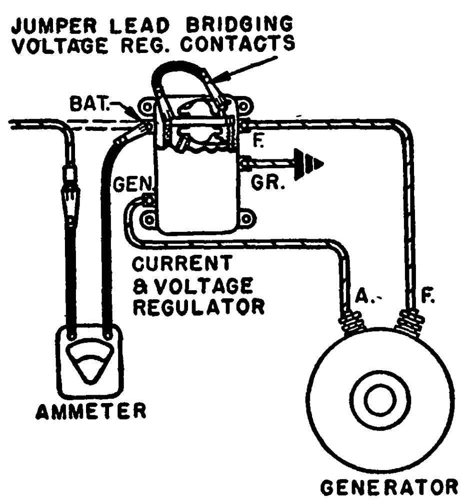


Fig. 30 M ter c nnections for ch cking cur-r nt r gulat r s tting f r typ having no "IGN" t rminal n D lco-Remy tw c re r gulators. Jump r l ad is c nnected acr ss v ltag r gulat r c ntacts to prev nt v lt-ag r gulat r fr m op rating

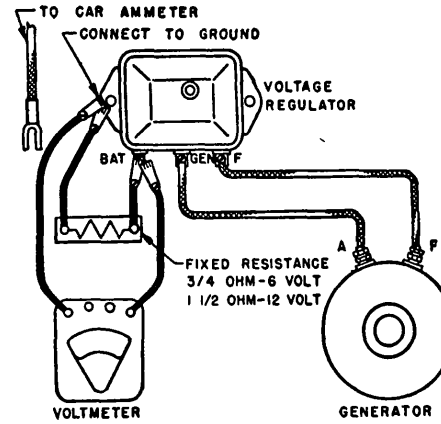


Fig. 31 Meter connecti ns f r checking voltage regulator setting by a fixed resistance method on Delc -Remy single core regulat rs

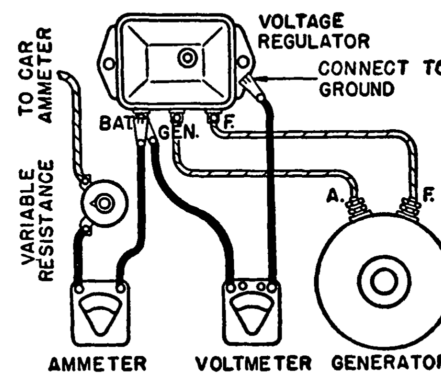


Fig. 32 Meter connecti ns for checking voltage regulator setting by variable resistance method on D lc - R my single core regulat rs

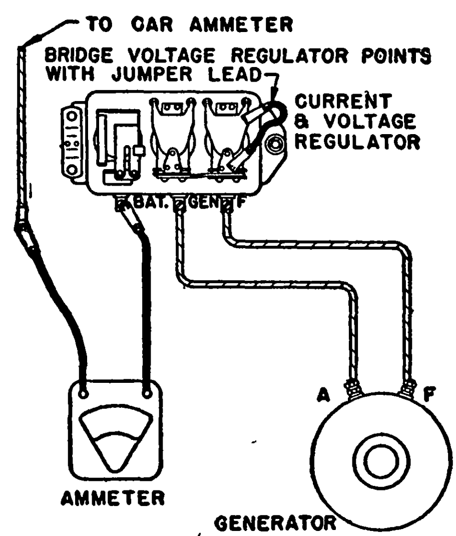


Fig. 33 M t r c nn cti ns f r ch cking cur-r nt regulator s tting n D lc -Remy single c re regulat rs. Jump r lead is bridg d acr ss v ltage regulat r c ntacts t pr v nt its op ration

GENERATOR REGULATORS

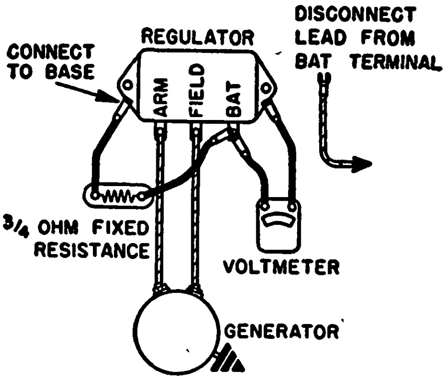


Fig. 35 M ter connections for checking voltage r gulator on Ford vibrating regulators

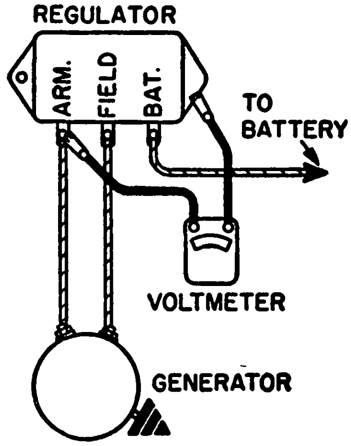


Fig. 34 Meter connections for checking cutout relay on Ford regulators

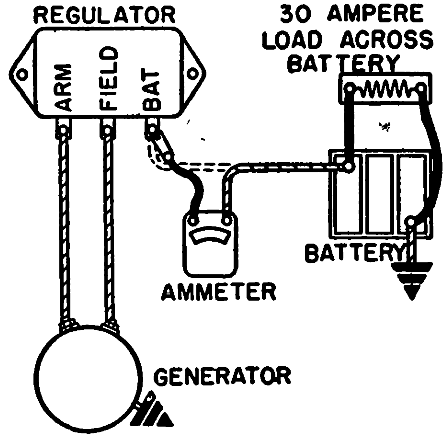


Fig. 36 Meter connecti ns f r checking current regulator on F rd r gulat rs

FORD TESTS

CIRCUIT BREAKER—Make meter connections as shown in Fig. 34 and check the closing voltage in the usual manner by slowly increasing generator speed until the relay points close,. noting the voltage.

VOLTAGE REGULATOR — With the meter connected as shown in Fig. 35, check the voltage setting by speeding up the generator until the maximum voltage is obtained. Cover must be in place and regulator at operating temperature.

CURRENT REGULATOR—With meter connected as shown in Fig. 36, and lights and other accessories turned on to prevent battery overcharge, speed up the generator until maximum output is obtained.

STARTING MOTORS

STARTING MOTORS have four or six poles according to their rated capacity. Some four pole motors have field windings on only two poles, the poles without windings being used merely to complete the magnetic circuit. The field circuit is connected in series with the armature so that all of the armature current passes through the field windings. Therefore, they are known as series motors.

Starting motor field windings are usually connected in series-parallel in order to increase the current carrying capacity of the field coils, and reduce the resistance of the motor as a unit. Typical starting motor wiring circuits are shown in Fig. 1.

The MAX type has four poles and four field coils. The two right hand coils are in series, as are the two left hand coils. The two groups, however, are connected in parallel, while the complete field circuit is in series with the armature.

The MAW motor, Fig. 1, has four poles, two of which are connected in parallel with each other and in series with the armature. The two poles without winding complete the magnetic circuit, and are sometimes called coincidental poles.

The ML type motor is practically the same as the MAX type previously described.

The DN type is a six pole motor with four sets of brushes. With this combination, the brushes are 60 degrees apart, the same spacing as there would be if six sets of brushes were used.

The field winding in the DN motor consists of heavy copper bars wound around the inside of the motor frame, passing alternate sides of the field poles to change the polarity of the poles. This construction permits the use of more copper in the field circuit-to-magnetic circuit.

For light duty vehicles, the mechanical power necessary to crank the engines will vary from 1 hp to 2 hp, depending upon the size of the engine and conditions existing when the engine is cranked. The current required to produce the necessary driving torque is from 125 to 300 amperes for summer starting and from 300 to 700 amperes for winter starting. To carry such heavy currents, the cables between the battery and starter must have ample current carrying capacity. The exact size is dependent upon the length of the cables necessary to connect up the circuit.

STARTER TESTS

NO LOAD TEST—Remove the starter and connect it in series with a battery and ammeter capable of reading several hundred amperes. Of course, the battery to use depends upon whether a six or twelve volt system is being used. If an r.p.m. indicator (tachometer) is available, read the armature r.p.m. in addition to the current draw. The starter should draw the number of amperes listed in the charts for the particular unit being tested, and at the voltage and r.p.m. specified.

TORQUE TEST—A simple and practical type of torque test may be made in a few moments with the starter on the vehicle. Make sure that the battery is fully charged and that the starting circuit wires are in good condition. Check to see that the engine turns over normally. If the starter does not turn the engine over easily under these conditions, the torque developed is below standard and the starter should be removed for further checking.

INTERPRETING RESULTS OF ABOVE TESTS—

1. Low free speed and high current draw with low developed torque may result from:
   (a) Tight, dirty or worn bearings, bent armature shaft, or loose field pole screws which would allow the armature to drag.
   (b) Shorted armature.
   (c) Grounded armature or field. Check by raising grounded brushes and insulating them from commutator with cardboard. Then check with a test lamp between the insulated terminal and frame. If the test lamp lights, raise the other brushes from the commutator and check the field and com-

AUTO-LITE STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Lock Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
AMERICAN BANTAM AND AUSTIN								
1935–41	MAK-4001	38–61	70	5.5	5000	520	4.0	7.0
AUBURN								
1935–36 Six	MAJ-4032	42–53	67	5.5	4100	750	4.0	17.0
1935-36 Eight	MAB-4063	42–53	60	5.5	3700	775	4.0	22.5
CHRYSLER								
1935, C6, CZ	MAX-4002	42–53	65	5.5	5300	880	4.0	25.0
1935, CZ	MAX-4004	42–53	65	5.5	5300	880	4.0	25.0
1935–37 Eight	MAX-4003	42–53	65	5.5	5300	880	4.0	25.0
1936 Six	MAX-4016	42–53	65	5.5	5300	880	4.0	25.0
1936, C8	MAX-4020	42–53	65	5.5	5300	880	4.0	25.0
1937 Six	MAW-4010	42–53	65	5.5	4900	670	4.0	18.0
1937, C14	MAX-4015	42–53	65	5.5	5300	880	4.0	25.0
1938–40	MAX-4020A	42–53	65	5.5	5300	880	4.0	25.0
1938–40 Eight	MAX-4037	42–53	65	5.5	5300	880	4.0	25.0
1938, C20	MAX-4003A	42–53	65	5.5	5300	880	4.0	25.0
1941	MAX-4045	42–53	65	5.5	5300	880	4.0	25.0
1941	MAX-4045A	42–53	65	5.5	5300	880	4.0	25.0
1942–49	MAX-4050	42–53	65	5.5	5300	880	4.0	25.0
1949–50	MCL-6101	42–53	65	5.0	4900	410	2.0	8.0
1950	MCL-6108	42–53	65	5.0	4900	410	2.0	8.0
1950–52	MCL-6109	42–53	65	5.0	4900	410	2.0	8.0
CROSLEY								
1939–42	MZ-4077	42–53	70	5.5	4300	560	4.0	11.8
1946–48	MAK-4027	38–61	70	5.5	5000	520	4.0	7.0
1946–52	MZ-4147	42–53	70	5.5	4300	280	2.0	4.4
DE SOTO								
1935, SF	MAX-4002	42–53	65	5.5	5300	880	4.0	25.0
1935, SG	MAX-4003	42–53	65	5.5	5300	880	4.0	25.0
1936, S1	MAX-4015	42–53	65	5.5	5300	880	4.0	25.0
1936, S2	MAX-4016	42–53	65	5.5	5300	880	4.0	25.0
1937–38	MAW-4010	42–53	65	5.5	4900	670	4.0	18.0
1939–40	MAW-4016	42–53	65	5.5	4900	670	4.0	18.0
1941	MAW-4019	42–53	65	5.5	4900	670	4.0	18.0
1942	MAW-4026	42–53	65	5.5	4900	670	4.0	18.0
1942	MAX-4050	42–53	65	5.5	5300	880	4.0	25.0
1946–48	MAW-4025	42–53	65	5.5	4900	670	4.0	18.0
1949–50	MCH-6102	42–53	65	5.5	4900	335	2.0	6.0
1950	MCH-6105	42–53	65	5.5	4900	335	2.0	6.0
1951–52	MCL-6109	42–53	65	5.0	4900	335	2.0	6.0
1952	MCL-6116	42–53	65	5.0	4900	410	2.0	8.0
1952	MCL-6117	42–53	65	5.0	4900	410	2.0	8.0
DODGE								
1935	MAW-4003	42–53	65	5.5	4900	670	4.0	18.0
1936–38	MAW-4010	42–53	65	5.5	4900	670	4.0	18.0
1939	MAW-4016	42–53	65	5.5	4900	670	4.0	18.0
1940	MZ-4062	42–53	70	5.5	4300	560	4.0	11.
1940	MZ-4062A	42–53	70	5.5	4300	560	4.0	11.8
1941	MZ-4089	42–53	70	5.5	4300	560	4.0	11.8

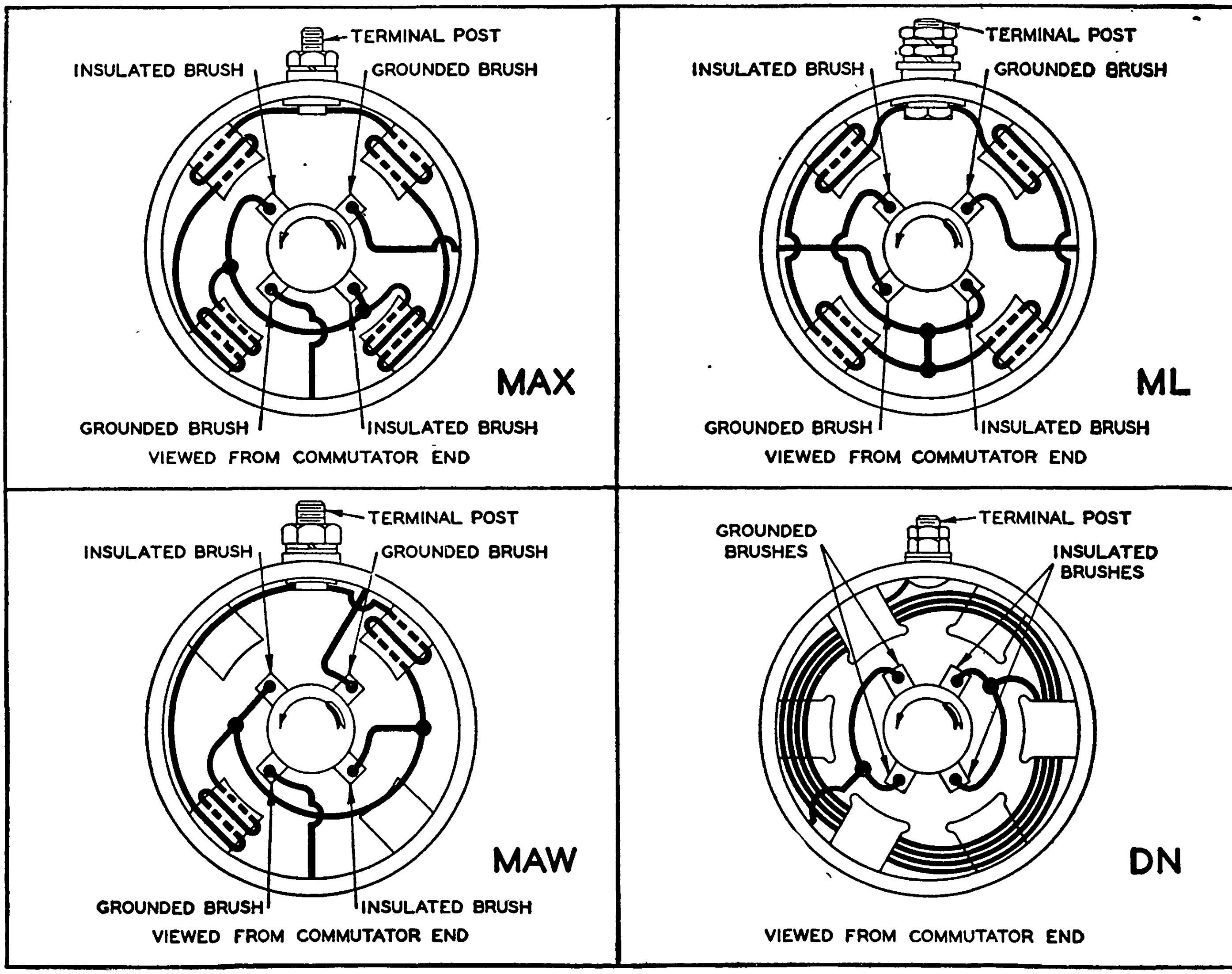


Fig. 1 Wiring circuit of four series of Auto-Lite starting motors

mutator separately to determine whether it is fields or armature that is grounded.

2. If starter fails to operate with high current draw, test for:
   (a) A direct ground in starter switch, terminal or fields.
   (b) Frozen shaft bearings which prevent armature from turning.

3. If starter fails to operate with no current draw, test for:
   (a) Open field circuit. Inspect internal connection and trace circuit with test lamp.
   (b) Open armature coils. Inspect commutator for badly burned bars.
   (c) Broken or weak brush springs, worn brushes, high mica insulation on commutator, or other causes which would prevent good contact between brushes and commutator.

4. If the no load speed is low with low torque and low current draw, test for:
   (a) Open field winding. Raise and insulate ungrounded brushes from commutator with cardboard and check fields with test lamp.
   (b) High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under 3c above.

5. A high free speed with low developed torque and high current draw indicates shorted fields. There is no easy way to detect shorted fields since field resistance is already low. If shorted fields are suspected, replace them and check for improvement in performance.

STARTER SERVICE

COMMUTATOR—Starting motor commutators and brushes require special attention to insure low resistance contacts. The brushes are nearly 100% copper, which makes the sanding in process more difficult. Commutators are usually held within .003" concentricity with the armature shaft bearing surfaces during manufacture.

It is recommended that starting motor commutators be undercut not more than $\frac{1}{64}''$. The motor should then be assembled and run free at approximately 2000 r.p.m. The burrs from undercutting will quickly seat the brushes better than would be possible with the customary sandpaper method. After the brushes are seated to not less than 90% contact surface, sand the commutator with No. 00 sandpaper to remove burrs, or any roughness from undercutting.

By undercutting only $\frac{1}{64}''$, the grooves will be shallow and will not have a tendency to fill up with copper chips from the brushes to cause short circuits. Be sure to blow out the copper chips inside the motor and around the brush holders with compressed air.

Oil or grease on the commutator and brushes cause arcing and burning, resulting in a considerable reduction in power output available to start the engine.

BRUSH SPRING TENSION—Brush spring tension should be tested with a pull spring scale. Swinging type brush holders should have the scale hooked under the brush screw, tight to the brush, and the reading taken just as the brush leaves the commutator.

Box type brush holders should have

AUTO-LITE STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Lock Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
DODGE—(continued)								
1941	MZ-4089A	42–53	70	5.5	4300	560	4.0	11.8
1942	MAW-4026	42–53	65	5.5	4900	670	4.0	18.0
1946–48	MAW-4041	42–53	65	5.5	4900	670	4.0	18.0
1949–51	MCH-6101	42–53	65	5.5	4900	335	2.0	6.0
1951–52	MCH-6201	42–53	65	5.5	4900	335	2.0	6.0
FRAZER								
1947–48	MAW-4043	42–53	65	5.5	4900	500	3.5	11.55
1949–51	MAW-4054	42–53	65	5.5	4900	505	3.0	11.5
1951	MAW-4057	42–53	65	5.0	4300	335	2.0	6.0
HENRY J								
1951–52	MZ-4163	42–53	68	5.0	4000	280	2.0	4.4
HUDSON AND TERRAPLANE								
1935 Six	MAB-4060	42–53	60	5.5	3700	775	4.0	22.5
1935 Six	MAB-4074	42–53	60	5.5	3700	775	4.0	22.5
1935 Eight	MAB-4061	42–53	60	5.5	3700	775	4.0	22.5
1936–39	MAB-4075	42–53	60	5.5	3700	775	4.0	22.5
1939, 90	MAJ-4057	42–53	67	5.5	4100	750	4.0	17.0
1939	MAB 4100	42–53	60	5.5	3700	775	4.0	22.5
1940 Six	MZ-4079	42–53	70	5.5	4300	560	4.0	11.8
1940 Six	MZ-4079A	42–53	70	5.5	4300	560	4.0	11.8
1940 Eight	MAB-4103	42–53	60	5.5	3700	775	4.0	22.5
1940 Eight	MAB-4103A	42–53	60	5.5	3700	775	4.0	22.5
1941–47 Six	MZ-4092	42–53	70	5.5	4300	560	4.0	11.8
1941–47 Eight	MAB-4100	42–53	60	5.5	3700	775	4.0	22.5
1948–50	MCL-6006	42–53	65	5.0	4900	410	2.0	8.0
1950 Six	MZ-4159	42–53	70	5.5	4300	280	2.0	4.4
1951	MZ-4164	42–53	70	5.5	4300	280	2.0	4.4
1951–52	MZ-4167	42–53	70	5.5	4300	280	2.0	4.4
1951–52	MCH-6107	42–53	65	5.0	4300	335	2.0	6.0
1951–52	MCH-6109	42–53	65	5.0	4300	335	2.0	6.0
KAISER								
1947–48	MAW-4043	42–53	65	5.5	4900	500	3.5	11.55
1949–50	MAW-4054	42–53	65	5.5	4900	505	3.0	11.5
NASH AND LAFAYETTE								
1935, 10	MAB-4068	42–53	60	5.5	3700	775	4.0	22.5
1935, 20	MAB-4053	42–53	60	5.5	3700	775	4.0	22.5
1935–39, 80	MAB-4054	42–53	60	5.5	3700	775	4.0	22.5
1936–48, 20, 60	MAB-4076	42–53	60	5.5	3700	775	4.0	22.5
1936, 20	MAB-4077	42–53	60	5.5	3700	775	4.0	22.5
1940–42, 80	MAB-4104	42–53	60	5.5	3700	775	4.0	22.5
1946–48, 40	MZ-4103	42–53	70	5.5	4300	560	4.0	11.8
PACKARD								
1935 Eight	DI-1272	56–60	60	6.0	4500	730	3.6	29.2
1935 Eight	DI-1297	56–60	60	6.0	4500	730	3.6	29.2
1935 Super 8	DN-1270	56–60	50	6.0	3000	810	3.6	39.0
1935 Twelve	DN-1273	56–60	50	6.0	3000	810	3.6	39.0

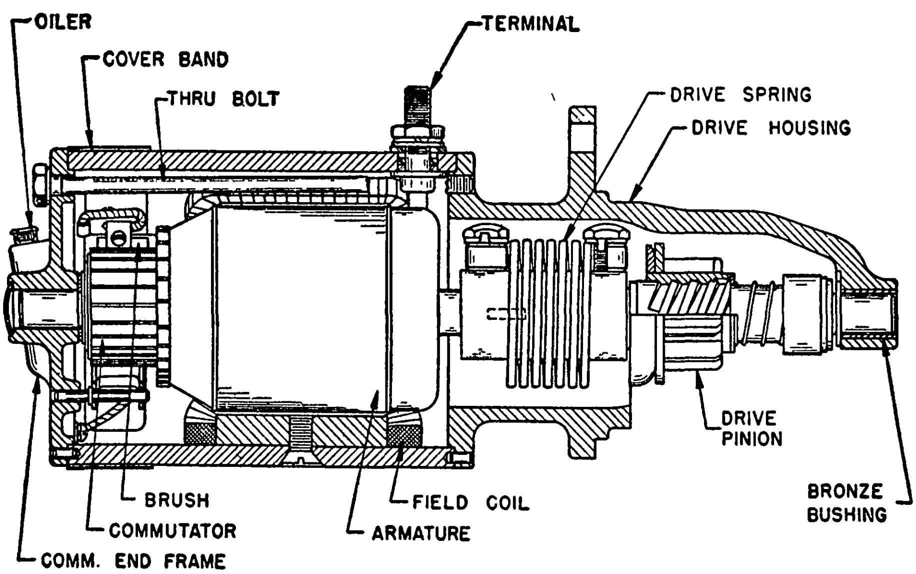


Fig. 2 Starting motor with standard type Bendix Drive

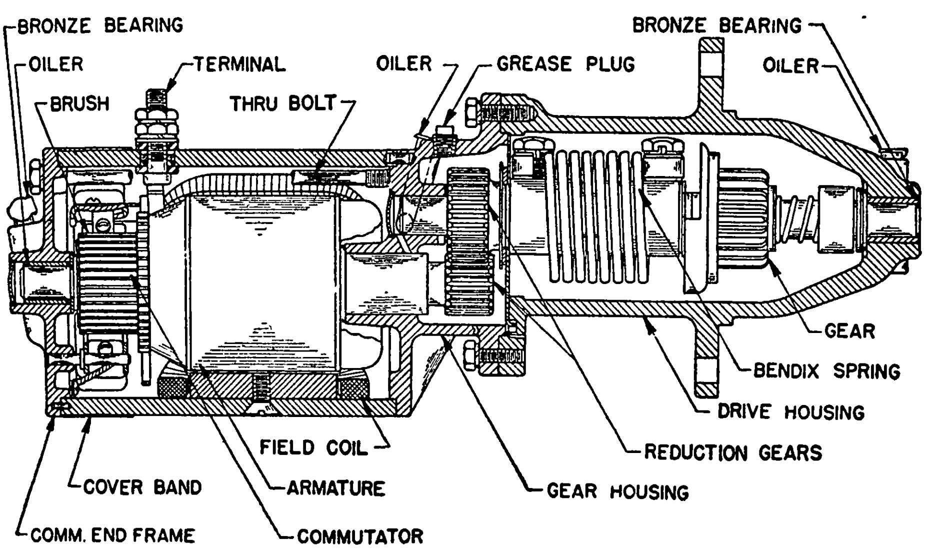


Fig. 3 Starting motor with standard type Bendix Drive and reduction gear

the scale hooked under the spring bend nearest to the small loop which rests on the brush, and the reading taken just as the spring leaves the brush.

A thin piece of paper between the brush and commutator, with a slight pull by hand, can be used to indicate exactly when to read the scale.

BEARINGS—The clearance for all plain bearings used in starting motors should be held to .001″ minimum on both the drive and commutator ends and .006″ maximum on the drive end, .005″ on the commutator end.

In servicing absorbent bronze bearings the following points are very important for successful operation. These bearings must never be touched with a bearing scraper, reamer or burnishing tool; must have no oil holes drilled in them, and must be installed in perfect alignment.

Absorbent bronze bearings are built with oversize dimensions for both inside and outside limits. When installed with the proper arbor the bearing is compressed and the arbor determines the correct inside diameter. Never attempt to install one of these bearings without using the correct arbor. Although the bearing before installing will fit the arbor freely, after installing, it will be necessary to press out the arbor. This operation with the correct size arbor gives the bearing its correct finished bearing surface. Arbors should be oiled with SAE 20 engine oil before being used.

Absorbent bronze bearings, as stated above, are not drilled for an oil hole but that oil is fed to its outside surface. The composition of the bearing is such that it will absorb 70% of its own volume of oil. This oil in the bearing causes the bearing to act much like an oil wick in lubricating the shaft.

POLE PIECES—Some starting motors have pole pieces with one tip longer than the other in order to shift the magnetic neutral point. It is important that pole pieces be installed correctly. For example, Auto-Lite MAX-4003A starting motor, with the frame on end and terminal post up the pole pieces should be assembled with the short tip to the right, or in a clockwise direction from the center of the pole piece. For MAX-4022, the pole pieces are reversed.

ARMATURE END PLAY—The armature shaft end play should be measured after the armature and frame are assembled, and should not exceed $\frac{1}{16}$″ maximum. Excessive end play should be removed by installing thrust washers between the bearing shoulder and armature shaft at either end so located that the brushes will be kept centered on the commutator.

ARMATURE SHAFT ALIGNMENT—For motors using pinion housings, the armature shaft drive end bearing surface, when measured from centers, should be true within a maximum of .003″. For motors not using pinion housings, the maximum allowance is .005″.

The spacing of pinions on the armature shaft for motors with overrunning clutch drive should be carefully adjusted to prevent damage to the pinion or fly wheel ring gear.

BENDIX DRIVES

There are a number of different types of Bendix Drives and the servicing procedure will vary according to the type.

Standard type Bendix Drives and their modifications employ an externally threaded hollow sleeve on which is mounted the drive pinion (see Figs. 2 and 3). The pinion has internal threads which match the threads on the sleeve. The sleeve is connected to the armature shaft through the drive spring and drive head.

Fig. 4 shows the conventional type Bendix Drive carrying the "F" type

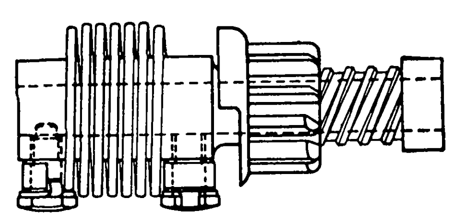


Fig. 4 Bendix Drive with "F" typ spring

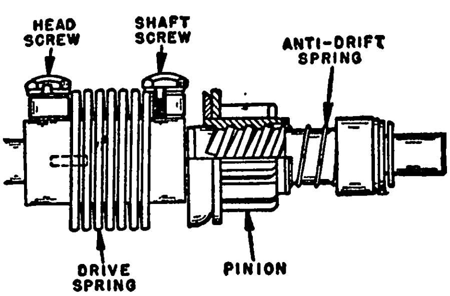


Fig. 5 B ndix "CD" type drive

AUTO-LITE STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Lock Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
PACKARD—Continued								
1936–38, Eight, 115C	MAX-4006	42–53	65	5.5	5300	880	4.0	25.0
1936–38, Super 8	MAX-4014	42–53	65	5.5	5300	880	4.0	25.0
1936 Super 8	DN-1298	56–60	50	6.0	3000	810	3.6	39.0
1936 Twelve	DN-1299	56–60	50	6.0	3000	810	3.6	39.0
1937–39 Twelve	DN-1389	56–60	50	6.0	3000	810	3.6	39.0
1939, 6 & 8	MAW-4018	42–53	65	5.5	4900	670	4.0	18.0
1939 Super 8	DI-1568	56–60	60	6.0	4500	730	3.6	29.2
1940 Six	MZ-4078	42–53	70	5.5	4300	560	4.0	11.8
1940 Eight	MAW-4018	42–53	65	5.5	4900	670	4.0	18.0
1940–41 Super 8	MAX-4041	42–53	77	5.5	2695	906	4.0	45.9
1941, 6 & 8	MAW-4021	42–53	65	5.5	4900	670	4.0	18.0
1941 Eight	MAW-4024	42–53	65	5.5	4900	670	4.0	18.0
1942–47, 6 & 8	MAW-4027	42–53	65	5.5	4900	670	4.0	18.0
1942–47, Super 8	MAX-4052	42–53	77	5.5	2695	906	4.0	45.9
1948–51	MCL-6003	42–53	65	5.0	4900	410	2.0	8.0
1948–50	MAX-4052	42–53	77	5.5	2695	906	4.0	45.9
1951–52	MCL-6113	42–53	65	5.0	4900	410	2.0	8.0
1951–52	MCL-6114	42–53	65	5.0	4900	410	2.0	8.0
PLYMOUTH								
1935	MAW-4002	42–53	65	5.5	4900	670	4.0	18.0
1936–37, P6	MAW-4009	42–53	65	5.5	4900	670	4.0	18.0
1938, P5	MZ-4056	42–53	70	5.5	4300	560	4.0	11.8
1939–40	MZ-4062	42–53	70	5.5	4300	560	4.0	11.8
1941	MZ-4089	42–53	70	5.5	4300	560	4.0	11.8
1942	MZ-4105	42–53	70	5.5	4300	560	4.0	11.8
1946–48	MZ-4133	42–53	70	5.5	4300	560	4.0	11.8
1949–51	MCH-6101	42–53	65	5.5	4900	335	2.0	6.0
1951–52	MCH-6201	42–53	65	5.5	4900	335	2.0	6.0
STUDEBAKER								
1935, 1A	MAN-4005	42–53	70	5.5	4000	820	4.0	23.0
1935, 2A	MAN-4002	42–53	70	5.5	4000	820	4.0	23.0
1936 Dic.	MAX-4018	42–53	65	5.5	5300	880	4.0	25.0
1936–37 Dic.	MAX-4019	42–53	65	5.5	5300	880	4.0	25.0
1937 Dic.	MAX-4028	42–53	65	5.5	5300	880	4.0	25.0
1938–40 Com.	MAW-4015	42–53	65	5.5	4900	670	4.0	18.0
1939 Champ.	MZ-4066	42–53	70	5.5	4300	560	4.0	11.8
1939–40 Champ.	MZ-4074	42–53	70	5.5	4300	560	4.0	11.8
1941–46 Champ.	MZ-4090	42–53	70	5.5	4300	560	4.0	11.8
1941–47 Com.	MAW-4020	42–53	65	5.5	4900	670	4.0	18.0
1942 Pres.	MAX-4051	42–53	65	5.5	5300	880	4.0	25.0
1947 Champ.	MZ-4136	42–53	70	5.5	4300	560	4.0	11.8
1947 Com.	MAW-4020A	42–53	65	5.5	4900	670	4.0	18.0
1947–50 Champ.	MZ-4151	42–53	60	5.5	4300	280	2.0	4.4
1947–49 Com.	MCH-4001	42–53	65	5.5	4900	335	2.0	6.0
1950–52 Champ.	MZ-4157	42–53	70	5.5	4300	280	2.0	4.4
WILLYS								
1935–36	MZ-4033	42–53	70	5.5	4300	560	4.0	11.8
1937–39	MZ-4049	42–53	70	5.5	4300	560	4.0	11.8
1939–40	MZ-4064	42–53	70	5.5	4300	560	4.0	11.8
1940	MZ-4082	42–53	70	5.5	4300	560	4.0	11.8
1941	MZ-4099	42–53	70	5.5	4300	560	4.0	11.8
1942	MZ-4109	42–53	70	5.5	4300	560	4.0	11.8
1946–50	MZ-4137	42–53	70	5.5	4300	280	2.0	4.4
1950–51	MZ-4162	42–53	68	5.0	4000	280	2.0	4.4
1952	MCH-6203	42–53	65	5.0	4300	335	2.0	6.0

A—Stamped on plate riveted to h using.

DELCO-REMY STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Lock Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
BUICK								
1935–38, 40	734-Z	24–28	65	5.0	5000	525	3.37	12
1935, 60, 90	727-F	24–28	65	5.0	5500	600	3.0	16
1936–38, 60, 80, 90	727-W	24–28	65	5.0	5500	600	3.0	16
1939–41, 40, 50	1107005	24–28	65	5.0	5000	525	3.37	12
1939–41, 60, 70, 80, 90	1107908	24–28	60	5.0	6000	600	3.0	16
1942–49, 40, 50	1107049	24–28	65	5.0	5000	525	3.37	12
1942–48, 60, 70, 90	1107929	24–28	60	5.0	6000	600	3.0	16
1949, 40	1107049	24–28	65	5.0	5000	525	3.37	12
1949, 50	1107078	24–28	65	5.67	5000	525	3.4	12
1949–50, 70	1107953	24–28	65	5.67	5500	600	3.0	16
1950, 40, 50	1107078	24–28	80	5.7	5000	525	3.4	12
1951–52, 40, 50	1107097	24–28	60	5.0	6000	600	3 0	15
1951–52, 70	1107981	24–28	65	5.0	5500	600	3.0	16
CADILLAC								
1935, V8	728-U	24–28	70	5.0	2500	600	3.0	28
1936, V8	727-Y	24–28	60	5.0	6000	600	3.0	15
1936–37, V12	580	36–40	70	5.7	2200	600	3.0	35
1937–38, V8	727-V	24–28	65	5.0	5500	600	3.0	16
1939–40, V8	1107912	24–28	60	5.0	6000	600	3.0	16
1941	1107923	24–28	60	5.0	6000	600	3.0	16
1942–48	1107931	24–28	60	5.0	6000	600	3.0	16
1949	1107945	24–28	60	5.0	6000	600	3.0	16
1950–52	1107969	24–28	60	5.0	6000	600	3.0	15
CHEVROLET								
1935–36	738-G	24–28	65	5.0	5000	525	3.37	12
1937	739-A	24–28	65	5.0	5000	525	3.37	12
1938	1107001	24–28	65	5.0	5000	525	3.37	12
1939–40	1107009	24–28	65	5.0	5000	525	3.37	12
1941	1107033	24–28	65	5.0	5000	525	3.37	12
1941	1107047	24–28	65	5.0	5000	525	3.37	12
1942	1107054	24–28	65	5.0	5000	525	3.37	12
1946–48	1107061	24–28	65	5.0	5000	525	3.37	12
1948	1107055	24–28	65	5.0	5000	525	3.37	12
1949–51	1107075	24–28	80	5.7	5000	525	3.4	12
1952	1107109	24–28	65	5.0	5000	525	3.4	12
GRAHAM								
72, 75	734-U	24–28	65	5.0	5000	525	3.37	12
73	728-D	24–28	70	5.0	2500	600	3.0	28
74, 80	738-J	24–28	65	5.0	5000	525	3.37	12
80, 85	738-V	24–28	65	5.0	5000	525	3.37	12
1936–40	738-T	24–28	65	5.0	5000	525	3.37	12
KAISER								
1951–52 Std.	1107087	24–28	65	5.0	5000	525	3.37	12
1951–52 Hyd.	1107088	24–28	65	5.67	5000	525	3.37	12
LA SALLE								
1935–36	727-N	24–28	65	5.0	5500	600	3.0	15
1937–38	727-V	24–28	65	5.0	5500	600	3.0	16
1939–40	1107912	24–28	60	5.0	6000	600	3.0	16

A—Stamped on plate riveted to housing.

DELCO-REMY STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Lock Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
NASH								
1941–42, 40	1109451	24–28	60	5.7	6000	540	3.3	11.5
1948–50, 40	1109451	24–28	60	5.7	6000	540	3.3	11.5
1948, 60	1107949	24–28	60	5.0	6000	600	3.0	16
1949–52, 60	1107950	24–28	60	5.0	6000	600	3.0	16
1950–52, 60	1107965	24–28	80	5.7	5500	600	3.0	14
1950–51, 10, 40	1109459	24–28	60	5.7	6000	540	3.3	11.5
1951, 40	1109463	24–28	55	5.7	5000	555	3.2	12.2
1951, 40	1109465	24–28	55	5.7	5000	555	3.2	12.2
1952, 10, 40	1107119							
1952, 40	1107121							
OLDSMOBILE								
1935 Six	734-K	24–28	65	5.0	5000	525	3.37	12
1935 Eight	725-Y	24–28	60	5.0	6000	600	3.0	15
1936 Six	738-S	24–28	65	5.0	5000	525	3.37	12
1936 Eight	727-Z	24–28	60	5.0	6000	600	3.0	15
1937–38 Six	739-G	24–28	65	5.0	5000	525	3.37	12
1937–38 Eight	729-J	24–28	60	5.0	6000	600	3.0	15
1939–40 Six	1107007	24–28	65	5.0	5000	525	3.37	12
1939–40 Eight	1107907	24–28	60	5.0	6000	600	3.0	15
1941–48 Six	1107034	24–28	65	5.0	5000	525	3.37	12
1941–48 Eight	1107922	24–28	60	5.0	6000	600	3.0	15
1942–47 Six	1107050	24–28	65	5.0	5000	525	3.37	12
1942–47 Eight	1107930	24–28	65	5.0	5500	600	3.0	15
1948	1107930	24–28	60	5.0	6000	600	3.0	15
1949–50 Six	1107955	24–28	65	5.0	5000	600	3.0	15
1949–50 Eight	1107956	24–28	60	5.0	6000	600	3.0	15
1951	1107982	24–28	60	5.0	6000	600	3.0	15
1952	1107997	..						
PACKARD								
1937–38 Six	739-F	24–28	65	5.0	5000	525	3.37	12
1941–47 Six	1107037	24–28	65	5.0	5000	525	3.37	12
1942 Six	1107056	24–28	65	5.0	5000	525	3.37	12
1948–50 Except Custom	1107943	24–28	60	5.0	6000	600	3.0	16
1951–52	1107943	24–28	60	5.0	6000	600	3.0	16
PONTIAC								
1935–36 Six	727-T, 727-Y	24–28	60	5.0	6000	600	3.0	15
1935–38 Eight	727-S	24–28	65	5.0	5500	600	3.0	15
1937–38 Six	729-E	24–28	60	5.0	6000	600	3.0	15
1939 Six	1107008	24–28	65	5.0	5000	525	3.37	12
1939–40 Eight	1107914	24–28	60	5.0	6000	600	3.0	15
1940 Six	1107022	24–28	65	5.0	5000	525	3.37	12
1941–47 Six	1107032	24–28	65	5.0	5000	525	3.37	12
1941–47 Eight	1107921	24–28	60	5.0	6000	600	3.0	15
1948 Six	1107070	24–28	65	5.0	5000	525	3.37	12
1948 Eight	1107947	24–28	60	5.0	6000	600	3.0	15
1949–52 Six	1107079	24–28	80	5.7	5000	525	3.4	12
1949–52 Eight	1107957	24–28	80	5.7	5500	600	3.0	14
STUDEBAKER								
1936 Eight	737-J	24–28	65	5.0	6000	570	3.15	15
1937 Eight	729-G	24–28	65	5.0	5500	600	3.0	16
1938–40 Eight	1107903	24–28	60	5.0	6000	600	3.0	16
1950 Commander	1107084	24–28	65	5.7	5000	525	3.4	12
1951 Commander	1107089	24–28	65	5.7	5000	525	3.4	12
1951 Commander	1107095	24–28	65	5.7	5000	525	3.4	12
1952 Commander	1107115	24–28	65	5.7	5000	525	3.4	12
1952 Commander	1107116	24–28	65	5.7	5000	525	3.4	12

FORD, MERCURY, LINCOLN STARTING MOTOR INDEX AND SPECIFICATIONS

Year and Model	Unit Number	Normal Engine Cranking Speed	Maximum Torque		Teeth in Pinion	Teeth in Ring Gear	Amperage Idle	Brush Spring Tension, Ounces
			Pounds Feet	Load (Amperes)				
1938–48 90 and 100 H.P.	18–11002	100	14	550	10	112	45–60	20–22
1938–40 60 H.P.	9N–11002	100	14	550	9	122	45–60	20–22
1938–48 Lincoln	18–11002	100	14	550	10	112	45–60	20–22
1942 Lincoln (Liquamatic)	26H–11001B	100	14	550	10	112	45–60	20–22
1947–50 Ford Six	7HA–11002	150	15	600	10	112	45–60	20–22
1949–51 Ford and Mercury V8	7RA–11002	130	15	600	10	112	45–60	48–56
1949–51 Lincoln	7EH–11002B	130	15	550	10	120	45–60	48–56
1949–51 Lincoln	8EL–11002A	150	15	550	10	120	45–60	48–56
1951 Ford and Mercury V8	1CM–11002A	130	15	550		112	45–60	48–56
1951 Ford	1A–11002A	150	15	550		114	45–60	48–56

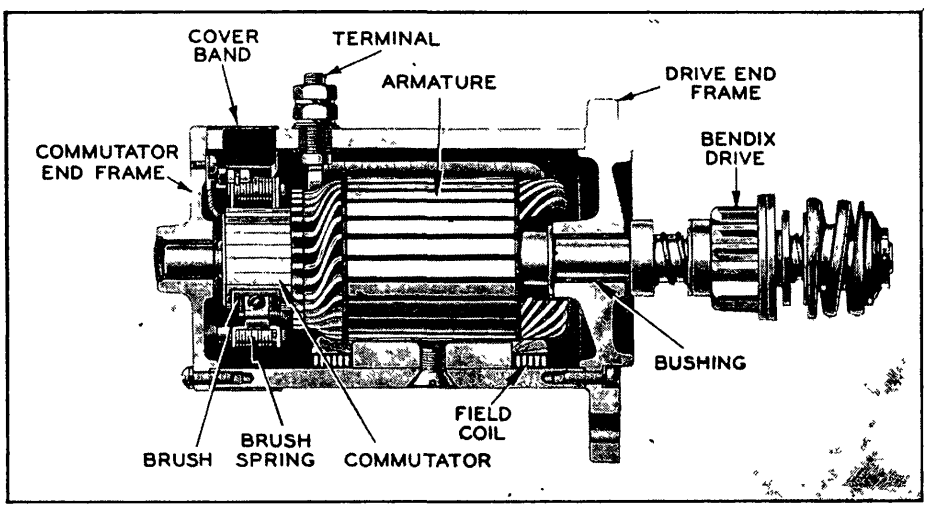


Fig. 6 Bendix compression spring type drive

spring. The spiral threads on this drive continue out to the end of the shaft.

Fig. 5 shows the "CD" type. This type does not carry the triple thread out to the end of the shaft, but carries a plain surface with a low tension coil spring wound around the shaft, which prevents the pinion from vibrating toward the flywheel ring gear during engine operation. The CD type also carries two counterweights on the pinion, one being concentric and the other eccentric.

Fig. 6 shows the compression spring type drive used only on low torque starting motors for small engines. The shaft carries a coil spring to prevent pinion drifting while the engine is running. It is different, however, in that instead of being keyed to the armature shaft, it is assembled by means of splines on the armature shaft and the inside of the drive. There are no screws holding the drive spring in place, inasmuch as the starting shock is absorbed by compressing the drive spring instead of twisting it radially.

Fig. 7 shows the "XXX" type drive, which is used only on large trucks, excavation equipment, marine engines and large power plants. It is similar to the CD type in all respects except that the counterweight on the pinion is a single concentric weight.

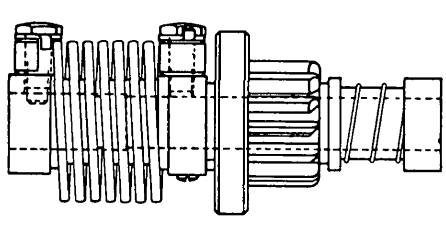


Fig. 7 Bendix "XXX" type drive

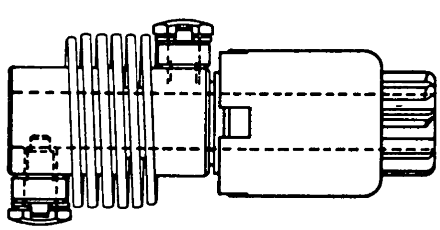


Fig. 8 Bendix barrel type drive

Fig. 8 shows the barrel type drive. Among the features of this design is that a much smaller pinion is used, which improves starting performance, particularly in cold weather, by increasing the cranking speed. The method of disconnecting the threaded engagement of the screw shaft and provision for re-engagement through a meshing spring inside the pinion barrel is unusual. This "off-heel" construction is similar in operation to a ratchet. The screw shaft is mounted loosely on the armature shaft to allow longitudinal movement on an extended portion of the drive head, which rides on the armature shaft.

Instead of the conventional pinion and counterweight assembly, there is a comparable triple threaded piece called the control nut, Fig. 9. The pinion and barrel assembly is assembled to the control nut by a lock ring. Therefore, any movement of the control nut carries the pinion assembly with it, and the pinion rides directly on the armature shaft. A stop nut staked in place on the outer end of the drive head extension governs the control nut travel. Any tendency for the pinion to drift toward the flywheel, due to road or engine vibration, is prevented by an anti-drift spring assembled on the screw shaft.

The friction clutch type drive, Fig. 10, is used on heavy duty applications and employs a series of spring loaded clutch discs which slip to take up the shock of engagement and then take hold to transmit the cranking torque.

BENDIX DRIVE SERVICE

SLEEVE TYPE—Disassembly of this type is accomplished by removing the drive spring attaching screws and slipping the assembly off the armature shaft.

The drive sleeve is assembled under the drive spring and it prevents wrapping down of the spring. To install a new sleeve, slip the sleeve over the hollow

shaft and drive the two divided portions down into the groove on the end of the shaft with a blunt chisel and hammer. It is not necessary to swedge the material down into the groove; merely drive it down enough to hold the sleeve and yet permit it to turn freely on the shaft.

Before assembling the drive on the shaft, clean the shaft of rust, burrs or score marks and lubricate it with just a trace of graphite grease or light engine oil. Be sure to use the proper shaft spring and shaft head screws.

After assembly is complete, check to see that there is free longitudinal movement of the drive along the armature shaft. It should be possible to compress the spring so the threaded sleeve moves freely about ¼" with respect to the shaft. Without this free movement, drive operation would be impaired. Damaged or distorted parts, rough shaft, long spring screw, and improper assembly are causes of restricted movement.

BARREL TYPE—This type drive has the drive spring either attached with spring screws or anchor plates. To remove the drive from the armature shaft, turn the pinion and barrel back to the drive spring and then push end of anchor plate against the drive spring. This uncovers the pilot pin or screw which, when removed, permits removal of the drive unit. The barrel and pinion may be detached from the remainder of the drive by removing the lock ring from the groove on the inside of the barrel.

After cleaning, the threads on the sleeve may be lubricated with a small amount of kerosene. Heavy oil or grease should not be used, since this would cause sluggish action, particularly in cold weather. The armature shaft should be free of rust, gum, rough spots, etc. Lubricate the shaft with just a trace of graphite grease or light engine oil. When assembled, make sure the pilot pin is fully covered by the anchor plate.

COMPRESSION SPRING TYPE — Disassembly of this type is accomplished by removing the nut from the end of the shaft and sliding off the parts. The threaded portion of the screw sleeve may be lubricated with light engine oil. In addition, the splines on the armature shaft may be lubricated with graphite grease or oil.

FRICTION CLUTCH TYPE—No attempt should be made to adjust the clutch, since special instructions and tools are required to test and set correctly the spring tension. The drive is removed from the armature shaft by releasing the lock ring and removing the head screw.

Clutch drives from different models of starting motors may be mechanically interchangeable but it is a dangerous practice to do so since the clutch adjustment may be different. Bendix recommends returning the complete drive to their factory for any necessary service. Application information, including the make and type starting motor and engine, should be sent along with the unit so the correct clutch setting may be made.

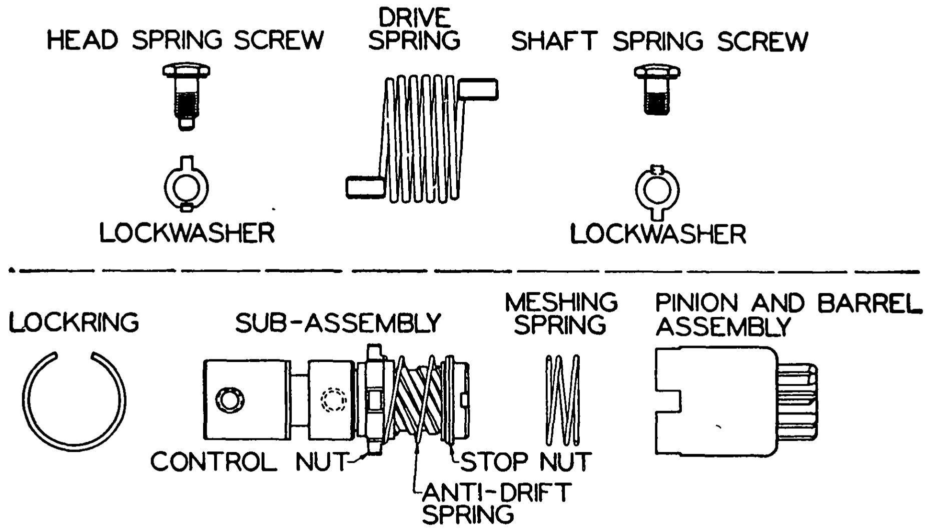


Fig. 9 Component parts of Bendix barrel type drive

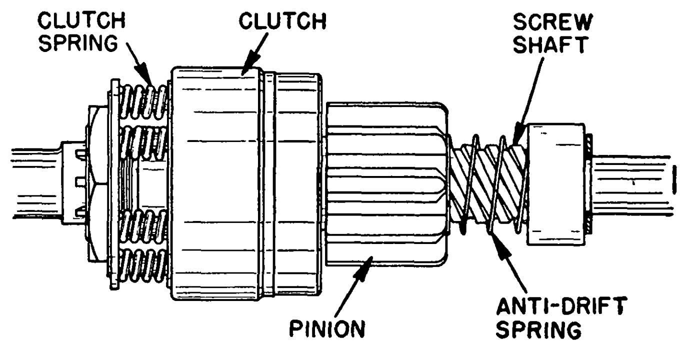


Fig. 10 Bendix friction clutch type drive

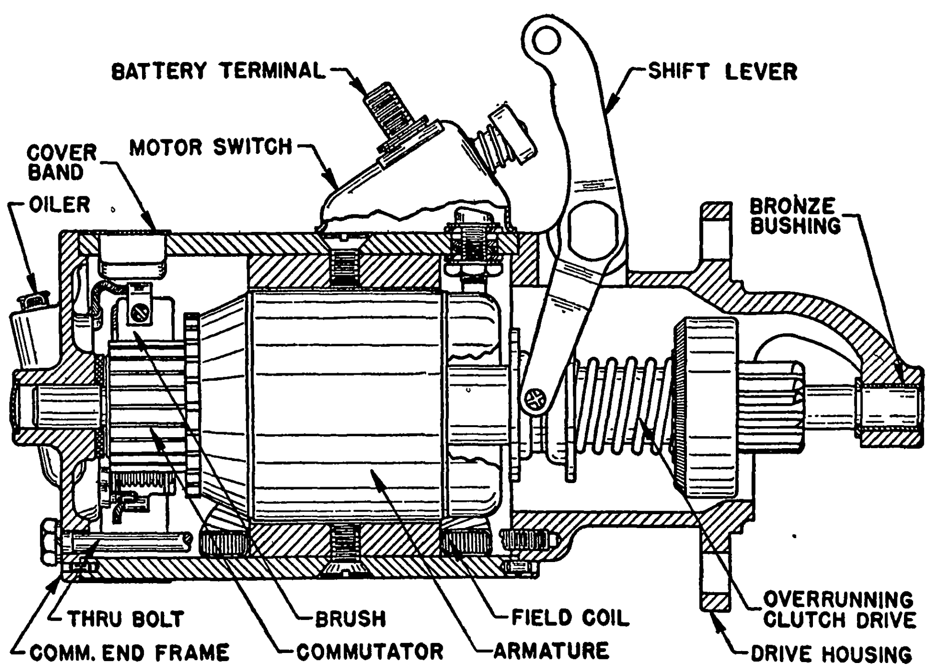


Fig. 11 Starting m t r with v rrunning clutch type driv

OVERRUNNING CLUTCH DRIVE

Fig. 11 shows this type of drive mounted on a starting motor, while Fig. 12 illustrates its construction. The clutch should never be submerged in any cleaning fluid as the lubricant with which it is packed on assembly dissolves and the clutch would eventually fail.

A torque test may be applied to an overrunning clutch to check its operation. To do this, use a torque wrench and, with the clutch mounted on an old armature shaft clamped in a vise, apply about 25 to 50 pounds of torque according to the type of clutch. The clutch should not slip. Remove the torque wrench and turn the pinion in the overrunning direction. The pinion should turn freely and smoothly. If the pinion slips in the driving direction, or if it rolls roughly in the overrunning direction, it should be replaced. Never attempt to relubricate or attempt to repair a defective overrunning clutch.

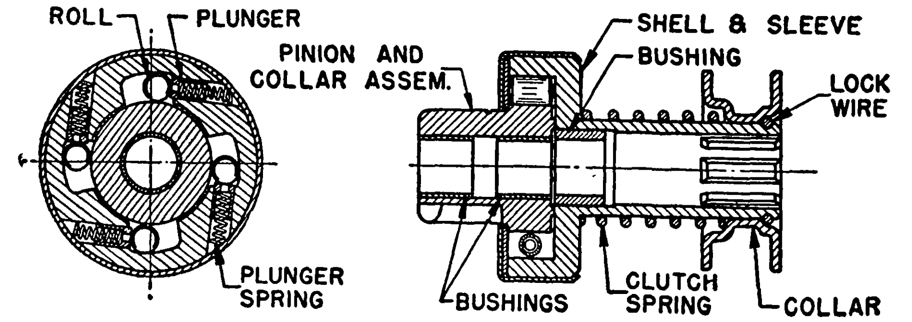


Fig. 12 Construction of overrunning clutch type drive

On some manually operated, and on all solenoid operated solenoid clutch starting motors, the clearance between drive pinion and housing (pinion in cranking position) can be adjusted by setting the starting motor switch button or the solenoid plunger stud. The clearance on Auto-Lite starting motors between the thrust washer and pinion should be $\frac{5}{64}$". On Delco-Remy starting motors, the clearance between the pinion and housing should be $\frac{3}{16}$". Take measurement with pinion in cranking position.

STARTING SWITCHES

STARTING SWITCHES

There are four general types of starting switches used on passenger cars:

1. The foot operated type which is usually mounted on the floor board, or on the starting motor. When this type is used on motors equipped with Overrunning Clutch drive, a manually operated shift lever is used to mesh the drive pinion with the flywheel gear, while the switch closes the starting circuit.
2. Solenoid switch with relay. This type is used on motors with Overrunning Clutch drive. The solenoid not only closes the circuit but it also meshes the drive gears. It is also known as the Pinion Shifting type of switch.
3. Solenoid switch without relay. This type is also known as the Magnetic Switch and is used on motors equipped with Bendix Drive.

Solenoid switches are controlled by either a push button switch on the dash, built in with the ignition switch, or by a vacuum switch, the details of the latter being given further on.

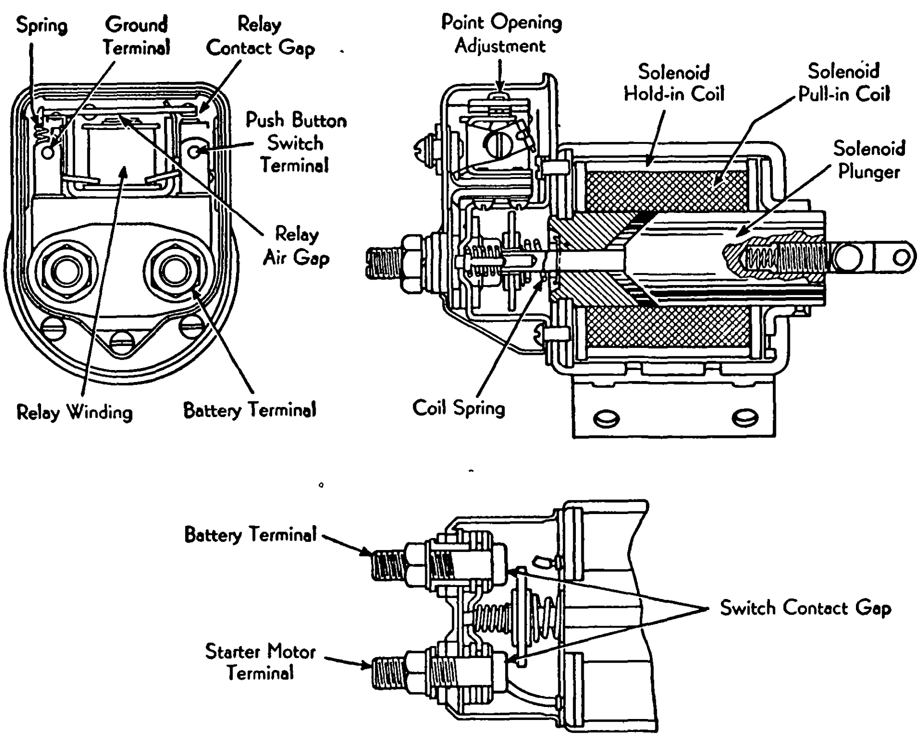


Fig. 1 Auto-Lite solenoid starting switch with relay

AUTO-LITE SOLENOID SWITCH

PINION SHIFTING TYPE

As stated above, this type switch, Fig. 1. closes the starting circuit and meshes the drive pinion with the flywheel gear. Both operations are obtained through the action of the solenoid. The switch is controlled by a push button through a relay mounted within the main switch case.

As shown in the wiring diagram, Fig. 2, the solenoid coil includes two windings; a series winding connected from the relay stationary contact to the main switch terminal connecting with the starting motor, and a shunt winding connected from the relay stationary contact to ground.

Between the time the relay contacts close and the main switch is closed, current is flowing through both windings, causing the solenoid to exert its strongest magnetic pull on the plunger, thus assuring positive meshing of the pinion.

When the main switch closes, the effect of the series winding is nullified due to equal voltage at both ends of the winding. The plunger is then held in place by the shunt winding only. This results in a minimum amount of arcing at the relay points when the switch opens.

SERVICE NOTE—When assembling these switches, apply a thin coat of

light grease to the solenoid plunger, main switch contact blade, and the bridge supporting the switch plunger.

ADJUSTMENTS & TESTS—When open, the relay contact points should have from .025 to .035 inch gap.

When adjusting the relay for opening and closing voltages, adjust the armature spring tension to change opening voltage. To change the closing voltage, adjust the armature stop.

Before making any tests on the switch, make sure that all linkage operates freely with no binding. The switch plunger should be checked to see that it can be bottomed in the solenoid with no drag or restriction. When under test, the plunger should bottom instantly with no chattering.

SWITCH SPECIFICATIONS

*Switch Number**	*Test*
SS-4001	D
SS-4014	D
SS-4017	D
SS-4030	D
SS-4101	A
SS-4104	A
SS-4106	A
SS-4201	B
SS-4205	B
SS-4206	B
SS-4208	B
SS-4702	C
SS-4703	C
SS-4705	C
SS-4707	C
SST-4001	D
SST-4006	D
SSX-4001	E
SSX-4101	E
SSX-4102	E

*Number stamped on legs of switch base.

TEST A

Relay coil resistance:—7.5 to 8.3 ohms at 77 degrees.
Relay closes:—3.5 to 4.5 volts.
Relay opens:—1.5 to 2.5 volts.
Shunt coil draw:—14 to 16 amperes at 6 volts.
Shunt and series coil draw:—34 to 38 amperes at 3 volts.

TEST B

Relay closes:—3.5 to 4.5 volts.
Relay opens:—1.5 to 2.5 amperes at 3 volts.
Shunt coil draw:—7.0 to 8.0 amperes at 3 volts.
Shunt and series coil draw:—34 to 38 amperes at 3 volts.

TEST C

Relay closes:—3.5 to 4.5 volts.
Relay opens:—1 5 to 2.5 volts.
Shunt coil draw:—7.0 to 8.0 amperes at 3 volts.
Shunt and series coil draw:—45 to 50 amperes at 3 volts.

TEST D

Coil draw at 77° F.:—2.9 to 3.3 amperes at 6 volts.
Contacts close:—3.0 to 4.0 volts.
Contacts open:—0.5 to 1.25 volts.
Voltage drop:—.20 maximum at 100 amperes.

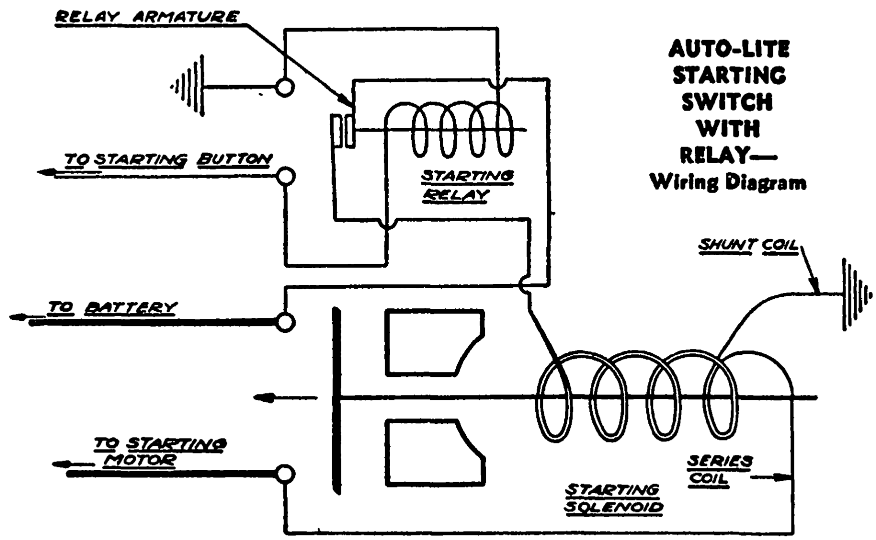


Fig. 2 Wiring diagram of Auto-Lite solenoid starting switch with relay

TEST E

Relay closes:—1.5 to 3.0 volts. Armature seals at 4 volts maximum.
Relay opens:—0.5 volts minimum from sealed position.
Pull-in coil draw:—31.5 to 36.0 amperes at 3 volts.
Hold-in coil draw:—8.8 to 10.1 amperes at 3 volts.

TROUBLE DIAGNOSIS—If the starter fails to operate when the push button is depressed, check the following in the order given:

1. Be sure connections are clean and tight.

2. Remove the relay cover and, with dash switch depressed, the contacts should close. If they don't, it may be due to a faulty dash switch, relay coil, or faulty wire between dash switch and relay. If the points close when a jumper wire is placed across the terminals of the dash switch, the switch is defective. If, by using the jumper wire, the points do not close, place a jumper from the relay terminal to the battery terminal on the solenoid. Then, if the points still fail to close, the trouble is in the relay coil and this assembly should be replaced.

3. If the relay points close and the starter fails to operate, clean the points with fine (00) sandpaper.

4. If the starter still fails to operate, all solenoid lead wire soldered connections should be examined for looseness. If these connections are tight, the solenoid is defective and should be replaced.

5. If the drive pinion disengages from the flywheel after a start is made but the starter switch fails to break contact and the armature continues to revolve, the starter switch push rod may be stuck; if so, replace the solenoid.

6. If the starter tries to engage while the engine is running, look for trouble in the dash switch or its terminals. They may be vibrating into contact with each other. This trouble may also be attributed to a weak or broken return spring or hinge spring on the solenoid relay armature.

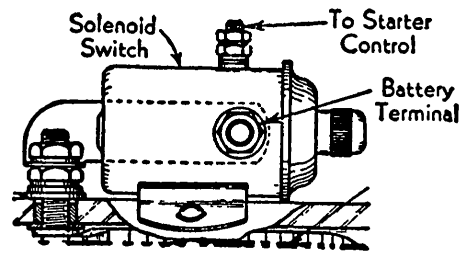


Fig. 3 Auto-Lite solen id starting switch without relay

AUTO-LITE SOLENOID SWITCH

STARTING TYPE

This type switch, Fig. 3, is used for closing the starting circuit only where an automatic starter pinion (Bendix Drive) engagement is used.

There are two springs which, with the solenoid coil, control the operation of the solenoid plunger. The pull of the solenoid coil against a light spring allows the closing of the switch contacts, at which time, the plunger bottoms by compressing the second spring. When the plunger bottoms, a strong magnetic pull is exerted, thus assuring positive connection between the starting switch main contacts.

Upon release of the operating button, this second spring immediately breaks the pull of any residue magnetism, thus assuring a quick break of the switch contacts and prevents any arcing or burning.

As a safety feature, the switch can be operated manually by removing the cap and pushing the solenoid plunger in by hand.

TEST SPECIFICATIONS

Solenoid coil resistance:—1.82 to 2.06 ohms at 77° F.
Coil draw at 77° F.:—2.9 to 3.3 amperes at 6 volts.

Contacts close:—3.0 to 4.0 volts.
Contacts open:—0.5 to 1.25 volts.
Voltage drop:—.20 volts maximum at 100 amperes.

AUTO-LITE VACUUM SWITCH

This type switch, Fig. 4, used on Nash cars prior to 1940, is a vacuum controlled starting switch. It is manually operated through the clutch pedal and vacuum release lock while the engine is running.

With the engine not running, depressing the clutch pedal closes the starting switch. When the engine starts, the switch lever is lifted through a connection with the vacuum diaphragm so that it disengages with the cam and the switch is opened by spring action. As long as the engine continues to run, the lever is disengaged so that the clutch pedal can be operated without closing the switch.

ADJUSTMENTS—The switch should engage just after the clutch pedal has been depressed enough to release the clutch completely. This can be determined by placing the car in gear and depressing the clutch pedal slowly. The length of the cable can be adjusted at the clutch shaft lever to give this result. The cam operating lever on the outside of the switch should have ⅛ inch movement at the stop screw. This can be adjusted by turning the cam adjusting screw.

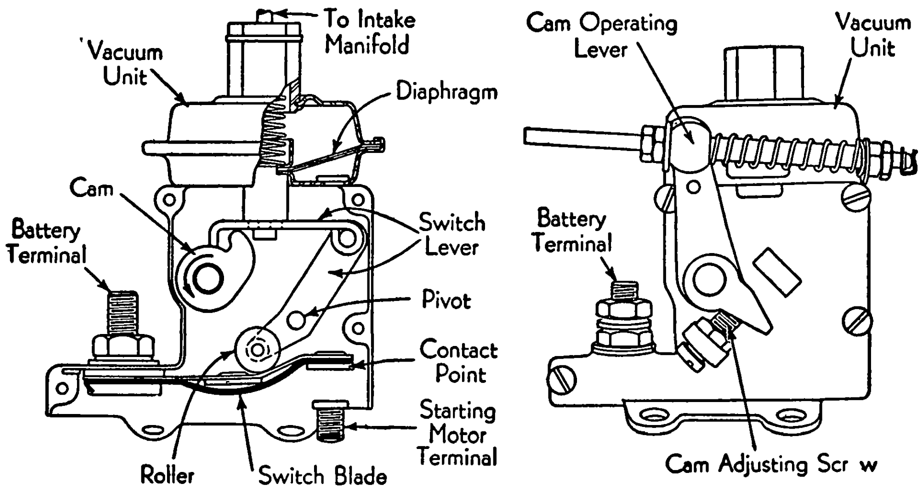


Fig. 4 Auto-Lite vacuum switch

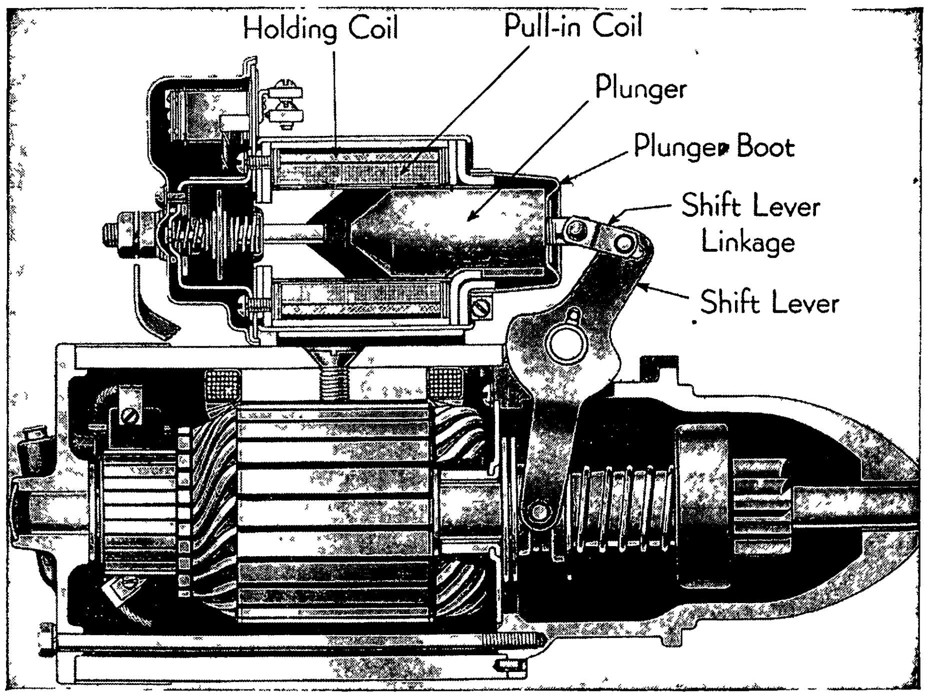


Fig. 5 Delco-Remy solenoid starting switch with relay

DELCO-REMY SOLENOID SWITCH

PINION SHIFTING TYPE

This type switch, Fig. 5, is designed to close the starting circuit and to mesh the pinion with the flywheel. Both operations are obtained by solenoid action. The switch is controlled in some cases by a switch on the instrument panel. In other cases, it is controlled by a vacuum switch, the details of which are given further on.

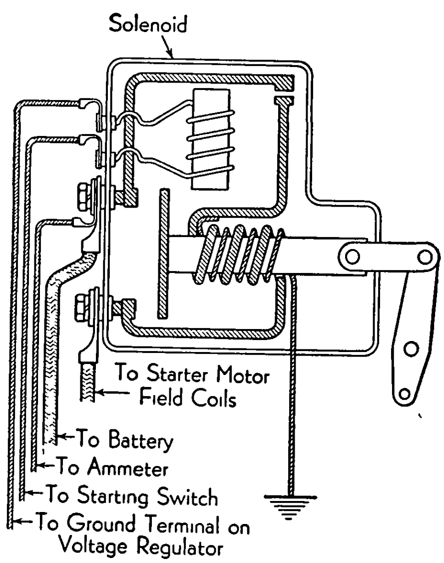


Fig. 6 Wiring diagram of Delc -R my s len id starting switch with relay

When the starter switch circuit is closed, current flows through the solenoid relay to ground (see Fig. 6). This causes the relay armature to pull down and close the contact points. Current then flows from the battery connection at the solenoid through the relay points and coils of the solenoid.

As soon as pressure on the starter switch is released, the relay contacts open, breaking the solenoid circuit and allowing the return spring on the shaft lever to disengage the starting motor pinion.

The starter relay is grounded through a pair of contacts mounted on the generator regulator. When the generator starts charging, these contacts open and stop the flow of current through the solenoid relay winding. This prevents the starter from being accidentally engaged when the engine is running. A torsional spring on the starter shift yoke pulls the solenoid plunger back, allowing the starter switch to open. At the same time, it pulls the pinion out of mesh with the flywheel gear.

TESTS & ADJUSTMENTS—When open, relay points should have from .030 to .045 inch gap. This is adjusted by raising or lowering the upper armature stop.

The air gap between the armature and core should be from .010 to .014 inch and is adjusted by moving the lower armature stop.

When necessary to remove the solenoid for repairs, it is important to see that the pinion travel is properly adjusted when the solenoid is reinstalled. To adjust, remove the pin from the solenoid plunger and push the plunger forward all

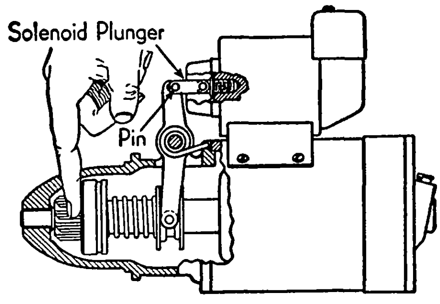


Fig. 7 Take lash out of drive clutch as sh wn wh n adjusting pinion travel

the way. Take the lash out of the drive clutch by pressing a finger on the clutch shell, Fig. 7. Then adjust the stud in the solenoid plunger until the pin can just be inserted at the forward end of the slot with the pinion $\frac{1}{8}$ inch from the housing.

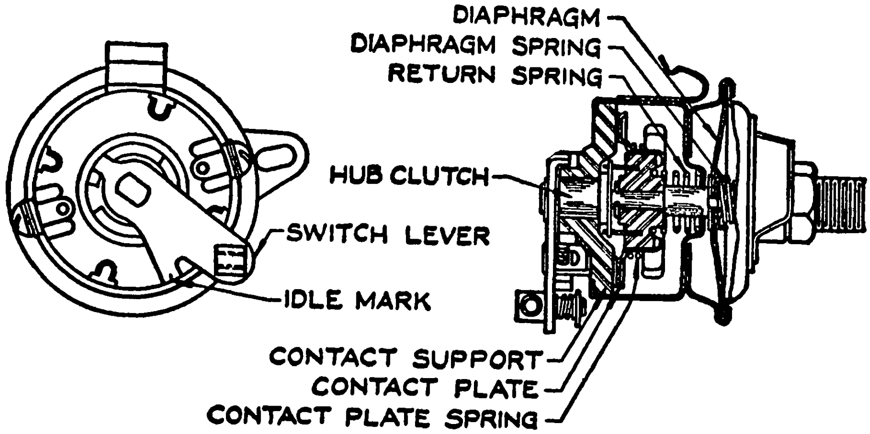


Fig. 8 Delco-Remy manifold mounted vacuum switch

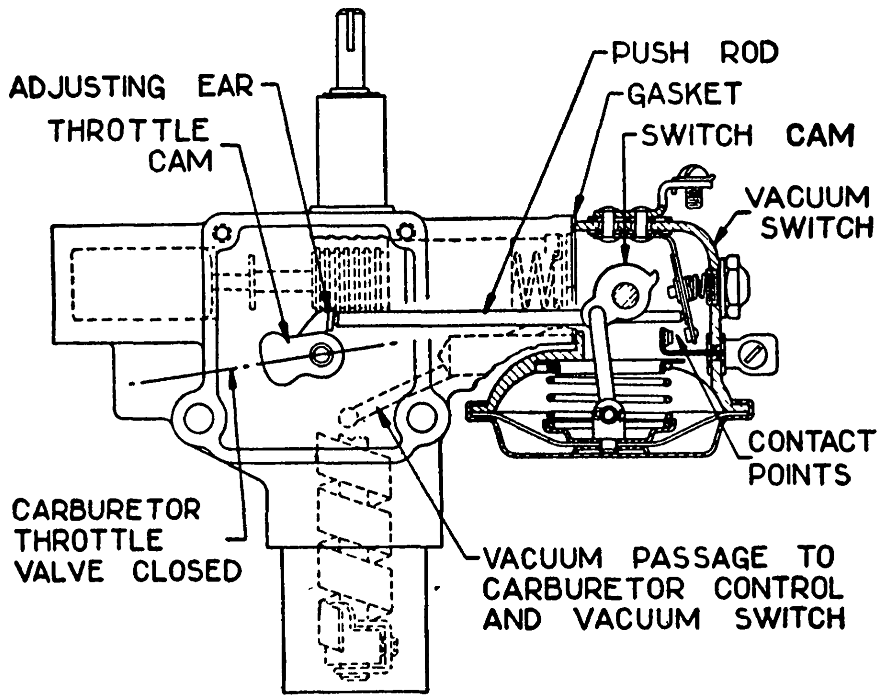


Fig. 9 Delco-Remy choke mounted vacuum switch. Buick 1938

SOLENOID SPECIFICATIONS

Switch Number*	Test
1512	A
1542	B
1546	B
1547	B
1118019	C
1118102	C
1118135	D
1118136	D
1118140	D
1118141	C
1118148	E
1118156	E

* Switch number is stamped on end of solenoid.

TEST A

Relay points close:—4 volts.
Relay points open:—1.6 to 2.0 volts.
Hold-in coil draw:—12 to 14 amperes at 5 volts.
Draw of both coils:—65 to 71 amperes at 5 volts.

TEST B

Relay points close:—1.9 volts.
Relay points open:—1.0 to 1.2 volts.
Hold-in coil draw:—12 to 14 amperes at 5 volts.
Draw of both coils:—65 to 71 amperes at 5 volts.

TEST C

Relay points close:—3.0 volts.
Relay points open:—1.9 volts.
Hold-in coil draw:—14-16 amperes at 5 volts.
Draw of both coils:—85-90 amperes at 5 volts.

TEST D

Hold-in coil draw:—14-16 amperes at 5 volts.
Draw of both coils:—85-90 amperes at 5 volts.

TEST E

Hold-in coil draw:—14-16 amperes at 5 volts.
Draw of both coils:—85-90 amperes at 5 volts.
Closing voltage:—1.3 to 1.6.
Sealing voltage:—2.4 volts maximum.
Opening voltage:—.7 to 1.5.

TROUBLE DIAGNOSIS — In case the starter fails to operate when the starter switch is closed, the following procedure should be followed. Be sure all connections are clean and tight. Remove the solenoid relay cover. With the starter switch closed, the contacts should close. Failure to close may be due to a faulty dash switch, relay coil or a faulty wire between the dash switch and the relay. If the points close when a jumper is placed across the terminals of the dash switch, then the switch is defective and should be replaced. If using a jumper does not cause the points to close, place a jumper from the relay terminal to the battery terminal of the solenoid. If the points still fail to close, then the trouble is in the relay coil and this assembly should be replaced. If the points close and the starter fails to operate, the points should be cleaned with fine sandpaper No. 00.

If the starter fails to operate, all the soldered connections of the solenoid lead wire should be examined for loose connections. If these connections are tight, the solenoid is defective and the unit should be replaced.

If the starting motor pinion disengages from the flywheel after a start is made but the starter switch fails to break contact and the armature continues to revolve, the starter switch push rod may be stuck. If so, replace the solenoid.

If the starter tries to engage when the engine is running, look for trouble in the dash switch or its terminals. They may be vibrating into contact with each other. This trouble may also be attributed to a weak or broken return spring or hinge on the solenoid relay armature.

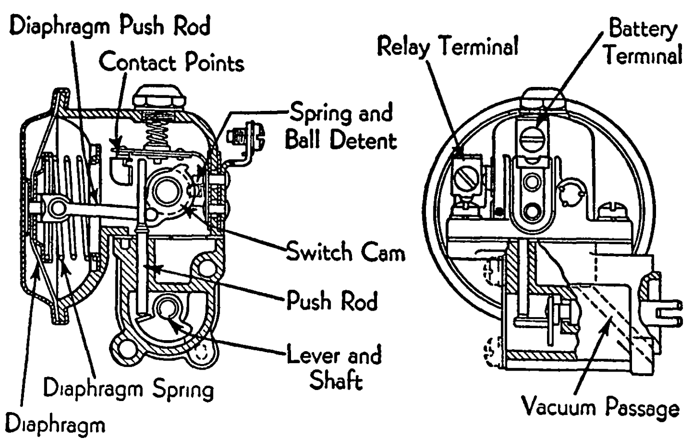


Fig. 10 Delco-Remy carburetor mounted vacuum switch. Buick 1939

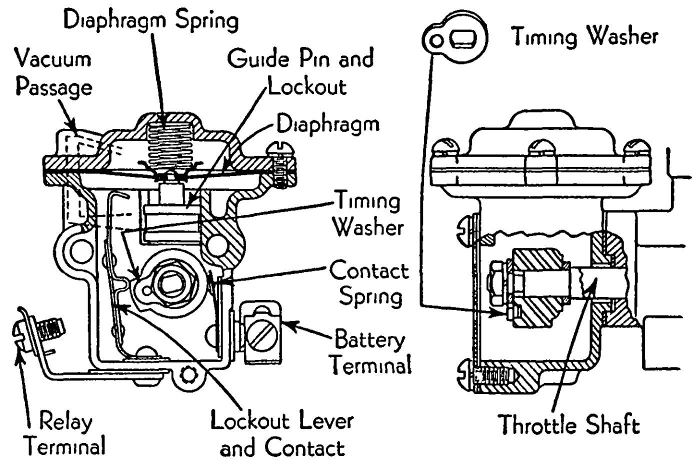


Fig. 11 Delco-Remy direct operated carburetor mounted vacuum switch. Buick 1940-47

DELCO-REMY VACUUM SWITCH

Delco-Remy accelerator controls have a vacuum switch incorporated in the starting solenoid control circuit The purpose of the vacuum switch is to protect the starting motor from unintentional or accidental operation which might damage either the motor or the drive

The vacuum switch operates on manifold vacuum and opening of the throttle Initial opening of the throttle, through linkage, allows the switch contacts to close, completing the starting motor solenoid relay circuit As soon as the engine starts, manifold vacuum opens and latches the contact points

Two types of vacuum switches are used, one being mounted on the intake manifold, while the other is mounted on the carburetor control or carburetor

MANIFOLD MOUNTED VACUUM SWITCH

Buick 1935-37, Pontiac 1935-38

This type, Fig 8, mounts on the intake manifold and is directly connected to the throttle linkage The switch lever has a pointer which, used with the white mark on the switch rim, provides an easy way to adjust the vacuum switch linkage With the engine idling, adjust the pointer to the white mark

TESTS—To check the operation of the vacuum switch, proceed as follows

1 With the engine idling, disconnect the two leads on the vacuum switch

2 Connect a 110-volt test lamp on the two terminals

3 Open the throttle to increase engine speed The test lamp should not light from idle to high speed

4 With the engine still idling, disconnect the throttle lever from the switch and move the switch through the complete range of travel Lamp should not light and no binding should occur through the total range.

5 With the lever in the center position, disconnect the vacuum line Move the lever to full throttle position and return to within 1/8 inch of the white line on the switch case At this position, 1/8 inch ahead of the white line, the contact assembly will be released, giving a clicking noise (Test lamp should not light at any time)

6 After contact assembly has been released, movement of the switch lever forward through 1/16 to 1/8 inch of travel should complete the circuit through the switch The test lamp should light

CARBURETOR OR CHOKE MOUNTED VACUUM SWITCH

Buick 1938-47 With Stromberg Carburetors

On this type switch, variations of which are illustrated in Figs 9, 10 and 11, mechanical linkage to operate the contact points is obtained through the carburetor throttle shaft

On the type illustrated in Figs 9 and 10, motion of the carburetor throttle is transmitted through an "Adjusting Ear" and "Push Rod" in the vacuum switch, to the switch contact points, causing them to open and close On the type illustrated in Fig 11, a rotor assembled on the throttle shaft directly operates the movable contact points (Details of the type shown in Fig 11 are given further on)

On the types shown in Figs 9 and 10, the setting at which the switch cam unlatches to allow the contact points to close again after the engine has been stopped is an important factor in the correct operation of the starting system To test the switch on the engine, proceed as follows

1 With engine warm, set idle screw to the equivalent of 8 m p h , then stop engine

2 Pull out hand throttle until distance between end of idle screw and cold idle cam in fast idle position is 1/16 inch This can be set with a 1/16 inch spacer Hand throttle must be left in this position throughout following test.

3 Turn on ignition and start engine

4 Turn off ignition and make another start immediately after engine is stopped This starting operation should be repeated at least three or four times If the engine starts in each case after making the above check, the vacuum switch is timed properly for making contact in all positions of the cold idle cam

5 Pull out hand throttle until space between idle adjustment screw and cold idle cam in fast idle position is 1/4 inch It should then be impossible to start the engine more than once

If starting is possible under conditions in item 5, or is not possible under the conditions in items 2 and 4, the unlatch points is not in proper adjustment, and the carburetor and control unit should be removed from the engine and further adjustments made on a vacuum testing machine

The carburetor mounted switch, Fig 10, has an opening through which the adjusting ear may be reached without removing the switch from the engine Loosen the two through-bolts and swing the protective cover out of the way to get to adjusting ear Tighten bolts before checking and adjusting Bending the ear away from the push rod lowers the contact point unlatching setting (The testing machine carries instructions for all further tests and adjustments)

When assembling switch unit to the choke (choke mounted type, Fig 9) be sure to open the throttle wide and push the push rod in against the shoulder This will insure against possible damage to the switch contact arm.

DIRECT OPERATED VACUUM SWITCH

Buick 1940-47 With Stromberg Carburetors

Fig 11 This type switch requires no attention in normal service other than to compensate for manufacturing tolerances in the switch, rotor and throttle shaft This is taken care of by special timing washers, supplied by the Stromberg Carburetor Co , which vary the

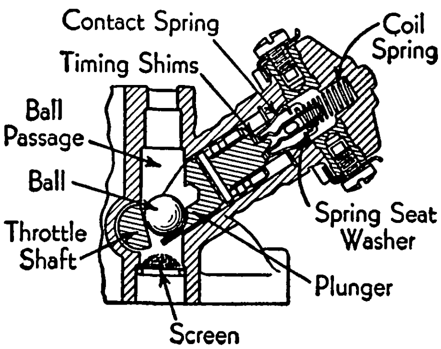


Fig. 12 Carter Carstarter switch
Courtesy Carter Carburetor Corp.

position of the rotor on the throttle shaft, thus establishing the relationship between the throttle shaft and lock-out lever. The washers are numbered and each number represents a difference of three angular degrees in throttle shaft rotation.

A felt gasket, located beneath the cover plate, is a protection against dust entering the unit. The gasket is porous enough to allow breathing, which is caused by the movement of the diaphragm. Gaskets of any other material should never be substituted.

To check for minimum clearance between cold idle cam and idle screw, proceed as follows:

1. Set idle screw for 8 m.p.h, hot idle.
2. Turn on ignition and start engine. Release throttle, then open throttle until distance between idle screw and cold idle cam in fast idle position is approximately ¼ inch. Turn off ignition, then release throttle slowly until this distance is 3/64 inch. Do not allow idle screw to drop closer than 3/64 inch to cam as this would void the test.
3. Now turn on ignition switch and open throttle from 3/64 inch position to start. Car should start.
4. Repeat this cycle several times. If engine starts each time, the vacuum switch is timed for starting in all positions of the cold idle cam.
5. If engine fails to start more than once on the above test, it will be necessary to use a higher number timing washer to allow engine to start.

To check for maximum clearance between cold idle cam and idle screw, proceed as follows:

1. Set idle screw for 8 m.p.h., hot idle.
2. Turn on ignition and start engine. Release throttle, then open throttle until distance between idle screw and cold idle cam in fast idle position is approximately ¼ inch. Turn off ignition. Then release throttle slowly until this distance is not less than ⅛ inch. Do not allow idle screw to drop closer to the cam than ⅛ inch as this would void the test.
3. Turn on ignition and open the throttle from ⅛ inch position to attempt starting. Car should not start. If the car does start, it indicates that the maximum clearance is above the specified high limit and it will be necessary to use a lower numbered timing washer. After changing to a lower numbered washer, repeat the check for minimum clearance as described above.

CARTER CARSTARTER

Buick 1939-52 and Packard 1942-52 With Carter Carburetors

The starting switch, Fig. 12, is incorporated in the carburetor. When the accelerator is depressed, with the engine stopped, a steel ball which rests on milled portion of throttle shaft, is forced against a plunger, which raises a W-shaped copper contact spring until it makes an electrical connection between two brass blocks in the bakelite top of the switch. This closes the solenoid relay circuit.

As soon as the engine starts, the manifold vacuum raises the steel ball up away from the shaft and plunger to a seat in the casting, where it remains as long as the engine runs.

As soon as the ball is raised, the coil spring pushes down on the W-shaped contact, forcing the contact and plunger down, which breaks the connection, opening the starting solenoid relay circuit. The ball cannot return to the starting position until the engine stops, and the throttle is returned to the idle position.

SERVICE NOTES—The W-shaped contact spring rests on two or more brass shims with square holes. These shims determine the point at which the switch contact is made. Contact should be made when the throttle valve is opened between 30 and 45 degrees. If not enough of these shims are in place, contact will not be made soon enough. Too many will cause the switch to function too soon (before 30 degrees) in which case, there is danger that the switch may be in contact all the time.

In disassembling the switch, carefully remove these shims and put them aside in a safe place so they all will be returned to their proper position.

Between the W-shaped spring and the coil spring is a round washer with a square hole. This washer must not be confused with the timing shims. Neither the W-shaped spring nor the coil spring should be stretched or otherwise altered or the operation of the switch will be affected.

When reassembling the switch to the carburetor, be sure the plunger is placed in the position shown, Fig. 12. If the piston is installed wrong side up, the switch will not function.

Never apply oil or grease to any of the switch parts as dust will collect and eventually cause the switch to stick.

In making the electrical connection, the red or hot wire should be attached to the terminal screw nearest to the center of the carburetor.

It is good practice to use Carstarter Gauge T-109-155S after the switch has been reassembled. When any new switch parts are installed, it is essential to do so to make certain that the contact is not made before 30° throttle opening and is made before 45° opening.

In using Gauge T-109-155S, Fig. 13, for determining the degree of throttle opening at which switch contact is made, proceed as follows for WDO series carburetors:

Attach plate "A" to the climatic control housing and tighten in position.

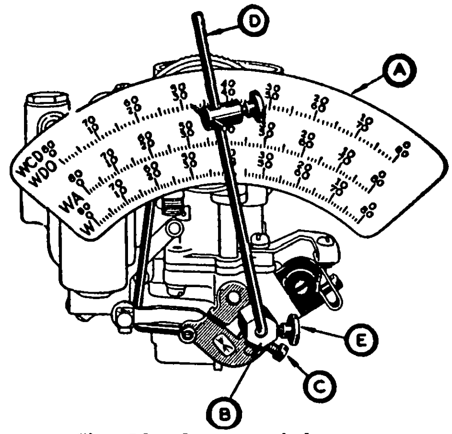


Fig. 13 Carter switch gauge
Courtesy Carter Carburetor Corp.

Connect block "B" to the throttle shaft lever by means of the screw, as shown, being sure the block is tight. Back out throttle lever adjusting screw "C". Hold choke valve open to release fast idle block, close throttle valve tight, and set shaft "D" so that the pointer rests on the line marked zero next to WDO at the left of the plate. Tighten adjusting screw "E". With the carburetor on the car and the switch connected, the switch should make contact when the throttle is opened so that the indicator has passed 30°, but engine must start before pointer has reached 45°. If it does not, the shims mentioned above must be increased or decreased in number until the desired result is obtained. (On 1947-48 Buick carburetors that use the late style throttle connector rod with the bend at the top of the rod, disconnect upper end of rod before installing the protractor gauge T109-155S.)

When the carburetor is on the bench, it is necessary to attach a battery and a bulb in series by wires to the two switch terminals. The point of contact of the switch can then be determined by the lighting of the bulb.

FORD SOLENOID SWITCH

When the dash switch completes the circuit to the solenoid magnetic switch, heavy battery current energizes the magnetic coil which draws in the solenoid plunger. The contact disc which is mounted on the plunger is pulled toward the terminals until the circuit is completed to the starting motor.

When this circuit is completed, the major portion of the magnetic coil is short-circuited and only a small portion is required to maintain contact with the terminals, thereby releasing practically all the battery current to drive the starting motor. The starting motor will continue to run until the dash switch is released.

As a safety feature, should the switch fail to operate electrically, it can be operated manually by removing the metal cap on one end of the switch and pushing the plunger in by hand.

TEST SPECIFICATIONS

At 6 volts, the normal current is approximately 3.9 amperes. If, when the

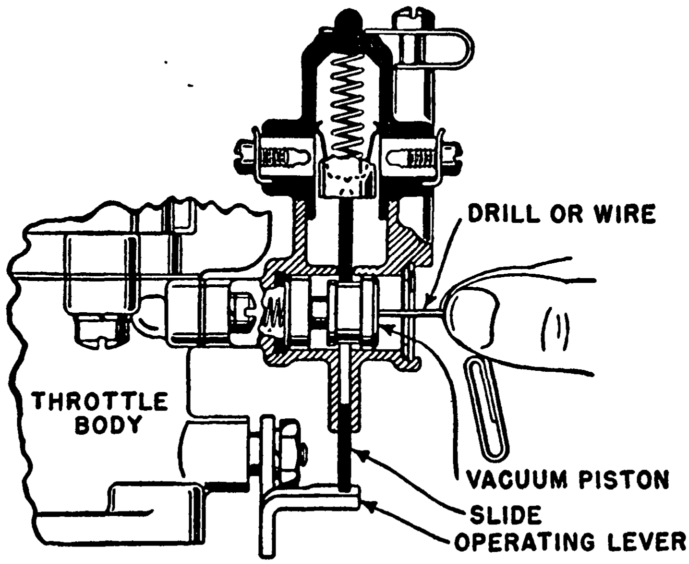


Fig. 13B Inserting drill or wire through screen to operate vacuum piston on Stromberg starter switch

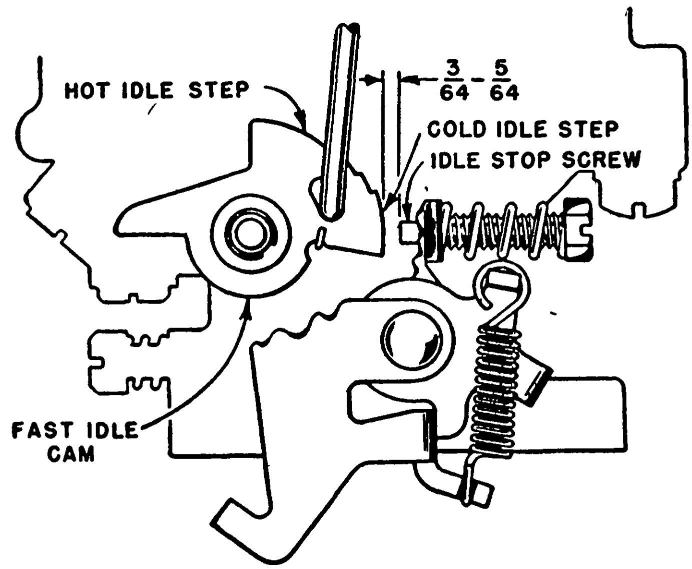


Fig. 13C Checking Stromberg starter switch timing n car

push button is depressed, the switch does not operate, connect a 30 ampere meter at the starter switch in series with the push button and note the amperage. If no reading is obtained, the circuit is not being completed. If the reading is above 5 amperes, the starter switch is shorted and should be replaced. If the reading is between 3 and 5 amperes and the starter does not operate, test the starter circuit. If the reading is below 3 amperes, test the circuit to the starter switch for voltage drop with a 3-volt meter parallel to the circuit. With the button depressed readings above ½ volt indicate excessive resistance in the circuit which must be corrected.

STROMBERG

Buick 1948-52

This switch, Fig. 13A, consists of a housing which is flange mounted with a gasket to the carburetor throttle body and held in place by two screws. The housing has a horizontal cylinder barrel to which vacuum is applied at one end by means of cored and drilled holes in the carburetor body. The end of the barrel is provided with a washer which forms a seal to prevent leaks when the piston (opposed by a light spring) is drawn against it by vacuum.

The opposite end of the barrel is vented to the atmosphere through a screen which is held in place by a clip. A flat slide, actuated by an operating lever on the throttle shaft, moves in a confined slot in the housing. This slide engages a cylindrical contact guide, the upward movement of which is opposed by a heavy contact guide spring. The contact guide carries a U-shaped spring contact which moves up and down within the terminal cap to engage stationary contacts for opening and closing the starter control circuit.

OPERATION—With the engine not running and throttle closed the switch operating lever holds the slide in the proper position, thereby holding the U-shaped spring contact away from the contacts in the terminal cap.

Pressing down on the accelerator pedal causes the operating lever to move away from the slide. This allows the contact guide spring to move the slide and U-shaped contact down to bridge the contacts in the terminal cap, thus closing the circuit.

When the engine starts and the throttle is allowed to close, the slide and U-shaped spring contact is moved upward by the switch operating lever, opening the circuit. With the slide in the up position, manifold vacuum pulls the vacuum piston inward until it seats against the seal. This aligns the shallow groove in the piston with the slide.

When the throttle is opened beyond the idle range, the operating lever moves away from the slide, which is then forced downward by the contact guide spring until it strikes the shallow groove

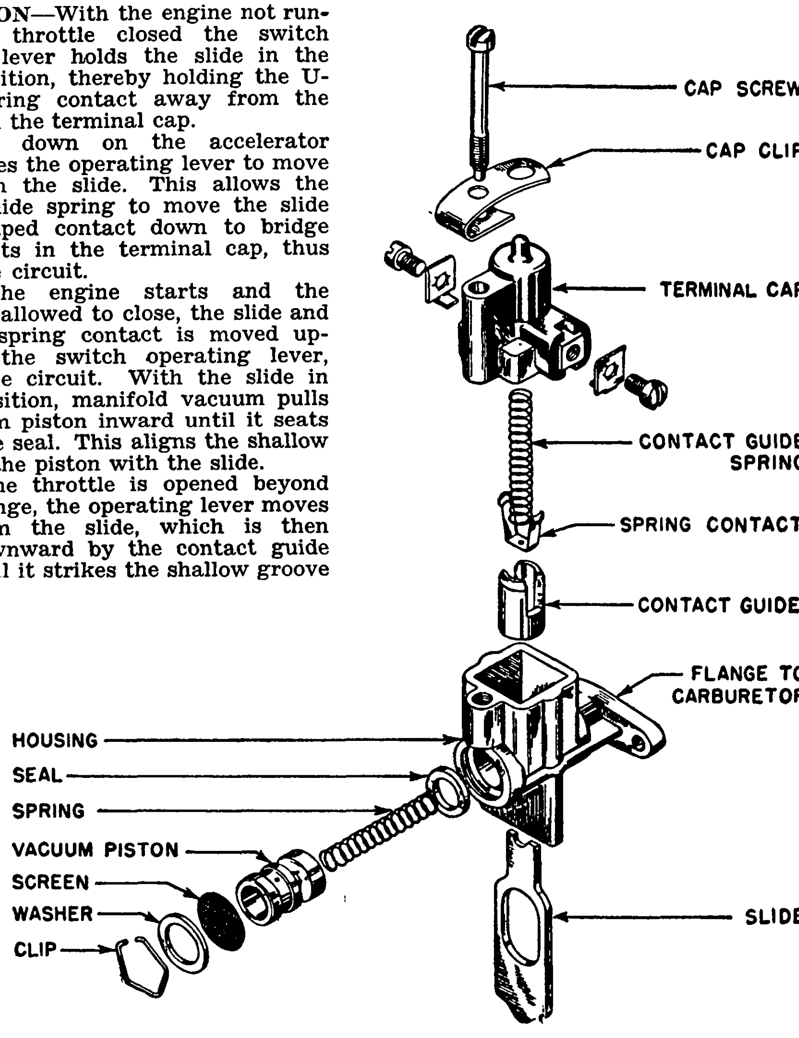
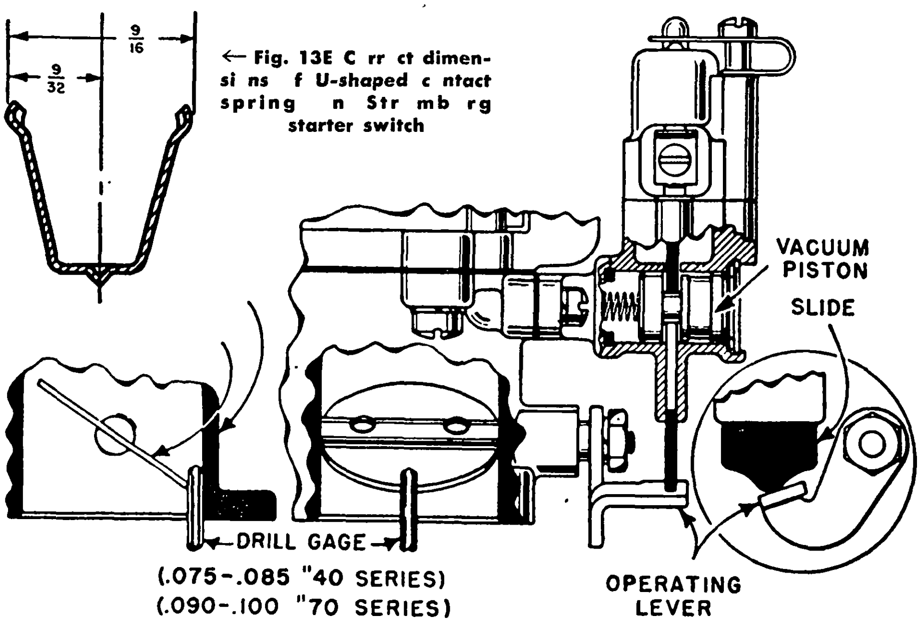


Fig. 13A Str mb rg vacuum start r switch



← **Fig. 13E Correct dimensions of U-shaped contact spring on Stromberg starter switch**

Fig. 13D Checking Stromberg starter switch timing on bench

in the vacuum piston. This acts as a stop and prevents the switch contacts from engaging while the engine is running. It also holds the piston in the inner position—when engine load conditions cause the vacuum to become too low to hold the piston in.

ADJUSTMENTS — Before working on the switch, always place the gearshift lever in neutral and apply the parking brake. Then proceed as follows:

1. Set idle adjusting screw for 8 mph (hot idle).
2. With engine not running, insert a No. 65 drill (or a small size paper clip) through the center of the screen to operate the vacuum piston, Fig. 13B. *Do not remove the screen.* With throttle closed, first push the vacuum piston to its inner position and hold it there while opening the throttle. This will allow the slide to drop into the shallow groove in the piston and will lock it in the inner position and prevent the slide from dropping far enough to complete contact, Fig. 13B. Hold the throttle open to prevent release of the piston until completion of steps 4 and 5.
3. Remove drill or wire.
4. Place a 5/64" spacer between the idle stop screw and the fast idle cam while holding the cam in the extreme cold idle position, Fig. 13C. Close the throttle so that the spacer will hold the cam in this position. Turn ignition on, hold spacer and open the throttle — *the engine should not crank.*
5. Still holding the throttle open, place a 3/64" spacer between the idle stop screw and fast idle cam while holding cam in extreme fast idle position. Close the throttle so the spacer holds the cam in this position, Fig. 13C, and again open the throttle with the ignition on—*engine should crank.*
6. If the 5/64" spacer causes the engine to crank, bend the tang on the operating lever downward. If the 3/64" spacer does not cause the engine to crank, bend the tang on the lever upward. In making either adjustment, bend the tang a slight amount each time until, by rechecking after each bend, the specified spacing is obtained.

If the carburetor has been removed from the engine, an approximate switch timing may be achieved as follows: Place the drill size for the model being serviced, Fig. 13D, between the throttle valve and carburetor barrel. Close the throttle to hold the drill in position. Bend the tang on the operating lever until it is just touching the slide, Fig. 13D. After the carburetor is installed on the car, recheck the switch timing.

CAUTION—If the switch has been disassembled, make certain that the contact guide spring and vacuum piston springs are assembled into their respective positions. The contact guide spring is heavier. Be sure the piston position has not been reversed. The end having the deep groove and tapered counterbore must be nearest the seal. Use care in handling the U-shaped contact spring to avoid altering dimension of the open ends. This should be as shown in Fig. 13E. Make certain that the narrow projection on top of the guide has been properly entered in the slot in the bottom of the contact guide.

SWITCH LUBRICATION—This is unnecessary unless the parts have been cleaned or replaced, in which case, the inside of the terminal cap should be given a light coating of special lubricant (Stromberg No. 385093), which is available at Stromberg Service Stations. The lubricant should be applied sparingly by working into a clean cloth and lightly swabbing the inside surface of the terminal cap.

STARTERATOR

Chevrolet 1935-36 Master

The starter mechanism is connected through a vacuum unit to the accelerator pedal. When the accelerator pedal is depressed, with the engine stopped, the starting motor switch is closed by means of linkage. When the engine starts, vacuum in the intake manifold acts upon the vacuum unit diaphragm, disconnecting the starter control from the accelerator pedal and thus permitting the accelerator pedal to operate the throttle only.

There are four adjustments. To adjust the height of starter control fork, loosen the lock nut on the lever connected to the starter link and turn the adjusting screw until the starter fork clears the floor board by 3/16".

To adjust the vertical position of the starter control fork, loosen the lock nut at the inner end of the pull rod and turn the adjusting screw until the control fork is 1/8" past, to the left, a 90 degree angle with the cross shaft. Tighten the lock nut on the fork pull rod.

To adjust clearance between the face of the starter control and slot in the accelerator rod, disassemble the accelerator rod from the accelerator bellcrank on the side of the engine. Loosen the clevis and check nut and screw the clevis in or out to give 1/8" clearance between the back edge of the notch in the accelerator rod and the starter control fork.

The fourth adjustment is for the purpose of giving the throttle a lead over the starting motor switch. The clearance to give this throttle opening is secured between the starter link and the starting switch spring seat. This clearance should be 5/16" to 1/2" and is obtained by installing or removing snap springs between the two parts.

DASH GAUGES

ALL CARS are equipped with at least five instruments which indicate the operating condition of certain important units in the vehicle. These instruments and their function are as follows:

1. Fuel or gasoline gauge shows how much fuel there is in the tank.
2. Temperature gauge indicates the temperature of the water in the cooling system.
3. Oil pressure gauge which indicates the pounds of pressure at which the oil is being pushed through the engine by the oil pump.
4. Ammeter indicates whether the battery is being charged by the generator, or is being discharged by lights, engine, radio, etc.
5. The speedometer.

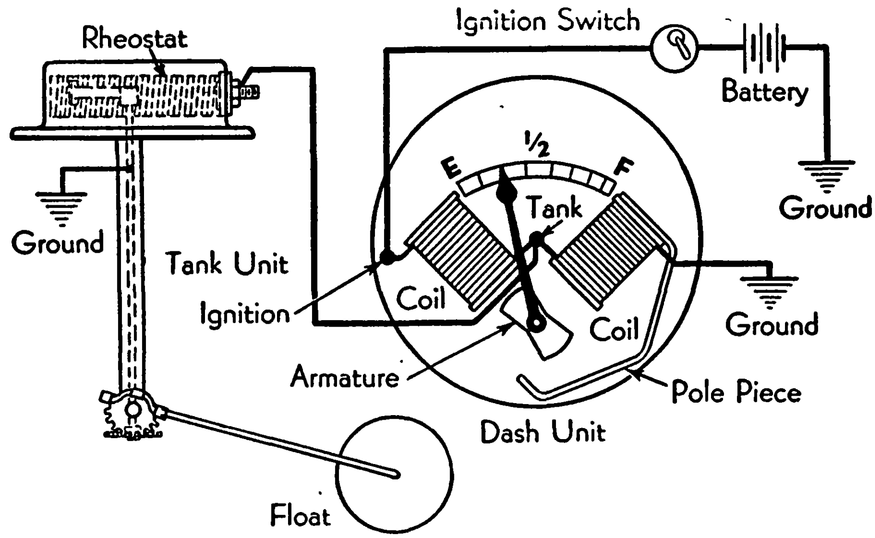


Fig. 1 AC electric fuel gauge

AC FUEL GAUGE

The gauge consists of two units: (1) The indicating or dash unit which is mounted on the instrument panel; (2) the tank unit which is installed in the fuel tank. These two units are connected by a single wire and each unit is grounded in its respective location.

Fig. 1 shows a wiring diagram of the gauge. The dash unit consists of two coils spaced 90 degrees apart with an armature and integral pointer at the intersection of the coil axis. An inertia dampener is provided on the armature to prevent vibration on rough roads.

The tank unit consists of a housing enclosing a rheostat or resistance unit with a brush which contacts the resistance unit. This contacting brush is actuated by the float arm—movement of which is controlled by the height of the fuel in the tank. Variations in resistance (height of fuel) change the value of the indicating unit coils so that the pointer indicates fuel availability. A calibrated friction brake is included in the tank unit to prevent wave motion of the fuel in the tank from oscillating the pointer on the indicating unit.

GAUGE SERVICE—If the gauge does not give an accurate indication of the amount of fuel in the tank, check to locate the trouble as follows:

First, make a tester using an extra AC tank unit known to be in good condition. Then attach a spring terminal clip to a five-foot length of *colored* wire. Connect the other end of this wire to the binding post of the tank unit. Next, attach two spring terminal clips to a similar piece of *black* insulated wire and the tester is ready for use.

Testing Dash Unit—

1. Turn off the ignition switch.
2. Disconnect one of the battery cables.
3. Disconnect the wire which leads to the tank unit.
4. Using the spring clip, connect your *colored* tester wire to the binding post from which the wire was removed.
5. Connect the *black* wire to the flange of the tester and to any convenient ground—such as the unpainted part of the instrument panel.
6. Turn on the ignition switch.
7. Connect the battery cable. Move the arm of the tester back and forth slowly, Fig. 2. If the dash unit is okay, the pointer will move from "Empty" to "Full" freely. If the pointer doesn't move, or only moves part way, the dash unit is defective and a new AC dash unit must be installed.

Test Wiring from Dash to Tank—

1. Turn off ignition switch. Disconnect battery and reconnect wire to dash unit.
2. Follow wire from tank unit to "bayonet connection" or the terminal junction block. Disconnect the wire at this point and clean wire contacts by scraping with a knife or sandpaper, Fig. 3.
3. Attach the *colored* wire of the end of the wire which runs to the instrument panel. Attach the *black* tester wire to the car frame for a ground.
4. Connect the battery cable and turn on the ignition switch. Move the arm of the tester back and forth. If the wiring is okay, the pointer on the dash unit will move from "Empty" to "Full" freely. If the pointer doesn't move or only moves part way, the trouble is in the wire from the dash unit to the tank.
5. If the pointer *does* move correctly, the trouble is in the tank unit or the wire which runs from it to the "bayonet connection", Fig. 3, or terminal junction block. If the connections are all clean and tight, and there are no breaks or chafes in the wire from the bayonet connection to the tank, then a new AC tank unit must be installed.

AUTO-LITE FUEL GAUGES

THERMOSTATIC TYPE

Figs. 4 and 5—With this type gauge two wires are used to connect the dash unit with the tank unit. The dash unit contains two thermostatic strips heated by resistance wires wound around the strips. The two bimetal strips that are not heated take care of variations in temperature.

The two terminals of the dash unit marked "1" and "2" are connected by separate wires to the tank unit terminals marked "1" and "2".

Movement of the float arm in the tank, due to changes in fuel level, moves a contact arm across a resistance winding in the tank unit. This varies the resistance in the windings of the dash unit, raising and lowering the temperature of the bimetal strips. The strips bend, depending upon the amount of heat they receive, moving the gauge pointer.

Due to the heating of the bimetal strips, the thermostatic type fuel gauge action is slow, and the pointer does not react to sudden changes in fuel level due to sloshing of the gasoline in the tank.

SERVICE—The gauge can be tested by using a spare tank unit known to be in good condition. The procedure is as follows:

1. Disconnect wires from terminals marked "1' and "2" on the tank unit.
2. Connect the disconnected wires to the corresponding terminals of the spare tank unit.
3. Then, connect a third wire to the frame of the spare tank unit to any good grounding point on the car.
4. Turn on ignition switch. Allow about one minute for the dash unit to heat, then operate the float arm of the spare tank unit (see Fig. 2).
5. If dash unit does not indicate correctly, install a new Auto-Lite dash unit. If dash unit works properly, the fault is in either the wiring or the tank unit.
6. If the dash unit is okay, reconnect the wires to the terminals and disconnect the wires from the tank unit. Ground the No. 1 wire and allow approximately one minute for the dash unit to reach its indication—which should be above the "Full" position. Then ground both wires and the gauge should return slowly to the "½ Full" position. If the indications are not as described it indicates a grounded or open-circuited wire which should be repaired.

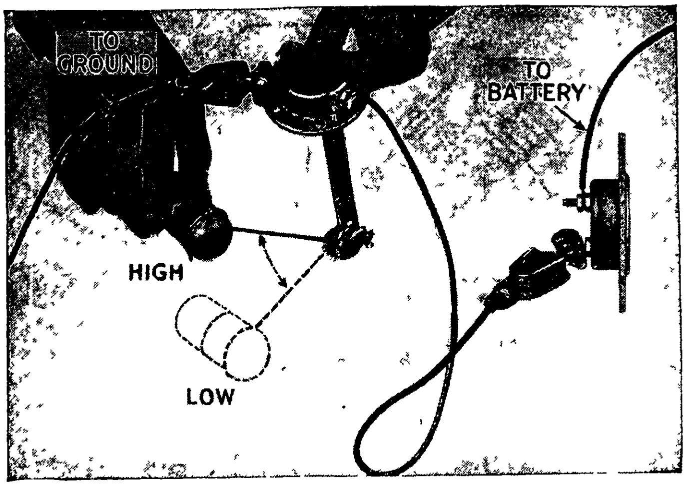


Fig. 2 Showing use of spare tank unit to check operation of dash unit

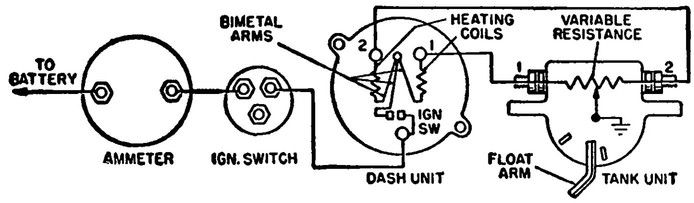


Fig. 5 Wiring diagram of Auto-Lit thermostatic type fuel gauge

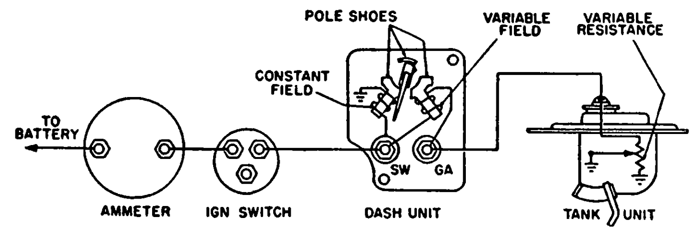


Fig. 6 Wiring diagram of Auto-Lit magnetic type fuel gauge

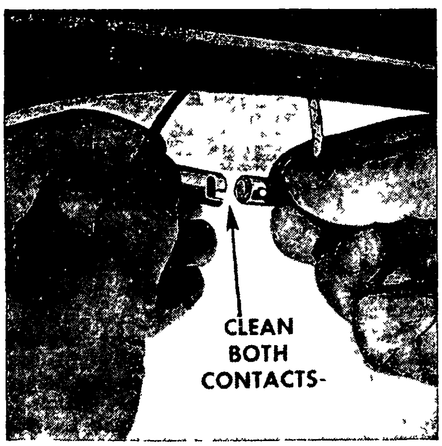


Fig. 3 AC fuel gauge connections

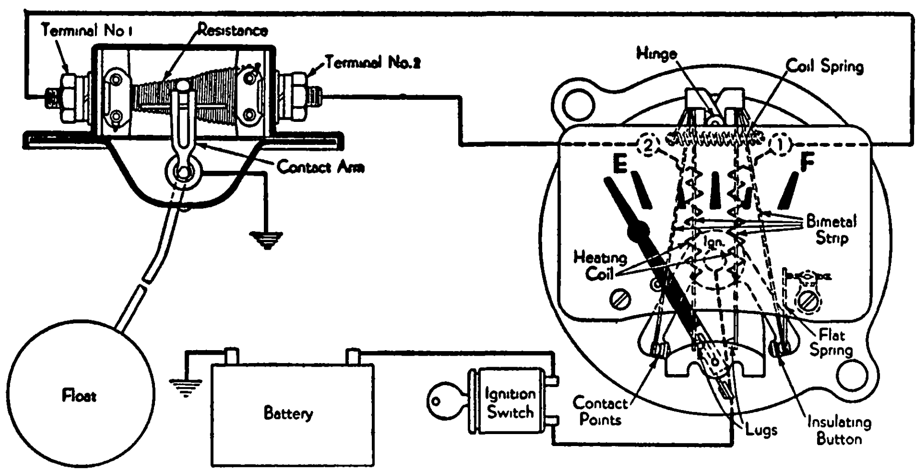


Fig. 4 Auto-Lite thermostatic fuel gauge

7. By elimination, if the gauge operates correctly in the above tests, the tank unit can be regarded as the cause of the original inoperation.

8. When reconnecting the leads to the dash or tank units, be careful not to interchange them as this would reverse the indications.

9. Erratic or incorrect indications may be caused by a loose connection or ground in the wiring or terminals. A fluctuating pointer is usually caused by dirty contacts in the dash unit. Sticking pointers may be caused by a bent pointer or frame or by interference between the gauge and dash panel. Remove the gauge from the panel and inspect for a bent pointer or pointer bearings. Check to see that there is a slight amount of end play in the pointer shaft and that the pointer turns freely. Clean the contacts by drawing a strip of clean bond paper between them.

MAGNETIC TYPE

Fig. 6—The dash unit has two magnetic circuits, each having a separate winding to produce two distinct magnetic fields. One of the windings is grounded internally, and sets up a constant pull toward the "Empty" indication when the ignition switch is turned on. The other winding, called the variable field winding, is grounded through the tank unit. This winding pulls the pointer across the gauge dial to indicate the amount of fuel in the tank.

The tank unit contains a resistor and a contact arm which moves as the float moves. The tank unit case is grounded to complete the fuel gauge circuit.

The magnetic field around the variable winding changes with a change in the amount of the fuel in the tank. As the float in the tank moves from "Full" to "Empty", the strength of the magnetic field is gradually reduced. When the float moves from "Empty" to "Full", the strength of the magnetic field is increased.

The pointer is mounted on a magnetic vane which is attracted by the two lower magnetic poles and assumes a position between them depending upon the combined magnetic field. A counterweight is mounted on the pointer to bring the reading back to "Empty" whenever the ignition is turned off.

SERVICE—If the gauge does not give an accurate indication of the amount of fuel in the tank, check to locate the trouble as follows:

1. Disconnect the lead from the "GA" terminal on the back of the dash unit.

2. Turn on the ignition and the pointer should stay against left stop pin ("Empty").

3. Ground the "GA" terminal and the pointer should move to the right stop pin ("Full").

4. Check the wiring from the ignition switch to the "SW" terminal and replace the dash unit if it does not act as described.

5. Reconnect the lead to the "GA" terminal and disconnect the lead from the tank unit. The gauge should stay against the left stop pin when the ignition is turned on. If it indicates "Full", look for a ground in the wiring between the dash and tank units.

6. Ground the lead at the tank unit. If the gauge does not move to the right pin, look for open circuit in wire.

NOTE—The above tests checked for faults in the dash unit variable field winding and for opens or grounds in the connecting wires, but did not check the

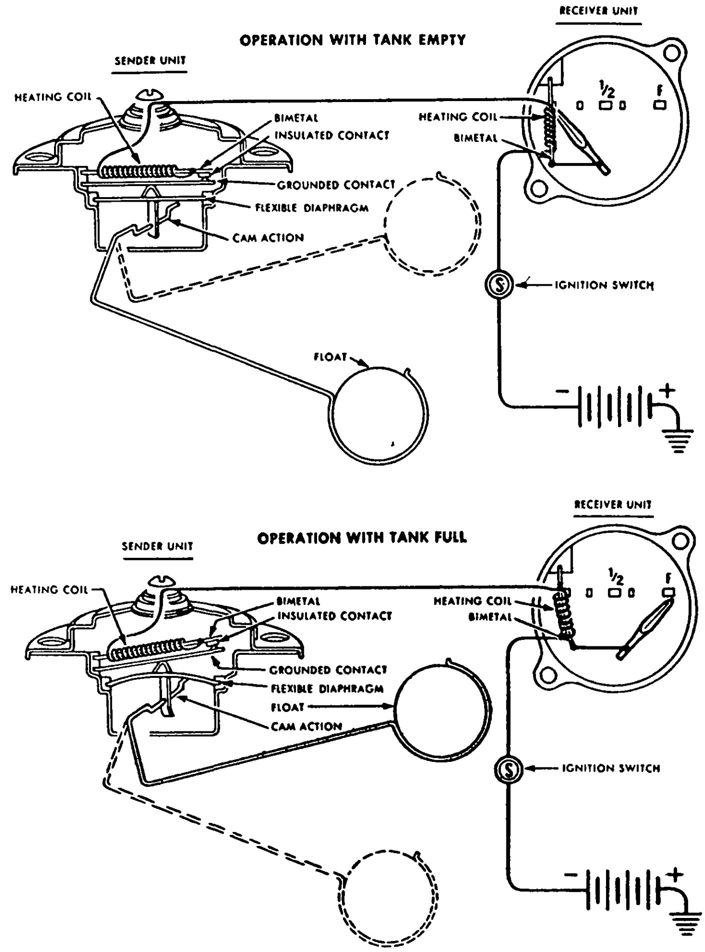


Fig. 7 Ford and King-Seeley fuel gauges

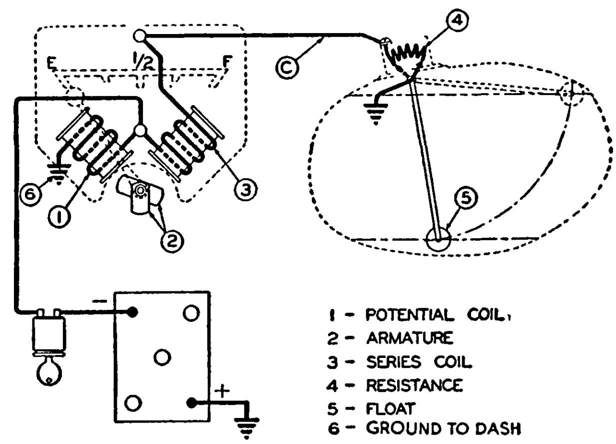


Fig. 8 Stewart-Warner fuel gauge

constant field winding or tank unit. To test these parts, proceed as follows:

1. Connect a spare tank unit, known to be in good condition, to the "GA" terminal on the dash unit and ground the tank unit case.

2. Operate the float arm manually and observe the readings. If the dash unit indications are incorrect, remove and calibrate the dash unit; if the dash unit indicates correctly, replace the tank unit.

3. If no spare tank unit is available to make this check, remove the tank unit and use it for the above check. If the dash unit constant field winding is open or grounded, the gauge will read "Full" over a large part of the float arm movement. If the tank unit is faulty, the gauge will be erratic or will not operate at all.

4. If the operation of the gauge is erratic it may indicate that there is interference with the pointer movement. Remove the dash unit and inspect the pointer and armature assembly. Straighten the pointer if it has been bent and rubs against the dial and frame. Check to make sure there is a slight amount of end play in the pointer shaft and that the bearing plates have not been bent out of alignment.

5. Make sure bearings are clean. If the adjustable bearing is loose, or after adjusting the end play, apply a drop of air drying varnish to prevent the bearing from turning. Later gauges do not have this adjustable bearing screw; the shaft being held in position between the bearing plates, the upper one being loose and held in place by the dial screws. In no case should varnish be applied to this type bearing and adjustment is not necessary.

6. To calibrate the dash gauge, remove it from the panel and mount it in the same position. Check to make sure the pointer turns easily and returns to the left hand stop (empty) from any position. The pointer should return promptly and have a very slight bank against the stop.

7. Connect the "SW" terminal on the dash unit to one battery terminal and ground the dash unit frame to the other battery terminal.

8. Connect the tank unit to the "GA" terminal and connect the tank unit case to the battery ground terminal.

9. Place the float arm in the "Full" position and turn the right hand pole shoe so that the pointer just indicates "Full".

10. Place the float in the "Empty" position and turn the left hand pole shoe to give the correct indication.

11. To rotate the pole shoes, pry the U-shaped lug on the top edge of the shoe.

12. Check the indications at the "Full", "½ full" and "Empty" positions.

13. When calibrating, it may be necessary to spread or reduce the indicator movement. This is done by bending the upper shoe to increase or decrease the air gap between the pole and armature.

14. After all adjustments are completed, apply a drop of air drying varnish to each shoe to prevent slipping.

KING-SEELEY & FORD FUEL GAUGES

Fig. 7—This type gauge consists of a receiver and sender unit. The sender, of course, is the tank unit whereas the receiver is the dash unit.

The sender unit contains a heating coil formed around a bimetal strip, and an external float which varies the height of a grounded spring contact, which in turn increases or decreases the tension of the bimetal strip.

The receiver unit contains a similar heating coil and bimetal strip, linked to a pointer. The receiver unit is series connected to the ignition switch and, therefore, operates only when the ignition switch is turned on.

When the fuel tank is empty, the float of the tank unit is at the bottom of its movement and the two contacts are just touching. With the ignition switch turned on, current flows through the circuit and heat is generated in the heating coil, causing the bimetal strip to bend. Bending of the bimetal opens the contacts and the circuit is broken. The heating coil and bimetal then cools and the spring returns to its former position where contact is again made.

Since the heating coils of the two units are connected in series, a similar slight bending of the bimetal strip in the dash unit takes place, which is just sufficient to pull the pointer to the "Empty" position.

When the fuel tank is filled, the action of the float and eccentric shaft (some units have cams) raises the grounded contact against the insulated bimetal contact, bending the bimetal strip in the dash unit.

With the bimetal strip under tension, a greater amount of current is required to bend it sufficiently to break contact.

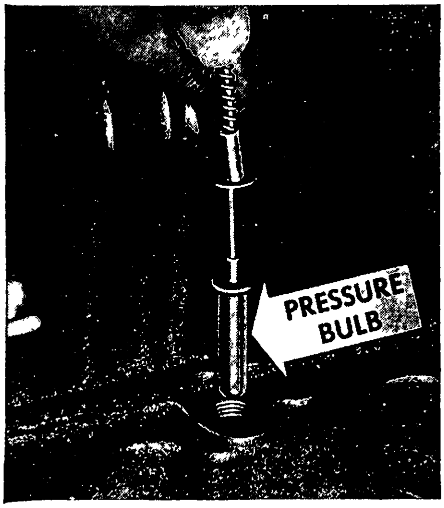


Fig. 9 Rem ving vapor pressure bulb fr m engine block

A similar increased bending of the bimetal strip in the dash unit occurs and this action pulls the needle over the "Full" position on the dial. The cycle of opening and closing of the contacts is continuously repeated.

Because the bimetal strips heat and cool slowly, sudden changes of fuel level caused by the sloshing of gasoline in the tank are dampened and a steady reading of the average fuel level in the tank is indicated.

SERVICE—Trouble in the units or circuits may cause the gauge to indicate "Empty" at all times or the pointer may constantly rest beyond the "Full" mark.

Gauge Does Not Indicate — When the dash unit does not indicate the fuel level with ignition switch turned on, check the dash unit and wire to the tank unit as follows:

1. With ignition switch turned off, connect a jumper wire from the tank unit terminal to a convenient ground.
2. Turn the ignition switch on momentarily. Then if the dash unit gives an indication, the tank unit is defective and must be replaced.
3. If the dash does not show any indication after completing step 2, ground the tank-to-dash wire at the dash unit terminal.
4. Turn ignition on momentarily. If the dash unit now indicates, then the wire to the tank unit is defective and must be repaired or replaced. However, if the dash unit fails to indicate, then the dash unit is defective.

CAUTION—In making tests, be sure to turn off the ignition switch before the pointer reaches the full end of the scale, otherwise damage to the dash unit will result. A defective tank unit or wiring may have damaged the dash unit. After installing a new dash unit, observe its action after turning on the ignition switch momentarily. If the pointer moves beyond the "Full" mark, then the tank unit or wiring is defective and must be replaced.

In rare cases, a false indication of fuel level would be obtained if a leak developed in the tank unit float. If this condition is found, replace the complete tank unit.

Gauge Indicates Beyond "Full" Mark—When this condition occurs, regardless of the quantity of fuel in the tank, make the following tests to determine the source of the trouble.

1. Disconnect the dash-to-tank unit wire and connect a jumper wire to the two terminals. Turn the ignition switch on momentarily and if the dash unit registers the correct amount of fuel present in the tank, look for a short in the dash-to-tank unit wire.
2. If the gauge still indicated beyond the "Full" mark after completing step 1, disconnect the jumper wire from the tank unit terminal. Turn on the ignition switch and if the gauge indicates the amount of fuel in the tank, then the short is in the tank unit and it must be replaced.
3. If the dash unit still indicates beyond the "Full" mark after completing steps 1 and 2, then the trouble is in the dash unit and it must be replaced.

NOTE—If the tank unit is equipped with a condenser which may be shorted, remove the wire connecting it to the tank unit and check the action of the dash unit. A defective condenser can cause damage to the dash unit. If the dash unit checks okay with the condenser disconnected, then replace the condenser.

STEWART-WARNER FUEL GAUGE

Fig. 8—This type gauge consists of an ammeter and rheostat. The ammeter, which is calibrated in gallons, is the dash unit and its readings are dependent on the amount of current passed to it by the float controlled rheostat—which is the tank unit. If the gauge fails to function properly, make the following tests:

1. Make sure that all wiring connections are tight and electrically secure; that the line from the tank unit to the dash unit is not grounded or open, and that the dash unit and tank unit are well grounded.
2. Disconnect the wire running from the tank to the dash unit at the tank terminal and ground it to the frame while the ignition is on. If the gauge now reads full and drops to empty when the wire is removed from the ground on the frame, the tank unit is faulty. If the dash unit behavior is not as just described when the wire is grounded to the frame and then removed, a defective dash unit is indicated.

If the tank unit is faulty, be sure to have the ignition turned off before removing it from the tank.

AC TEMPERATURE GAUGES

VAPOR PRESSURE TYPE

This type gauge consists of a metal case, enclosing a dial, a frame and mechanism assembly. Hermetically attached to the frame socket is a capillary tube (connector) and immersion bulb. The immersion bulb contains a liquid, such as ether, whose vapor pressure is proportional to the temperature.

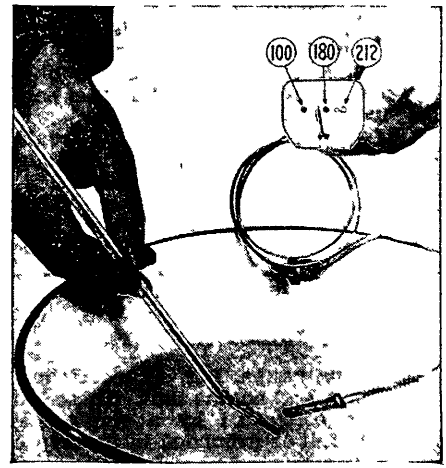


Fig. 10 Testing vap r type temperature guage

The expanded gas is directed up the capillary tube, and into the curved bourdon tube (C shaped) which has one end fastened to the mechanism frame. The applied pressure has a straightening effect on the bourdon tube and results in its free end moving outward in proportion to the pressure. Since the free end is connected to the pointer by a linkage, the bourdon tube movement is transferred to an indication on the dial. Because the vapor pressure is constant for any given temperature, the dial is calibrated directly in degrees Fahrenheit.

SERVICE—Vapor pressure gauge troubles are of three kinds: (1) The pointer movement is sticky, jumpy or uneven. (2) The pointer does not move at all. (3) The pointer shows temperatures which are obviously incorrect.

Most automotive engines are designed to operate at temperatures between 140 and 180 degrees. Should the gauge read consistently higher than normal operating temperatures, the engine may be overheating due to one or more of the following:

1. Broken or loose fan belt.
2. Collapsed radiator hose.
3. Frozen radiator.
4. Obstruction in front of radiator, such as dirt or insects.
5. Thermostat out of order.
6. Radiator pressure cap (if fitted) not operating properly.
7. Poor engine lubrication.
8. Low water level in radiator and cooling system.

After the cooling system is thoroughly checked, test the temperature gauge to make sure that nothing is wrong with it. The procedure is as follows:

1. Drain water from radiator.
2. Loosen plug which holds vapor pressure bulb in engine block.
3. Remove the vapor pressure bulb from the engine, Fig. 9.
4. Place the vapor pressure bulb in a pail of hot water, Fig. 10. Also place a thermometer which reads up to 200

degrees F. or higher, and which is reasonably accurate in the hot water. Leave them in about three minutes.

5. If the temperature gauge is okay, the pointer should register the same temperature as the thermometer.

6. If this test shows that the trouble is in the gauge itself, the entire gauge should be replaced with a new unit.

7. When reinstalling one of these gauges in the engine block, don't use a wrench with too long a handle, and don't turn the bulb down too hard. A water-tight fit is all that is needed.

AC ELECTRIC TYPE

This type gauge, Fig. 11, consists of a dash unit and engine unit. These two units are connected by a single wire and each unit is grounded in its respective location.

The indicating unit consists principally of two coils spaced 90 degrees apart with an armature and integral pointer at the intersection of the coil axis. An inertia dampener is provided on the armature assembly to prevent vibration of the pointer on rough roads. The dial has a scale graduated in degrees Fahrenheit.

The engine unit has no moving parts and is essentially an electrical resistor which changes resistance with changes in temperature. The unit has a high resistance value when cold and a low resistance value when hot.

The change in engine unit resistance modifies the strength of the indicating unit coils and causes proper indication of the pointer.

SERVICE—Electric temperature gauge troubles are of four kinds: (1) The pointer doesn't move when the ignition switch is turned on. (2) The pointer indicates a high temperature whether the engine is hot or cold. (3) The pointer does not show temperature accurately. (4) The pointer indicates a low temperature whether the engine is hot or cold.

In addition to the above, any of the cooling system troubles listed under vapor pressure gauges can also affect the electrical unit.

Incorrect temperature readings are checked as follows:

1. Disconnect wire from binding post on end of engine unit.
2. Turn ignition switch on.
3. Hold end of wire away from all wires or other metal.
4. Check dash unit. The needle should point to the low mark or "100".
5. Touch the bare end of the wire to the engine block.
6. Check dash unit again. The needle should then point to over "212" or the high mark.
7. If the dash unit reads as described in steps 4 and 6, it indicates reasonable performance of the dash unit and the connecting wire. In this event, the engine unit should be checked as described below. But if the dash unit does not indicate properly, then first check the wire. If it is okay, replace the dash unit.
8. To check the engine unit, drain the water from the radiator.
9. Disconnect the wire which is attached to the engine unit, Fig. 12.

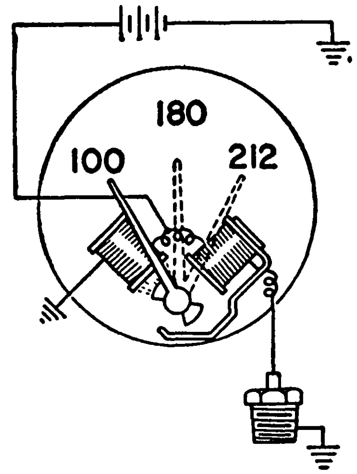


Fig. 11 Diagram of an AC electric temperature gauge

10. Loosen the engine unit and lift it out.
11. Reconnect the lead wire to the engine unit. Ground the threaded portion to a convenient point on the car with suitable wire and clamps.
12. Get a pail or other suitable recepticle and fill it with hot water. Also a thermometer having a reading of 200 degrees F. or higher which is known to be reasonably accurate. Place the threaded end of the engine unit *part way* down into the hot water. Place the thermometer in also. Leave them in the water for about three minutes. Do not let any water get above the threads on the engine unit as to do so may ruin the unit.
13. If the dash unit is okay, the pointer should indicate the same temperature as the thermometer. If the pointer does not indicate correctly, replace the engine unit.

AUTO-LITE TEMPERATURE GAUGES

VAPOR PRESSURE TYPE

This type gauge operates and is serviced in the same manner as described for AC vapor pressure gauges.

ELECTRIC TYPE

This type gauge, Fig. 13, includes two units. The dash unit has three magnetic poles, two of which have windings. One of these windings is connected to the ignition switch and to ground and creates a steady magnetic pull toward the low mark on the scale. The other winding is also connected to the ignition switch but it is grounded by the engine unit. It creates a magnetic pull toward the maximum temperature position the strength of which is dependent upon the amount of resistance inserted in the circuit by the engine unit.

The engine unit is actuated thermally without moving parts. The resistance unit in the engine unit is made of special metal oxides in the form of a flat disc that changes resistance as its temperature varies. When it is hot, the resistance inserted in the variable field circuit is reduced and the pointer is attracted toward the "Hot" position.

Fig. 12 Disconnecting wir fr m electric type temperatur gaug

The pointer on the dash unit is mounted on a magnetic vane which is attracted by the two lower magnetic poles and assumes a position between them depending upon the combined magnetic field. A counterweight is mounted on the pointer to bring the reading back to zero whenever the ignition is turned off.

SERVICE — The procedure for testing these gauges is the same as described for the AC electric temperature gauge.

KING-SEELEY & FORD TEMPERATURE GAUGES

These units, Fig. 14, consists of a sender unit located in the cylinder head and series connected to the receiver or dash unit. The illustrations show the two engine units, one for each cylinder head on 1949 and later Lincoln and Mercury engines. When only one sender unit is used, as is the case with an "In-Line" engine the single terminal sender unit is used.

The single terminal sender unit consists of a heating coil formed around a bimetal strip, insulated from the grounded frame. A grounded contact is attached to the frame in alignment with the bimetal contact.

The double terminal sender unit is similar in outward appearance to the single terminal unit with two terminals provided to allow series connection between the receiver unit and the single terminal unit in the opposite cylinder head. As shown in the illustration, this unit consists of a bimetal strip with a contact point, insulated from a supporting frame. The frame also supports a phosphor bronze spring with a contact point in alignment with the bimetal contact, both insulated from ground.

The bimetal assemblies of both sender units are sealed in their respective waterproof casings. The receiver and sender units are both calibrated at the factory and if either one become defective, it should be replaced with a new one.

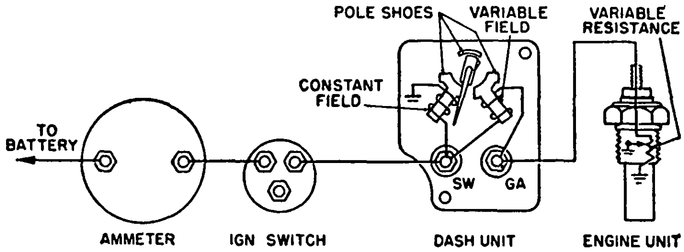


Fig. 13 Wiring diagram of Auto-Lite electric temperature gauge

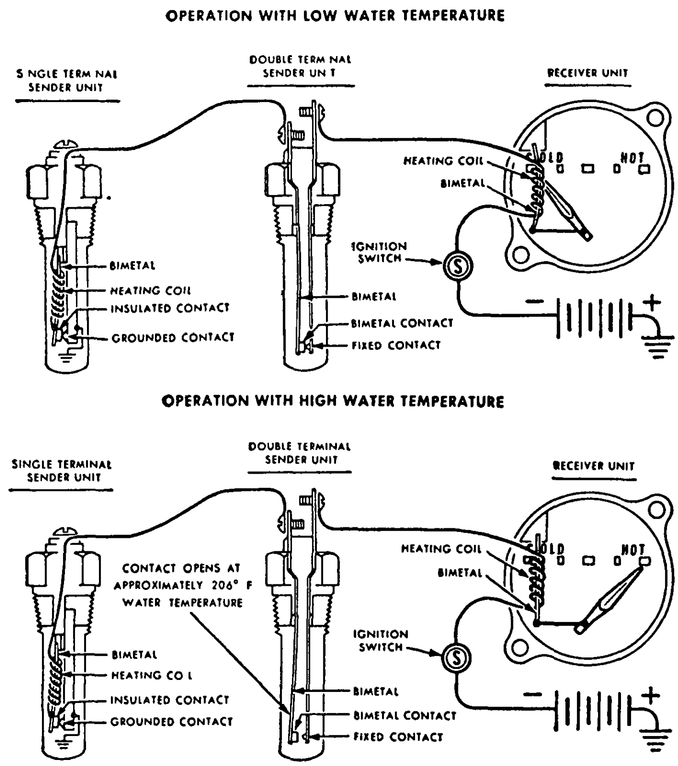


Fig. 14 Ford and King-Seeley temperature gauges. The diagrams show the installation on 1949 and later Lincoln and Mercury engines in which two engine units are used, one in each cylinder head

OPERATION — The dash unit is connected to the ignition switch and to the series connected engine unit (or units) The dash unit will indicate water temperature only when the ignition switch is turned on When the ignition is turned off, the pointer will register at the "Hot" position This does not indicate that the cooling system is overheated but that the pointer is at its normal at rest position

The dash unit, operated by a heater wire on a bimetal strip, is connected to a bulb in the cylinder head (or one bulb in each cylinder head as in Fig 14) The bulbs have similar bimetal strips as the dash unit When the ignition is turned on, current will pass through the dash unit and the engine unit (or units) The single terminal engine unit is normally grounded However, as the current passes through the engine unit (or units), heat is generated in the single terminal engine unit bimetal, causing it to bend and open the contact to ground Flow of current is then stopped, permitting the bimetal to cool and return to its normal, grounded position and the cycle is again repeated

The same amount of current passes through the dash and engine units since they are connected in series with each other This current also causes the bimetal in the dash unit to become heated and pull the pointer over to the left or right, depending on the temperature of the water. The cycle of opening and closing of the engine unit contact points is repeated continuously

When the temperature of the water increases, the heat from the circulating water around the single terminal engine unit supplements the heat generated by the current passing through the units, reducing the amount of current necessary to cause the bimetal to draw away from the fixed contact With less current flowing through the engine unit (or units), less current likewise flows through the dash unit and deflection or bending of the bimetal in the dash unit is lessened

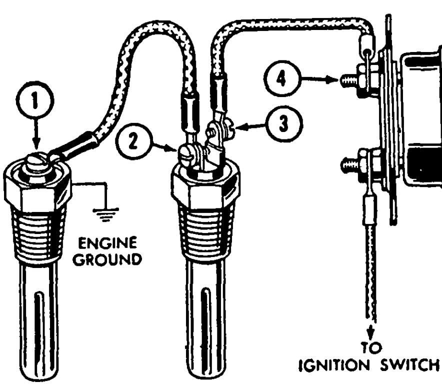


Fig. 15 Check points f r testing Ford and King-S l y temp ratur gauges wh n tw engine units are used

SERVICE — When the dash unit does not register with the ignition switch turned on, check the engine unit (or units) and wires as follows

1 With the ignition switch turned off, short out the single terminal engine unit by clipping one end of a jumper wire to its terminal and the other end to ground

2 Turn ignition switch on momentarily If the dash unit now gives an indication, then the single terminal engine unit is defective and must be replaced

3 On Lincoln and Mercury engines using two engine units, check the double terminal engine unit as follows If the dash unit does not register as in step 2, ground terminal "2" of the double terminal engine unit to which the wire connecting the single terminal unit is attached, Fig 15 Turn the ignition switch on momentarily and observe if the dash unit registers If it does, then the wire connecting the two engine units is defective

4 If the dash unit does not register as in step 3, move the clip of the ground wire to terminal "3" of the double terminal engine unit Turn the ignition switch on momentarily If the dash unit now registers, then the double terminal engine unit is defective and must be replaced

5 If the dash unit does not register as in step 4, ground terminal "4" at the dash unit, Fig 15 If the dash unit registers, then the wire connecting the double terminal engine unit to the dash unit is defective If the dash unit is still inoperative after the preceding tests, replace the dash unit

WARNING—In making the above tests, turn off the ignition before the pointer reaches the end of the scale, otherwise the dash unit will become damaged or burned out

AC OIL PRESSURE GAUGES

PRESSURE EXPANSION TYPE

This type gauge is similar in principle to the vapor-pressure type of water temperature gauge previously described In this unit, however, oil under pressure passes from the engine unit up the connecting tube to the dash unit As the pressure builds up it has a tendency to straighten out the C-shaped bourdon tube in the dash unit and thus move the pointer attached to the free end of the tube

As with the water temperature gauges, engine factors should be considered when checking oil gauge operation Engine oil should be brought to normal temperature Pressure at idling speed will vary from 3 to 15 lbs depending on the make of car Above 30 mph engine speed the gauge should show between ½ and ¾ distance across the dial

If the gauge is jumpy, sticky or un-

even in its operation it must be replaced. If it is suspected of being off its calibration, another gauge known to be accurate can be connected to the oil line and checked. If the new gauge indicates correctly, it proves that the old gauge is defective.

Occasionally the operation of the unit can be improved by using a fine wire to clear any accumulation of oxide that may plug the small hole in the oil gauge connection.

Also check the oil line from engine to gauge for leaks. Loosen the nut but do not remove the oil line at the engine block while the engine is running. If oil runs out, the trouble is in either the oil line or dash unit.

ELECTRICAL TYPE

This gauge, Fig. 16, consists of a dash and engine unit connected by a single wire. Each unit is grounded in its respective location.

The indicating unit consists principally of two coils spaced 90 degrees apart with an armature and integral pointer at the intersection of the coil axis. An inertia dampener is provided on the armature to prevent vibration of the pointer on rough roads. The dial has a scale graduated in pounds per square inch.

The engine unit consists of a housing enclosing a diaphragm and linkage which moves a contact over a resistance proportional to oil pressure. The change in engine unit resistance modifies the strength of the indicating unit coils and causes proper indication of the pointer.

SERVICE — Electrical oil pressure gauges are subject to five kinds of troubles:

1. The pointer will not move when the ignition switch is on. Probable causes are (a) defective dash unit, (b) break or poor connection between battery and dash unit, (c) dash unit not grounded.
2. The pointer indicates "high" all the time: Probable causes are (a) defective engine unit, (b) break in dash to engine unit wire, (c) engine unit improperly grounded.
3. The pointer indicates "low" all the time: Probable cause is a short to ground at engine unit terminal or in dash-to-engine unit wire.
4. The pointer never indicates low and is always too high: Probable causes are (a) loose or dirty connections, (b) defective dash unit, (c) defective engine unit.
5. The pointer never indicates high and is always too low: Probable causes are (a) partial ground at engine unit terminal or in dash-to-engine unit wire, (b) defective dash unit, (c) defective engine unit.

To locate the trouble, use the same testing apparatus pictured in Fig. 2 for testing AC fuel gauges, and proceed as follows:

1. Turn off ignition switch.
2. Disconnect one of the battery cables.
3. Disconnect the wire from the oil gauge dash unit which runs to the engine unit.
4. Using the spring clip, connect the colored tester wire to the binding post

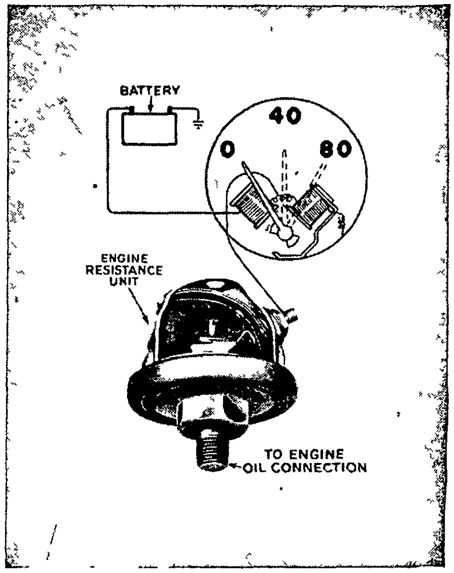


Fig. 16 AC electric oil pressure gauge

from which the wire was removed.

5. Connect the black tester wire to the flange of the tester and to any convenient ground—such as the unpainted part of the instrument panel.
6. Turn on the ignition switch.
7. Connect the battery cable. Move the arm of the tester back and forth slowly, Fig. 2. If the dash unit is okay, the pointer will move from the low mark to the high mark freely. If the pointer doesn't move, the dash unit is defective and a new one should be installed.
8. If the dash unit proves to be okay, the next step is to test the wiring between the dash and engine unit. This also can be done with the tester as follows:
9. Turn the ignition switch off and disconnect one battery cable.
10. Follow the wire from the dash to the engine unit, and disconnect the wire at the engine unit.
11. Attach the colored tester wire to the end of the wire which runs to the dash unit. Attach the black tester wire to any convenient ground, such as an unpainted part of the engine.
12 Connect the battery cable. Move the arm of the tester back and forth. If the wiring is okay, the pointer on the dash unit will move from the low mark to the high mark freely. If the pointer doesn't move, or only moves part way, the trouble is in the wire from the dash to engine unit. Repair or replace the wire.
13. If the pointer does move correctly, then the trouble is in the engine unit. If the connection at the engine unit is clean, then a new engine unit must be installed.

AUTO-LITE OIL PRESSURE GAUGES

PRESSURE EXPANSION TYPE

This type gauge is similar to the one described for AC and service is performed in the same manner.

ELECTRIC TYPE

This type gauge, Fig. 17, consists of a dash and engine unit. The dash unit has three magnetic poles, two of which have windings. One of these windings is connected to the ignition switch and to ground and creates a steady magnetic pull twoards the "zero" position when the ignition switch is turned on. The other winding is also connected to the ignition switch but is grounded by the engine unit. It creates a magnetic pull toward the maximum pressure position, the strength of which is dependent upon the amount of resistance inserted in the circuit by the engine unit.

The engine unit has a resistance with a sliding contact which is actuated by the oil pressure. When pressure is applied to the diaphragm in the engine unit, resistance is shorted out.

The pointer is mounted on a magnetic vane which is attracted by the two lower magnetic poles and assumes a position between them depending upon the combined magnetic field. A counterweight is mounted on the pointer to bring the reading back to zero whenever the ignition is turned off.

SERVICE—To test a gauge which does not give true indications of the oil pressure, make sure electricity is reaching the dash unit. This can be checked as follows: With ignition switch turned on, connect a test lamp from the "SW" terminal on the dash unit to a ground. If the lamp does not light it indicates no current is reaching the gauge, and the ignition switch, ammeter and wiring should be thoroughly inspected.

If current is reaching the gauge, disconnect the lead from the engine unit and again turn on the ignition. The pointer should stay against the left stop pin (no pressure side). Ground the engine unit lead and the pointer should stay against the right stop pin (high pressure side).

If the test results are not as described above, the source of the trouble may be found by following the same procedure outlined for AC electric oil pressure gauge, but using an Auto-Lite fuel gauge tank unit.

KING-SEELEY & FORD OIL PRESSURE GAUGES

These gauges, Fig. 18, consist of a dash unit and engine unit. The dash unit is connected to the ignition switch and in series with the engine unit. When the ignition switch is turned off, the pointer will rest at the extreme left position.

The engine unit contains a diaphragm which is deflected in proportion to the pressure of the oil in the line. When the diaphragm is deflected, an electrical circuit is closed, allowing current to flow through a heating coil wound around a bimetal strip. Heat, generated in this coil, deflects the bimetal to the point where the contact is opened. The bimetal then cools and returns to its original position, which again closes the electrical circuit. This cycle of opening and closing is repeated continuously.

The dash unit contains a similar

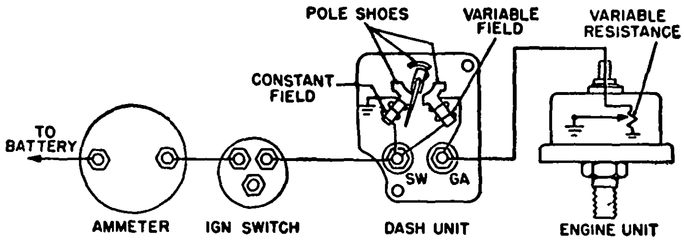


Fig. 17 Aut -Lite electric oil pressure gauge wiring diagram

heating coil formed around a bimetal, connected in series with the coil in the engine unit As heating takes place in the engine unit, heating also takes place in the dash unit, causing the bimetal strip in each unit to deflect simultaneously

The pointer indicator is linked to the bimetal strip and oil pressure is indicated by the amount of deflection actuating the pointer

Increased oil pressure causes greater deflection of the diaphragm in the engine unit, therefore a greater amount of current is required to open the heating coil circuit This increased current is transmitted to the dash unit, causing a corresponding increased bending of the dash unit bimetal and resultant indication of increased oil pressure

The heating coil in the engine unit is shunted by a calibrating resistor at the time of assembly to assure accuracy of the unit

SERVICE—If the oil pressure gauge is not functioning properly, make the following tests in the order given until the source of trouble is found If the dash unit pointer indicates oil pressure upon turning on the ignition switch (engine not running) contacts in the engine unit may be frozen, the wire from the dash-to-engine unit may be shorted to ground, or the dash unit may be defective If this condition existed for any length of time, it is probable that the dash unit is damaged To check the gauge, proceed as follows

1 Check for loose connections at the terminals of the dash and engine units and connections at the ignition switch Inspect condition of wire from dash-to-engine units and wire from dash unit to ignition switch

2 Remove wire from engine unit terminal If pointer of dash unit now remains at zero position (ignition switch turned on momentarily and engine not running) then the engine unit is defective and must be replaced

3 If the pointer still registers after completing step 1, remove the dash-to-engine unit wire at the dash unit and observe the pointer when the ignition is momentarily turned on (do not start engine) If dash unit does not register now, then the wire between the two units is grounded and must be repaired or replaced

4 If pointer still registers after completing step 2, then the dash unit is defective and must be replaced After installing new dash unit, check its action to make sure engine unit and wiring are satisfactory

If dash unit does not indicate oil pressure with ignition on and engine running, connections and wiring appearing satisfactory, test as follows

1 With ignition switch turned off, short out the engine unit at the terminal Use a jumper wire with clips for this purpose Clip one end to the terminal screw of the engine unit and the other end to engine ground

2 Turn ignition on momentarily If dash unit now registers, then the engine unit is defective and must be replaced

WARNING—Turn ignition off before pointer of dash unit reaches the highest pressure mark on the scale In this test the full voltage of the battery is placed on the dash unit and if allowed to remain for a longer period of time, the unit will burn out

3 If the dash unit fails to register with the engine unit shorted out as in step 2, either the dash unit or the wire running to the engine unit is defective Turn ignition switch off and check the wire by clipping one end of the jumper wire to the dash unit terminal and the other end to ground **CAUTION** — Be sure grounding wire is not connected to ignition side of dash unit

4. Turn ignition on momentarily If dash unit fails to register, then the dash unit is defective

5 A defective engine unit or wiring may have damaged the dash unit After installing a new dash unit, observe its action after turning ignition on momentarily If the indicator moves beyond the point of normal oil pressure, the engine unit or wiring is defective and must be checked

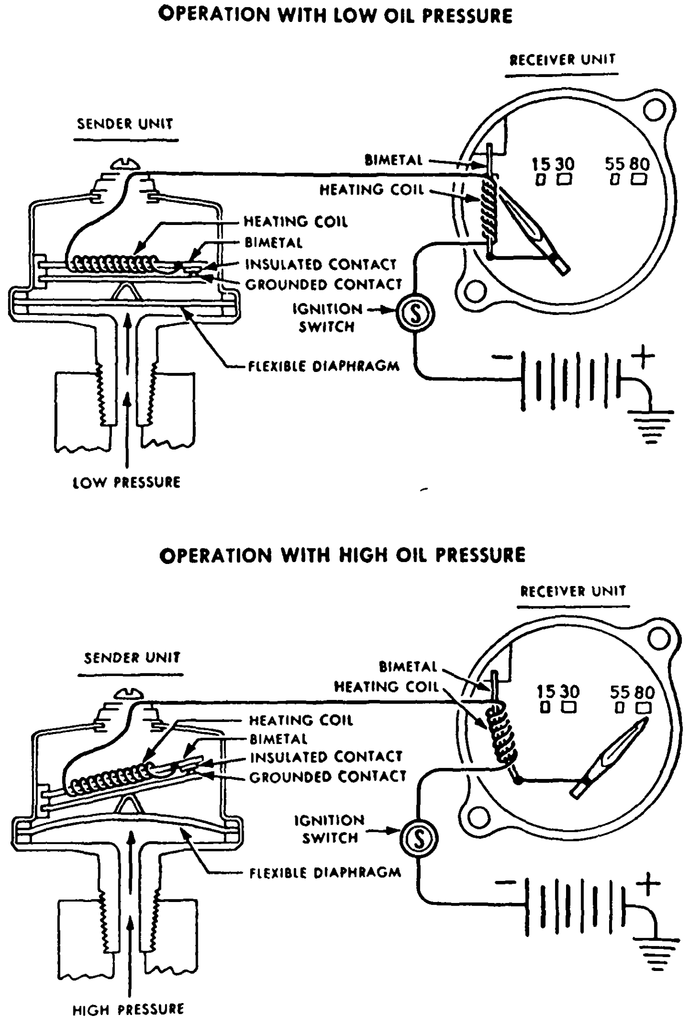


Fig. 18 Ford and King-Seeley electric oil pr ssure gaug

AMMETERS

Automotive ammeters indicates direction of current flow (charge or discharge) and the relative amount of current flow The center point of the dial, Fig 19, is the point of zero current flow and the two extremes of pointer travel indicate maximum charge and discharge Therefore, the indicator must not be read for the amount of current charge or discharge but only for charge condition of the generating system

The typical ammeter consists of a frame to which is attached a permanent magnet The frame also supports an armature and pointer assembly When no current flows through the ammeter,

the magnet holds the pointer armature so that the pointer stands in the center of the dial. When current passes in either direction through the ammeter, the resulting field attracts the armature away from the effect of the permanent magnet, thus giving a reading proportional to the current strength.

SERVICE—When the ammeter apparently fails to register correctly, there may be trouble in the wiring which connects the ammeter to the generator and battery, or in the generator and battery themselves. There are only a few simple things to check in order to find the cause:

1. Loose connections on the back of the ammeter.
2. Loose connections at the back of the ignition switch, or at the battery. (Ammeters are not grounded to the instrument panel.)
3. Spots on the wiring where the insulation has been chafed, burned or broken.

To check the connections, first tighten the two binding posts on the back of the ammeter. Then, following each wire from the ammeter, tighten all connections on the ignition switch, battery and generator. Chafed, burned or broken insulation can be found by following each ammeter wire from end to end.

After checking and repairing the wiring, tighten all connections and turn the ignition switch on. The pointer should point to the discharge side of the dial slightly. Start the engine and speed it up to about 30 mph. The pointer should then move to the charge side of the dial and its movement should be smooth.

If the pointer does not behave correctly the ammeter itself is out of order and must be replaced with a new one.

SPEEDOMETERS

The following material covers only that service on speedometers which is feasible to perform by the average service man. Repairs on the units themselves are not included as they require special tools and extreme care when making repairs and adjustments and only an experienced speedometer mechanic should attempt such servicing.

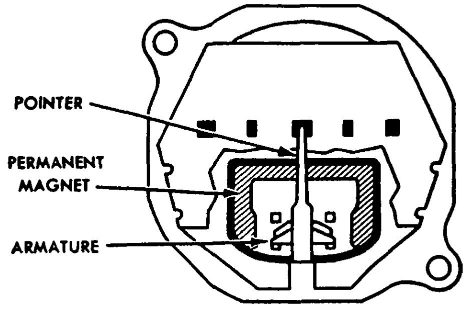


Fig. 19 Drawing of a typical ammeter or battery charge indicator

The speedometer has two main parts—the indicating head and the speedometer drive cable. When the speedometer fails to indicate speed or mileage, the cable or cable housing is probably broken.

SPEEDOMETER CABLE—Most cables are broken due to lack of lubrication, or a sharp bend or kink in the housing.

A cable might break because the speedometer head mechanism binds. If such is the case, the speedometer head should be repaired or replaced before a new cable or housing is installed.

A "jumpy" pointer condition, together with a sort of scraping noise, is due, in most instances, to a dry or kinked speedometer cable. The kinked cable rubs on the housing and winds up, slowing down the pointer. The cable then unwinds and the pointer "jumps".

To check for kinks, remove the cable, lay it on a flat surface and twist one end with the fingers. If it turns over smoothly the cable is not kinked. But if part of the cable flops over as it is twisted, the cable is kinked and should be replaced.

LUBRICATION—The speedometer cable should be lubricated with special cable lubricant every 10,000 miles. At the same time, put a few drops of the lubricant on the wick in the speedometer head.

Fill the ferrule on the upper end of the housing with the cable lubricant. Insert the cable in the housing, starting at the upper end. Turn the cable around carefully while feeding it into the housing. Repeat filling the ferrule except for the last six inches of cable. Too much lubricant at this point may cause the lubricant to work into the indicating hand.

INSTALLING CABLE—During installation, if the cable sticks when inserted in the housing and will not go through, the housing is damaged inside or kinked. Be sure to check the housing from one end to the other. Straighten any sharp bends by relocating clamps or elbows. Replace housing if it is badly kinked or broken. Position the cable and housing so that they lead into the head as straight as possible.

Check the new cable for kinks before installing it. Use wide, sweeping, gradual curves where the cable comes out of the transmission and connects to the head so the cable will not be damaged during its installation.

Arrange the housing so it does not lean against the cylinder head because heat from the engine may dry out the lubricant.

If inspection indicates that the cable and housing are in good condition, yet pointer action is erratic, check the speedometer head for possible binding.

The speedometer drive pinion should also be checked. If the pinion is dry or its teeth are stripped, the speedometer may not register properly.

The transmission mainshaft nut must be tight or the speedometer drive gear may slip on the mainshaft and cause slow speed readings.

HEADLAMPS

HEADLAMP SERVICE

Voltage and aiming are the two factors to be checked on Sealed Beam lamps. On earlier model cars, the lens, gasket, reflector, bulb, voltage, and aim require attention for maximum road illumination. On both types, if the aim is off one degree in elevation, the light will be off five feet at a point 300 feet in front, or ten feet 600 feet ahead. Hence a mis-aim of one degree can make a lower beam glaring and an upper beam less effective because the maximum light intensity is directed toward the sky. Downward mis-aim reduces vision to less than normal stopping distances.

Various types of mechanical aiming devices are available commercially and the manufacturers provide complete instructions as to their use in aiming all types of headlamps. If such a device is not at hand, all that is needed to service headlamps is sufficient space to permit aligning the car with an adjusting screen (or flat wall painted white) 25 feet from the lamps. The area need not be entirely dark, but the screen should be shielded from light from windows or lighting fixtures.

As shown in Fig. 3, vertical lines should be drawn at the center line of the headlamps and also at the car center line. A line three inches below the horizontal center line should be drawn.

As few garage floors are truly level over a large area, it is important that both vertical and horizontal lines on either screen or wall be accurately positioned in relation to the car. To do this, stand 36-inch sticks, Fig. 2, at front and rear hub caps on one side of the car. Then sight along the sticks to a point at this level on the screen. When the car is in place with properly inflated tires, measure from the floor to the center of the lamp or bulb. Then measure down from the 36-inch mark on the screen or wall to get the horizontal line three inches below the center line of the bulbs. Some state or local laws may require an

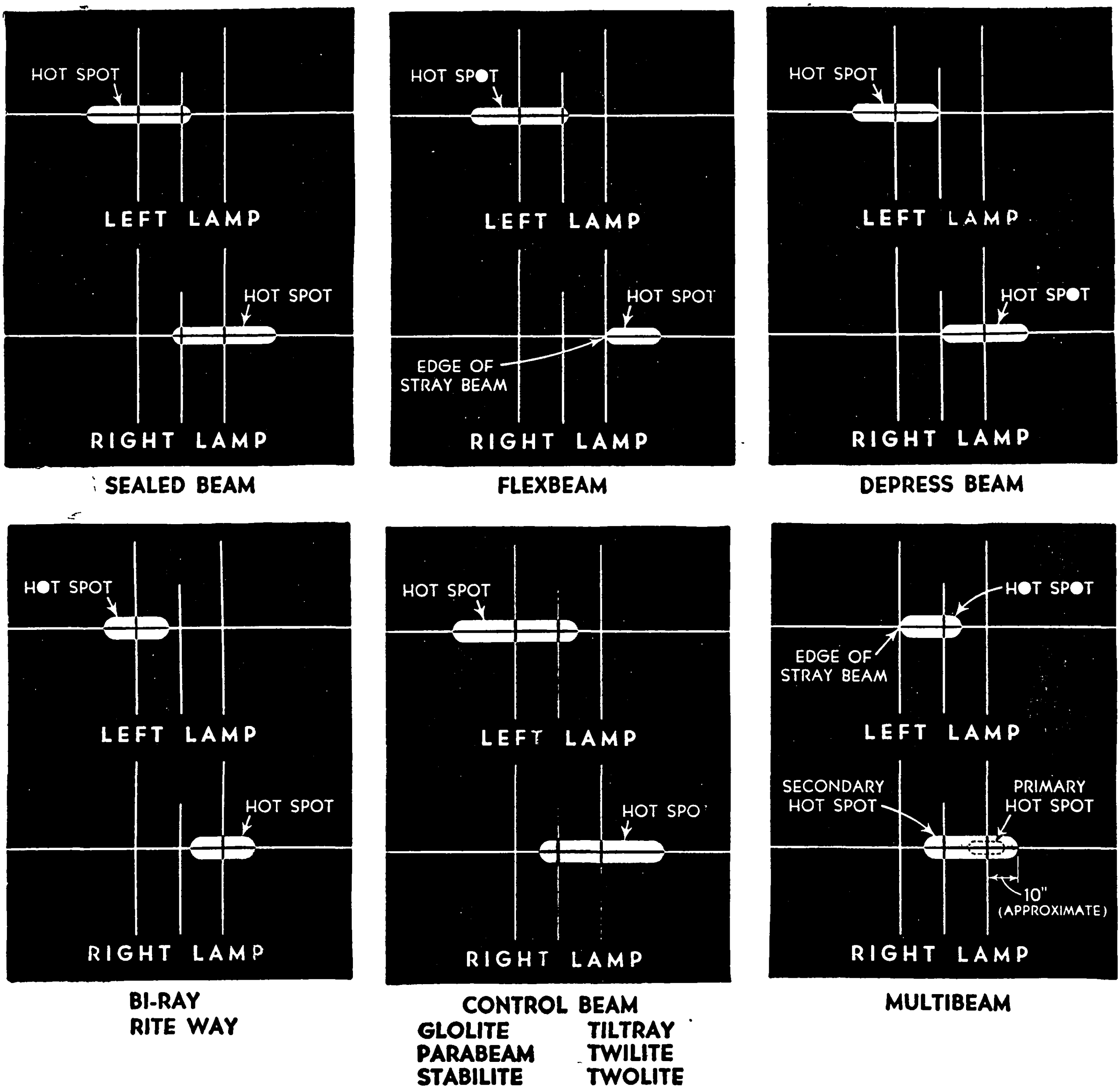


Fig. 1 How lamps should be aimed with upper beam on so that the spot (area with greatest intensity) falls as sh wn

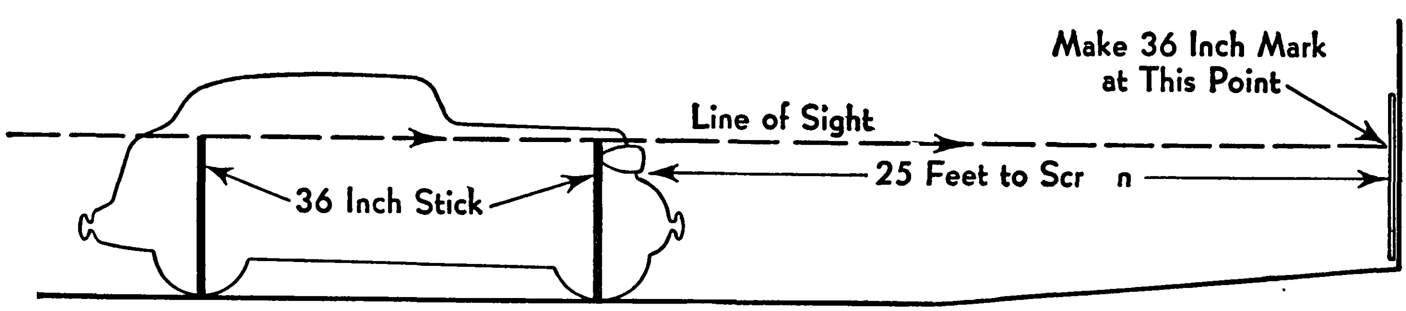


Fig. 2 Method f setting up headlamp aiming screen when fl r is n t truly level

alteration in the location of the horizontal line on which the hot spot falls.

With the unloaded car in place and the tires properly inflated, select the beam pattern for the particular lens you are servicing from Fig. 1. The lamps should be aimed with the upper beams on so that the hot spot or area of greatest intensity falls at the point shown in the beam pattern diagrams. To prevent interference or overlap of beams, one lamp should be covered when making adjustments on the other.

CHECKING VOLTAGE

Bulbs are designed to give their rated candlepower at a certain voltage and when the voltage at the socket varies, a sacrifice is made either in the amount of light delivered by the bulb or in the life of the bulb. Low voltage reduces the amount of light and high voltage reduces the life of the bulb.

High voltage is usually caused by setting the generator charging rate too high or to an improperly adjusted voltage regulator, when one is used. Low voltage is more frequently encountered and is usually caused by poor grounds or loose connections in the lighting circuit. All connections in the circuit should be checked, cleaned and tightened. Terminals improperly applied to the wire may produce a high resistance, and the same is true of terminals in which broken strands or corrosion has greatly reduced the area of contact, for corrosion and dirt prevent metal to metal contact. Undersized cables will also cause a voltage drop.

Voltage drop in the entire circuit can be checked with a bulb socket adapter which permits reading the voltage at the bulb socket and comparing it with the battery. A low reading voltmeter is handy in locating the source of trouble in the circuit. Replace the two prods that usually come on the voltmeter with two leads approximately 5 feet long. Connect a large battery clip to the end of one lead and solder a sharp prod or small ice pick to the end of the other lead.

To check the voltage drop, turn on the upper beam. With battery clip lead grounded, touch the other to the lamp body. There should be no reading. If there is a reading, the lamp is poorly grounded and the lamp mounting should be sandpapered clean of rust and dirt and the assembly tightened to form a good ground. Then check the voltage drop between the ground and the grounded battery terminal. There should be no reading. Next attach the clip to the starting motor terminal and touch the prod to the hot terminal of the battery. The voltage drop should be less than .1 volt. If an abnormal drop is encountered at either battery post, clean and tighten the terminals and replace the cables if necessary. With the voltmeter clip still connected to the starter terminal, pierce the insulation with the prod at each upper beam lead as close to the headlamps as possible. If the voltage drop is greater than .4 volt with a 21 cp bulb burning, .6 volt with a 32 cp bulb burning or greater than .9 volt with a 50 cp bulb burning, check all connections and units in the lighting circuit to locate the trouble. To check the units, leave the voltmeter clip on the starter terminal and place the prod first on the hot terrminal and then on the other terminal of the ammeter, fuse holder, lighting switch and the foot dimmer switch to check the voltage drop within these units. When trouble is located improve the contact or replace the defective unit.

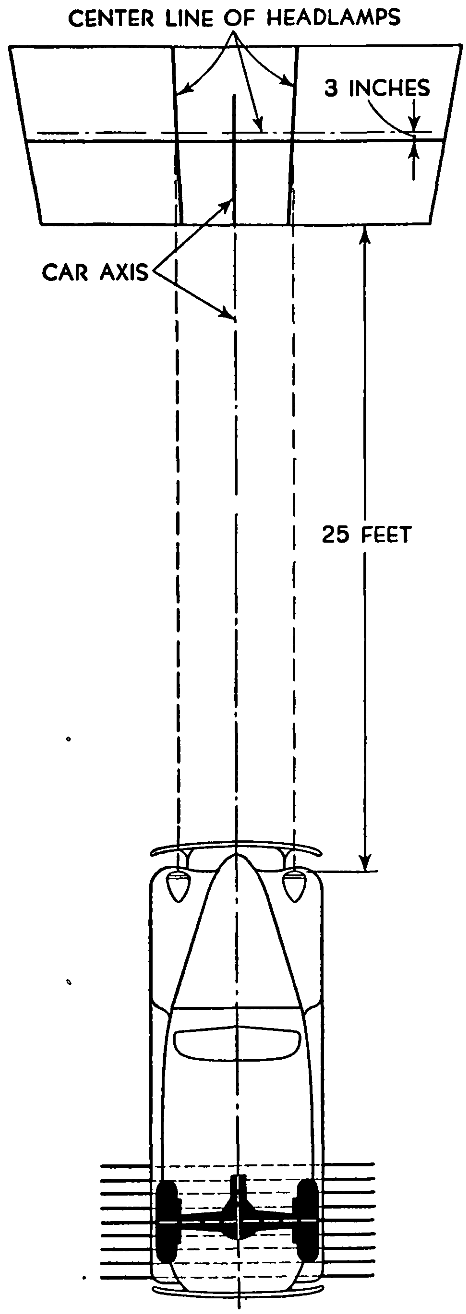


Fig. 3 Diagram showing how to lay out a screen and position car to aim headlamps. Lines painted on floor parallel to screen are of help in placing rear axle parallel to screen

CARBURETOR SERVICE INDEX

NOTE—For a description of the new four-barrel carburetors, see page 802.

CARTER CARBURETOR INDEX & ADJUSTMENTS

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
BUICK (See Stromberg for additional applications)												
1939-40, 40, 50	WD0	440S	225	1062B	3/16	1/2–1 1/4	T109-113	21/64 ①	None	3/16	.018	None
1940, 60, 70,	WD0	448S	227		3/16	1/2–1 1/4	T109-113	21/64 ①	None	3/16	.030	None
1940, 40, 50	WD0	474S	311	1062B	3/16	1/2–1 1/4	T109-113	21/64 ①	None	3/16	.030	None
1941-42, 40	WCD	487S	324	1098C	3/16	1/2–1 1/2	T109-152	21/64	None	3/16	.012	None
1941, 60, 70, 90	WCD	491S	346		3/16	1/4–1 1/4	None	None	None	None	None	None
1941, 50	WCD	509S	324 or 535		9/64	1/4–1 1/4	T109-152	21/64	None	3/16	.012	None
1941-42, 50	WCD	528S	324 or 535	1315C	3/16	1/4–1 1/4	T109-152	16/64 ②	None	3/16	.012	None
1941-42, 50	WCD	529S	346	1315C	3/16	1/4–1 1/4	None	None	None	None	None	None
1941-42, 60, 70, 90	WCD	533S	324 or 535	1316C	3/16	1/4–1 1/4	T109-152	14/64 ③	None	3/16	.015	None
1941-42, 60, 70, 90	WCD	534S	346	1316C	3/16	1/4–1 1/4	None	None	None	None	None	None
1941-42, 50	WCD	543S	409	1315C	3/16	1/4–1 1/4	None	None	None	None	None	None
1941-42, 60, 70, 90	WCD	544S	409	1316C	3/16	1/4–1 1/4	None	None	None	None	None	None
1946-47, 40, 50	WCD	608S–SA	324 or 546	1364D	3/16	1/2–1	T109-152	21/64	None	3/16	.012	None
1946-47, 70	WCD	609S–SA	402 or 548	1365D	3/16	3/4–1 3/4	T109-163	21/64	None	3/16	.018	None
1948–49, 40, 50	WCD	663S	546	1391B	5/32	3/4–1 1/4	④	21/64	None	3/16	.015	None
1948–49, 70	WCD	664S	573	1392B	5/32	3/4–1 1/4	④	21/64	None	3/16	.018	None
1950–51, 40, 50	WCD	725S–SA	624	1515D	5/32	7/8–1 3/8	④	33 ⑥	None	3/16	.015	None
1950–51, 70	WCD	726S–SA	626	1532C	5/32	3/4–1 1/4	④	33 ⑥	None	3/16	.015	None
1951, 70	WCD	883S	626	1596	5/32	1–1 1/2	④	33 ⑥	None	3/16	.018	None
1952, 40, 50	WCD	882S	624	1595	5/32	1 1/4–1 3/4	④	33 ⑥	None	3/16	.012	None
1952, 70	WCFB	894S	....	1599	⑦	1/4–1 1/4	④	⑧	None	3/16	.020	None

A) Located on face of carburetor flange. Use this number to identify carburetor if part number tag is missing. (B) Contains all parts necessary t rebuild carburetor. (C) Choke clearance at wide open throttle. (D) Throttle clearance with choke closed. (E) Distance between lip at lower end of fast idle link and throttle lever lock with throttle and choke valves wide open.

① Medium stroke. ② Long stroke. ③ Short stroke.
④ No gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting. With rods held thus, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.
⑤ With throttle closed, indicator lines should be flush with top of anti-percolator plugs; do not use gauge.
⑥ Short stroke as indicated on gauge T109-117S.
⑦ Primary float 1/4″; secondary float 3/8″.
⑧ Hold straight edge across top of dust cover boss at pump arm. Bend throttle connector rod at upper angle until upper flat of pump arm is parallel with straight edge while throttle valves are seated.

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
CADILLAC AND LA SALLE (See Stromberg for additional applications)												
1937, 50	WD0	374S	166	1071B	13/64	3/4-1 1/4	T109-27	16/64①	③	3/16	.015	None
1938-39, 50	WD0	392S	166	1070A	3/16	1/4—1	T109-27	16/64①	③	1/8	.030	None
1938-40, V16	WD0	407S	203		13/64	1/4—1	T109-27	19/64	③	3/16	.026	None
1938-40, V16	WD0	408S	203		13/64	1/4—1	T109-27	19/64	③	3/16	.026	None
1939-40, 50	WD0	423S	248	1069A	1/8	1/2—1 1/4	T109-113	26/64	③	1/8	.030	None
1940, 50, 52	WD0	460S	277	1081	1/8	1/2-1 1/2	T109-113	26/64	③	13/64	.023	None
1941	WD0	506S	277	1093A	1/8	1/2-1 1/2	T109-113	26/64	③	13/64	.023	None
1942	WCD	486S	385	1331A	9/64	3/4-1 3/4	T109-163	23/64①	None	3/16	.015	None
1946-48	WCD	595S-SA	456	1363D	9/64	1/2-1 1/2	T109-163	27④	None	3/16	.018	None
1949	WCD	682S	610	1508A	9/64	1/2-1 1/2	T109-163	24④	None	3/16	.020	None
1949	WCD	722S	610	1506A	9/64	1/2-1 1/2	②	32④	None	3/16	.020	None
1950	WCD	742S	672	1538A	11/64	3/4-1 1/4	②	30④	None	7/32	.020	None
1951	WCD	845S	821	1538A	11/64	3/4-1 1/4	②	19④	None	5/32	.017	None
1952	WCFB	896S		1701								

① Long stroke. ② No gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting With rods held thus, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.
③ With throttle closed and .015" feeler inserted between anti-percolator stem and lip of arm, indicator lines should be flush with with top of anti-percolator plugs.
④ As indicated n Pump Travel Gauge T109-117S.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
CHEVROLET												
1935	W1	284S	220	1003D	3/8	1/2-1 1/2	T109-25	①	None	None	None	None
1935	W1	321S	267		3/8	1/2-1 1/2	T109-25	①	None	None	None	None
1935-36	W1	319S	265	1004C	3/8	1-2	T109-25	①	None	None	None	None
1935-36	W1	334S	265	1004C	3/8	1-2	T109-25	①	None	None	None	None
1936	W1	335S	279		3/8	1-2	T109-25	①	None	None	None	None
1937	W1	346S	292	1005C	3/8	1-2	T109-25	①	None	None	None	None
1937-38	W1	358S	205		3/8	1-2	T109-25	①	None	None	None	None
1938	W1	391S	337	1006C	3/8	1-2	T109-25	①	None	None	None	None
1939-40	W1	420S	365	1013E	1/2	1-2	T109-25	①	None	None	None	None
1939-40	W1	434S	373		1/2	1-2	T109-25	①	None	None	None	None
1941-42	W1	483S	421	1089D	1/2	1 1/4-2 1/4	T109-25	None	None	None	None	None
1941-42	W1	492S	432	1091B	1/2	1 1/4-2 1/4	T109-25	None	None	None	None	None
1941-48	W1	574S	421	1089D	1/2	1 1/4-2 1/4	T109-25	None	None	None	None	None
1941-1949	W1	684S	603	1500A	1/2	1-2	T109-25	None	None	None	None	None
1946-48	W1	616S	432	1091B	1/2	1 1/4-2 1/4	T109-25	None	None	None	None	None

① Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in hot weather.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
CHRYSLER (See Stromberg for additional applications)												
1935-39	BB	E6P5	①	1308A	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1936, C7	BB	E6G1	①	1018B	5/64	1/4-1	None	③	None	None	None	None
1937, C16	BB	E6I1	①	1018B	5/64	1/4-1	None	③	None	None	None	None
1937, C16	BB	E6K1-4	①	1019B	5/64	1/2-1 1/4	None	③	None	None	None	None
1938, C18	BB	E6M1	①	1020B	5/64	1/2-1 1/4	None	27/64②	None	None	None	None
1939, C22	BB	E6N1-3	①	1308A	5/64	1/2-1 1/4	None	26/64②	None	None	None	None
1940-41, C25	BB	E6S1-3	①	1077B	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1940-41, C28	BB	E6W1	①	1311C	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1941, C28	BB	E6T1-2	①	1309B	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1942, C34	BB	EG1-EG2	①	1309B	1/16	1/2-1 1/2	None	26/64②	None	None	None	None
1942, C34	BB	EE1	①	1311C	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1942, C34	BB	EF1	①		1/16	1/2-1 1/2	None	26/64②	None	None	None	None
1946-48 Six	BB	EX1-EX2	①		5/64	3/4-1 1/4	None	26/64②	None	None	None	None
1946-48 Six	BB	EV1-EV2	①	1367C	1/16	3/4-1 1/4	None	26/64②	None	None	None	None
1946-48 Eight	BB	E7A1	①	1384	1/16	3/4-1 1/4	None	26/64②	None	None	None	None
1949 Six	BB	E7L1-2	①	1510A	5/64	1/2-1 1/2	None	20/64②	None	None	None	None
1949 Eight	BB	E7J1-2	①	1511A	5/64	1/2-1 1/2	None	26/64②	None	None	None	None

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
CHRYSLER—(continued)												
1949-50 Six	BB	E7L3-4	①	1528	5/64	1/2-1 1/2	None	④	None	None	None	None
1949-50 Eight	BB	E7J3-4	①	1511A	5/64	1/2-1 1/2	None	26⑤	None	None	None	None
1951 Six	BB	E9A1	①	1579	5/64	1/2-1 1/2	None	None	None	5/32	.017	None
1951 V8	WCD	830S-SA	①	1577A	11/64	3/4-1 1/4	⑥	30⑤	None	7/32	.017	None
1951-52 Six	BB	E9C1	①	1578	5/64	1/2-1 1/2	None	None	None	5/32	.017	None
1951-52 V8	WCD	931SA	①	1705	11/64	1/2-1	⑥	17/64	None	7/32	.019	None

① Refer to part number stamped on webbing of bowl cover or tag attached to carburetor.
② Medium stroke.
③ Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in hot weather.
④ No gauge necessary. Be sure pump lifter link arm is at right angle to lifter link shaft. Adjust by bending horizontal portion of pump lifter link.
⑤ As indicated on Pump Travel Gauge T109-117S.
⑥ No gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting. With rods held thus, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level	Idle Screw Setting	Metering Rod Gauge	Pump Travel	Anti-Percolator	Unloader	Fast Idle	Choke Lockout
DE SOTO												
1935-40	BB	E6P5	①	1308A	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1937	BB	E6K1-4	①	1019B	5/64	1/2-1 1/4	None	③	None	None	None	None
1938	BB	E6M1	①	1020B	5/64	1/2-1 1/4	None	27/64②	None	None	None	None
1939	BB	E6N1	①	1308A	5/64	1/2-1 1/4	None	26/64②	None	None	None	None
1940-41	BB	E6N3	①	1308A	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1940-41	BB	E6S3	①	1077B	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1941	BB	E6U1-2-2R	①	1310B	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1941	BB	E6V1	①		5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1942	BB	EE1	①	1311C	5/64	1/2-1 1/2	None	26/64②	None	None	None	None
1942	BB	EF1	①		1/16	1/2-1 1/2	None	26/64②	None	None	None	None
1942	BB	EG1-2	①	1309B	1/16	1/2-1 1/2	None	26/64②	None	None	None	None
1946-48	BB	EX1-2	①		5/64	3/4-1 1/4	None	26/64②	None	None	None	None
1941-46	BB	EV1-2	①	1367C	1/16	3/4-1 1/4	None	26/64②	None	None	None	None
1949	BB	E7L1-2	①	1510A	5/64	1/2-1 1/2	None	20/64②	None	None	None	None
1949-50	BB	E7L3-4	①	1528	5/64	1/2-1 1/2	None	④	None	None	None	None
1951-52 Six	BB	E9A1	①	1579	5/64	1/2-1 1/2	None	None	None	5/32	.017	None
1952 V8	WCD	884SA	①	1704	11/64	1/2-1	⑤	29⑥	None	7/32	.019	None

① Refer to part number stamped on webbing of bowl cover or tag attached to carburetor.
② Medium stroke.
③ Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in hot weather.
④ No gauge necessary. Be sure pump lifter link arm is at right angle to lifter link shaft. Adjust by bending horizontal portion of pump lifter link.
⑤ No gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting. With rods held thus, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.
⑥ Short stroke as indicated on gauge T109-117S.

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level	Idle Screw Setting	Metering Rod Gauge	Pump Travel	Anti-Percolator	Unloader	Fast Idle	Choke Lockout
DODGE (See Stromberg for additional applications)												
1946-49	BB	D6J1	515	1368	5/64	1/2-1 1/2	None	24/64①	None	None	None	None
1949-50	BB	D6M1	②	1527	5/64	1/2-1 1/2	None	22/64①	None	None	None	None
1949-50	BB	D6P1	②	1526	5/64	1/2-1 1/2	None	22/64①	None	None	None	None

① Medium stroke.
② Refer to part number stamped on webbing of bowl c ver or tag attached t carburetor.

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level	Idle Screw Setting	Metering Rod Gauge	Pump Travel	Anti-Percolator	Unloader	Fast Idle	Choke Lockout
FRAZER												
1947	WA1	610S		1095	5/16	3/4-1 3/4	T109-102	20/64①	②	7/16	5/8	1/32
1947-48	WA-1	622S	309	1362B	3/8	3/4-1 3/4	T109-102	18/64①	②	7/16	5/8	1/32

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
FRAZER—(Continued)												
1947–48	WA-1	622S	309	1362C	1/2	3/4–1 3/4	T109-102	18/64①	②	7/16	5/8	1/32
1948–49	WCD	685SA	550	1390B	1/16	1-1 1/2	T109-163	29/64③	None	1/8	.016	None
1949–51	WCD	723S	550	1512A	1/32	1–1 1/2	T109-163	29/64③	None	1/8	.018	None
1951	WGD	813S	774	1558B	1/4	1/2–1	④	1/2	None	9/64	.018	None

① Medium stroke.
② With throttle valve open .030", there should be .005" to .015" clearance between rocker arm and pump arm.
③ Short stroke.
④ No gauges are necessary. With throttle lever screw backed out and throttle valves seated in bores of carburetor, press down on vacumeter link until metering rod bottoms. With rods held thus, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level	Idle Screw Setting	Metering Rod Gauge	Pump Travel	Anti-Percolator Setting	Unloader Setting	Fast Idle Setting	Choke Lockout Adjustment
HENRY J												
1951–52 Six	YF	814S, 833S	648	1571	9/32	1–2	①	None	None	None	None	None
1951–52 Four	YF	820SB	648	1572	6/32	1–2	①	None	None	None	None	None

① No gauges are necessary. See text for procedure.

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level	Idle Screw Setting	Metering Rod Gauge	Pump Travel	Anti-Percolator Setting	Unloader Setting	Fast Idle Setting	Choke Lockout Adjustment
HUDSON AND TERRAPLANE												
1935, GU, GH	W1	309S	54	1047A	3/8	3/8–1	T109-25	①	None	None	None	None
1935 Eight	W1	310S	55	1048A	3/8	3/8–1	T109-25	①	None	None	None	None
1935 G	W1	311S	256	1045A	3/8	3/8–1	T109-25	①	None	None	None	None
1936, 62, 63	W1	329S	73	1049A	3/8	1/2–1	T109-25	①	⑤	7/16	None	⑨
1936 Eight	W1	330S	71	1050A	3/8	1/2–1	T109-25	①	⑤	7/16	None	⑨
1936, 61	W1	331S	272	1045A	3/8	1/4–1	T109-25	①	⑤	None	None	None
1937 Eight	WD0	344S	148	1053A	15/64	1/4–3/4	T109-27	15/64②	⑥	1/4	.018	None
1937, 71	W1	348S	272	1051A	3/8	1/4–1	T109-25	①	⑤	None	None	None
1937 Eight	WD0	377S	148	1053A	15/64	1/4–3/4	T109-27	15/64②	⑥	1/4	.018	None
1938 Eight	WD0	402S	148	1053A	15/64	1/4–3/4	T109-27	15/64②	⑥	1/4	.018	None
1938 Six	W1	397S	339	1052A	3/8	1/4–1	T109-25	14/64③	⑦	None	None	None
1938, 89	W1	411S	359		3/8	3/4–1 1/2	T109-25	14/64③	⑤	None	None	None
1938, 89	W1	417S	362	1054A	3/8	3/4–1 1/2	T109-25	14/64③	⑤	None	None	None
1939 Six	W1	437S	339	1067A	3/8	1/2–1 1/4	T109-25	14/64③	⑤	None	None	None
1939 Six	W1	438S	383	1067A	3/8	1/2–1 1/4	T109-25	14/64③	⑤	None	None	None
1939 Eight	WD0	430S	199	1068B	3/32	1/4–1	T109-113	18/64④	⑧	1/4	.018	None
1940 Six	W1	454S	298	1078A	3/8	3/4–1 1/2	T109-102	12/64②	⑤	7/16	5/8	1/32
1940	WD0	455S	279	1079C	3/32	1/2–1 1/2	T109-113	18/64④	⑧	1/4	.018	None
1940	WD0	461S	286	1080C	3/32	1/4–1 1/4	T109-113	18/64④	⑧	1/4	.018	None
1941-47 Six	WD0	501S	286	1302A	1/8	1/2–1 1/2	T109-113	18/64④	⑧	1/4	.045	None
1941-47 Eight	WD0	502S	279	1303A	1/8	1/2–1 1/2	T109-113	18/64④	⑧	1/4	.053	None
1942, 20	W1	524S			3/8	1/2–1 1/2	T109-25	17/64②	⑤	7/16	5/8	1/32
1948–49 Six	WD0	647S-SA	542	1381B	3/16	1 1/4–1 3/4	T109–113	18/64④	⑧	1/4	.054	None
1948–49 Eight	WD0	648S	542	1382A	13/64	1–1 1/2	T109-113	14/64④	⑧	1/4	.054	N ne
1950–51 Pacemaker	WA1	749S	682	1535	1/2	1/2–1 1/2	T109-102	16/64②	⑩	7/16	5/8	None
1950–51 Six	WGD	776S		1555B	3/16	1/2–1	⑪	1/2	None	5/32	.026	None
1950–51 Eight	WGD	773S		1554A	3/16	1/2–1	⑪	1/2	None	5/32	.026	None

① Holes in pump arm provide pump adjustment. Set f r longest stroke in cold weather; shortest in hot weather.

② Short stroke.

③ Medium stroke.

④ Long stroke.

⑤ With throttle valve open .030", there should be .005" t .015" clearance between r cker arm and pump arm.

⑥ With throttle closed and .015" gauge inserted between anti-percolator stem and lip of arm, indicator lines should be flush with top of anti-percolator plugs.

⑦ With throttle valve open .025", there should be .005" to .015" clearance between anti-percolator lip and pump arm.

⑧ With throttle closed, indicator lines should be flush with top of anti-percolator plugs; do not use gauge.

⑨ With throttle and choke valves wide open, adjust lip on choke lever to hold choke valve wide open. Choke valve releases when throttle is closed.

⑩ With throttle valve opened .020", there should be .005" to .015" clearance between rocker arm lip and pump arm.

⑪ N gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting. With r ds held thus, rev lve metering rod arm lip contacts vacumeter link. Tighten metering rod arm set screw.

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idl Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
KAISER												
1947–48	WA-1	622S	309	1362C	3/8	3/4–1 3/4	T109-102	18/64 ①	②	7/16	5/8	1/32
1947–48	WA-1	622SA	309	1362C	1/2	3/4–1 3/4	T109-102	18/64 ①	②	7/16	5/8	1/32
1949, 492	WCD	685SA	550	1390B	1/16	1–1 1/2	T109-163	29/64	None	1/8	.016	None
1949–50, 491, 501	WA-1	622SB	309	1362C	1/2	3/4–1 3/4	T109-102	18/64 ①	②	7/16	5/8	1/32
1949-50	WCD	723S	550	1512A	1/32	1–1 1/2	T109-163	29/64 ③	None	1/8	.018	None
1951–52	WGD	781S	774	1548C	1/4	1/2–1	④	1/2	None	9/64	.018	None

① Medium stroke.
② With throttle valve open .030″, there should be .005″ to .015″ clearance between rocker arm and pump arm.
③ Short stroke.
④ No gauges are necessary. With throttle lever screw backed out and throttle valves seated in bores, press down on vacumeter link until metering rod bottoms. With rods held in this position, revolve metering rod arm until lip contacts vacumeter link. Tighten metering rod arm set screw.

NASH (See Stromberg for additional applications)

Car and Model	Carb. Model	Part No.	Casting No.	Repair Kit No.	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch	Fast Idl Setting, Inch	Choke Lockout Adjustment, Inch
1939-41, 20, 60	WA1	435S	253	1065A	3/8	3/4–1 1/2	T109-102	27/64 ①	③	31/64	5/8	1/32
3980	WD0	436S	255		3/16	1/4–1	T109-113	32/64 ①	④	9/64	.015	None
4010	WD0	458S	295	1082	3/16	1/4–1 1/4	T109-113	32/64 ①	None	3/16	.026	None
4080	WD0	465S	255		3/16	1/2–1 1/2	T109-113	32/64 ①	④	9/64	.015	None
4140, 4240	BB	513S	177	1307A	5/64	1/2–1 1/4	None	30/64 ①	None	None	None	None
4180	WD0	511S	360	1306B	3/16	1/2–1 1/2	T109-113	32/64 ①	④	9/64	.015	None
1942–48, 60	WA1	464S	290	1065A	3/8	1/2–1 1/2	T109-102	27/64 ①	③	31/64	5/8	1/32
4280	WD0	538S	397		3/16	1/4–1 1/4	T109-113	32/64 ①	④	9/64	.015	None
1946-47, 40	WA1	611S	298	1361C	1/2	1 1/4–2 1/4	T109-102	25/64 ①	⑤	7/16	5/8	1/32
1948, 40	WA1	662S-SA	298	1379A	1/2	3/4–1 3/4	T109-102	25/64 ②	⑤	7/16	5/8	⑥
1949, 40	WA1	694S	298	1501A	1/2	3/4–1 3/4	T109-102	25/64 ①	⑤	7/16	5/8	⑥
1949, 60	WA1	683S	290	1399A	1/2	1/2–1 1/2	T109-102	27/64 ①	③	31/64	5/8	⑥
1950, 10, 40	WA1	780S	779	1501A	1/2	3/4–1 3/4	T109-102	25/64 ①	⑤	7/16	5/8	1/32
1950–51, 60	WA1	746S	269	1518	1/2	1/2–1 1/2	T109-102	27/64 ①	⑦	31/64	5/8	1/32
1951, 10	YF	757S			1/2	1–2	⑧	None	None	3/16	.048	None
1951, 40	YF	824S			1/2	1–2	⑧	None	None	3/16	.048	None
1951–52, 10	YF	876SA		1590A	5/16	1/2–1 1/2	⑧	None	None	9/32	.054	None
1951–52, 40	YF	877SA		1590A	5/16	1/2–1 1/2	⑧	None	None	9/32	.054	None

① Long stroke.

② Medium stroke.

③ With throttle valve open .020″, there should be 005″ to 015″ clearance between lip on metering rod arm and valve stem.

④ With throttle closed, indicator lines should be flush with top of anti-percolator plugs; do not use gauge.

⑤ With throttle valve open .030″, there should be 005″ to 015″ clearance between rocker arm and pump arm.

⑥ With throttle valve held wide open, push choke valve wide open, where it should lock. If not, bend lip at lower end of fast idle link.

⑦ With throttle valve open .020″, there should be .005″ to .015″ clearance between rocker arm and pump arm.

⑧ No gauges are necessary. See text for procedure.

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Fl at Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke L ckout Adjustment, Inch Note E
OLDSMOBILE (See Stromberg for additional applications)												
1936 Six	W1	327S	277	1031A	1/2	3/4-1 1/4	T109-25	④	⑦	1/2	None	1/32
1936 Six	W1	339S	277	1032A	3/8	3/4-1 1/4	T109-25	④	⑦	1/2	None	1/32
1936 Six	W1	342S	285	1032A	3/8	3/4-1 1/4	T109-25	④	⑦	1/2	None	1/32
1936 Eight	WD0	328S	143	1038A	3/16	3/4-1 1/4	T109-27	④	⑨	1/4	.018	None
1936 Eight	WD0	341S	143	1039A	3/16	3/4-1 1/4	T109-27	④	⑧	1/4	.018	None
1937 Six	W1	351S	290	1033A	3/8	3/4-1 1/4	T109-25	④	⑨	3/8	5/8	1/32
1937-38 Six	W1	385S	290	1034A	3/8	1-1 1/2	T109-25	④	⑨	3/8	5/8	1/32
1937 Eight	WD0	345S	153	1040A	9/64	3/4-1 1/4	T109-27	16/64①	⑨	1/4	.018	None
1937 Eight	WD0	367S	153	1040A	9/64	3/4-1 1/4	T109-27	16/64①	⑨	1/4	.018	None
1937-38 Eight	WD0	386S	153	1041	9/64	3/4-1 1/4	T109-27	19/64	⑨	1/4	.018	None
1938 Six	W1	388S	333	1035A	3/8	1/2-1	T109-25	19/64	⑩	3/8	5/8	1/16
1937-40 Eight	WD0	389S	192	1042	3/8	1/2-1 1/4	T109-104	19/64	⑨	1/4	.018	None
1939 Six	WA1	425S	194	1037A	3/8	1/2-1 1/2	T109-102	13/64②	⑩	7/16	5/8	1/32
1939-40 Six	WA1	426S	243	1036A	3/8	1/2-1 1/2	T109-102	13/64②	⑩	7/16	5/8	1/32
1940 Six	WA1	466S	194	1083A	3/8	1/2-1 1/2	T109-102	13/64②	⑩	7/16	5/8	1/32
1940 Six	WA1	467S	194	1083A	3/8	1/2-1 1/2	T109-102	13/64②	⑩	7/16	5/8	1/32
1940 Eight	WD0	471S	192	1042	3/8	1/2-1 1/4	T109-104	19/64	⑪	3/16	.015	None
1941-47 Six	WA1	481S	340	1097B	1/2	1/2-1 1/2	T109-102	16/64③	⑦	3/8	5/8	1/32
1941-47 Six	WA1	504S	340	1097B	1/2	1/2-1 1/2	T109-102	16/64③	⑦	7/16	5/8	1/32
1941-47 Eight	WD0	480S-SA	342	1096A	3/16	1/2-1 1/2	T109-113	19/64	⑨	3/16	.015	None
1941-47 Eight	WD0	503S-SA	342	1096A	3/16	1/2-1 1/2	T109-113	19/64	⑨	1/4	.015	None
1942 Six	W1	523S	462	1353A	9/16	1/2-1 1/2	T109-25	15/64③	⑩	7/16	5/8	1/32
1947 Eight	WCD	665S			3/16	3/4-1 3/4	T109-163	24/64	None	1/8	.018	None
1948 Six	WA1	651S	538	1383B	1/2	1/2-1 1/2	T109-102	16/64	⑦	3/8	5/8	1/32
1948 Eight	WD0	650S	540	1096A	3/16	1/2-1 1/2	T109-113	19/64	⑨	1/4	.015	None
1948 Eight	WD0	650SA	540	1096A	15/64	1/2-1 1/2	T109-113	19/64	⑨	1/4	.015	None
1949 Six	WA-1	709S	538	1383B	1/2	1/2-2	T109-102	16/64	⑦	3/8	5/8	1/32
1949 Six	WA-1	710S	538	1097B	1/2	1/2-2	T109-102	16/64	⑦	7/16	5/8	1/32
1949 Eight	WGD	714S	604	1505B	1/4	1/2-1	⑤	⑥	None	1/4	.015	None
1950 Eight	WGD	714SA	604	1505B	1/4	1/2-1	⑤	⑥	None	7/64	.018	None
1950 Six	WAI	763SA	538	1536	1/2	1/2-2	T109-102	16/64	⑦	3/8	5/8	None
1950 Six	WAI	764S	340	1537	1/2	1/2-2	T109-102	16/64	⑦	7/16	5/8	None
1951 V8	WGD	851S	836	1573	1/4	3/4-1 1/4	⑤	⑥	None	1/4	.020	None
1952	WCFB	932S			5/16	3/4-1 1/4	⑤	⑥	None	1/8	.015	None

① Long stroke. ② Short stroke. ③ Medium stroke.

④ Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in warm weather.

⑤ No gauges are necessary. With throttle valves seated, press down on vacumater link until metering rods bottom in bowl casting. With rods held thus, revolve metering rod arm until lip contacts vacumeter link and tighten set screw.

⑥ Hold straight edge across top of dust cover boss at pump arm. Bend throttle connector rod at upper angle until upper flat of pump arm is parallel with straight edge while throttle valves are seated.

⑦ With throttle valve open .020″, there should be .005″ to .015″ clearance between rocker arm and pump arm.

⑧ With throttle valve open .020″, there should be .005″ to .015″ clearance between lip on metering rod arm and valve stem.

⑨ With throttle closed, indicator lines should be flush with top of anti-percolator plugs. Do not use gauge.

⑩ With throttle valve open .030″, there should be .005″ to .015″ clearance between rocker arm and pump arm.

⑪ With throttle closed and .015″ gauge inserted between anti-percolator stem and lip of arm, indicator lines should be flush with top of anti-percolator plugs.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Fl at Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke L ckout Adjustment, Inch Note E
PACKARD (See Stromberg for additional applications)												
1936-41 Six	WA1	477S	332		3/8	1-1 3/4	T109-102	16/64	③	7/16	5/8	1/32
1937-39 Six	WA1	359S	312		3/8	1/4-1	T109-26	18/64①	④	3/8	33/64	1/32
1937 Eight	WD0	366S	164		1/8	1/2-1 1/4	T109-27	31/64	⑤	1/4	.018	None
1939-41 Super 8	WD0	479S	329		9/64	1/2-1 1/2	T109-113	26/64	⑤	11/64	.030	None
1941 Eight	WD0	478S	327	1092A	5/32	1/2-1 1/2	T109-113	14/64①	⑤	3/16	.030	None
1941-47 Eight	WD0	512S	371	1092A	5/32	1/2-1 1/2	T109-113	14/64②	⑤	11/64	.020	None
1942-47 Six	WA1	530S	317	1320A	3/8	1/2-1 1/2	T109-102	16/64	③	7/16	5/8	1/32
1942-49 Super 8	WD0	531S-SA	377 & 564	1321D	5/32	1 1/2-2	T109-113	26/64②	⑤	11/64	.023	None
1948-49 Eight	WD0	644S-SA	561	1376C	5/32	5/8-1 1/8	T109-113	14/64	⑤	11/64	.020	None

NOTE—See text for detailed instructions regarding these settings.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment Inch Note E
PACKARD—(Continued)												
1948-49 Super 8	WD0	643S-SA	377 & 561	1375B	5/32	¾–1¼	T109-113	28/64	(5)	11/64	.026	None
1949-50	WGD	728S-SA	615	(8)	13/64	1–1½	(6)	(7)	None	⅛	.026	None
1951-52, 200	WGD	784S	803	1568A	13/64	½–1½	(6)	15/32	None	⅛	.023	None
1951, 300, 400	WGD	767S	803	1542	13/64	½–1½	(6)	5/16	None	⅛	.023	None
1952, 300, 400	WGD	928S		1700	13/64	½–1½	(6)	5/16	None	⅛	.023	None

(1) Long stroke.
(2) Short stroke.
(3) With throttle valve open .030″, there should be .005″ to .015″ clearance between rocker arm and pump arm.
(4) With throttle closed, indicator lines should be flush with top of anti-percolator plugs. Do not use gauge.
(5) With throttle closed and .015″ gauge inserted between anti-percolator stem and lip of arm, indicator lines should be flush with top of anti-percolator plugs.
(6) No gauges are necessary. With throttle valves seated, press down on vacumeter link until metering rods bottom in bowl casting. With rods held thus, revolve metering rod arm until lip contacts vacumeter link and tighten set screw.
(7) No 42 on gauge T109-117S.
(8) 1524 on 728S; 1525 on 728SA.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment Inch Note E
PLYMOUTH (See Stromberg for additional applications)												
1935-38	BB	439S	(3)	1312A	5/64	½–1¼	None	24/64 (1)	None	None	None	None
1936	BB	C6E1-2	(3)	1010B	5/64	⅛–¾	None	(2)	None	None	None	None
1936	BB	B6F1	(3)		5/64	¼–¾	None	(2)	None	None	None	None
1937	BB	B6G1	(3)		5/64	¼–¾	None	(2)	None	None	None	None
1937	BB	C6F1-5	(3)	1011B	5/64	½–1½	None	(2)	None	None	None	None
1937	BB	C6H1	(3)	1011B	5/64	½–1½	None	(2)	None	None	None	None
1938	BB	B6H1	(3)		5/64	¼–¾	None	20/64 (1)	None	None	None	None
1938	BB	B6J1	(3)		5/64	¼–¾	None	20/64 (1)	None	None	None	None
1938	BB	C6J1	(3)	1012B	5/64	½–1¼	None	25/64 (1)	None	None	None	None
1938	BB	C6K1	(3)	1012B	5/64	½–1¼	None	25/64 (1)	None	None	None	None
1939	BB	B6K1	(3)		5/64	½–1¼	None	20/64 (1)	None	None	None	None
1939	BB	B6M1	(3)		5/32	½–1½	None	25/64 (1)	None	None	None	None
1939-41	BB	D6A1-2	(3)	1014E	5/64	½–1¼	None	24/64 (1)	None	None	None	None
1939-41	BB	D6C1-2	(3)	1014E	5/64	½–1¼	None	24/64 (1)	None	None	None	None
1940-42	BB	B6P1	(3)		5/64	½–1½	None	19/64 (1)	None	None	None	None
1942-48	BB	D6G1	(3)	1323C	5/64	½–1¼	None	24/64 (1)	None	None	None	None
1949-52	BB	D6H1-2	(3)	1513A	5/64	½–1½	None	22/64 (1)	None	None	None	None

(1) Medium stroke.
(2) Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in hot weather.
(3) Refer to part number stamped on webbing of bowl cover or tag attached to carburetor.

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment Inch Note E
PONTIAC												
1935 Six	W1	306S	227		⅜	½–1	T109-26	(4)	(5)	None	None	None
1935 Six	W1	314S	262	1023A	⅜	½–1	T109-26	(4)	(5)	None	None	None
1935 Eight	W1	298S	237	1024A	⅜	½–1¼	T109-26	(4)	(5)	None	None	None
1935 Eight	W1	315S	263	1024A	⅜	½–1¼	T109-26	(4)	(5)	None	None	None
1936 Six	W1	324S	270	1026A	⅜	½–1¼	T109-26	(4)	(6)	½	None	(8)
1936 Six	W1	340S	270		⅜	½–1¼	T109-26	(4)	(6)	½	None	(8)
1936 Eight	W1	322S	270	1025A	⅜	½–1¼	T109-26	(4)	(6)	¼	None	(8)
1937 Six	W1	364S	306		⅜	¼–¾	None	19/64 (2)	(5)	½	⅝	1/32
1937 Six	W1	352S	299	1028A	⅜	¾–1¼	T109-26	19/64 (1)	(6)	½	⅝	1/32
1937 Eight	W1	350S	288	1027A	⅜	½–1	T109-26	19/64 (1)	(6)	¼	⅝	1/32
1938 Eight	W1	400S	343	1029A	⅜	½–1	T109-26	19/64 (1)	(5)	5/16	⅝	1/32
1938 Six	W1	401S	344	1030A	⅜	¾–1¼	T109-26	19/64 (1)	(5)	5/16	⅝	1/32
1939 Eight	WA1	432S	245	1064A	½	½–1½	T109-102	19/64 (1)	(5)	¼	⅝	1/32
1939 Six	WA1	433S	154	1063A	½	½–1½	T109-102	16/64 (1)	(5)	7/32	⅝	1/32
1940 Six	WA1	462S-SP	288	1084A	7/16	¾–1½	T109-102	23/64 (2)	(5)	¼	⅝	1/32
1940 Six	WA1	463S-SP	245	1085A	7/16	¾–1½	T109-102	18/64 (2)	(5)	⅜	⅝	1/32

NOTE—See text for detailed instructions regarding these settings.

PONTIAC—(continued)

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
1940-41 Eight	WD0	469S	306	1086C	5/16	1/4–1 1/4	T109-104	19/64③	⑥	3/16	.010	None
1940-41 Eight	WD0	469SM	306	1086C	5/16	1/4–1 1/4	T109-27	19/64③	⑥	3/16	.010	N ne
1941 Six	WA1	494S	348	1300A	1/2	3/4–1 3/4	T109-102	18/64②	⑤	7/32	5/8	1/32
1942 Six	W1	521S	461		11/16	1/2–1 1/2	T109-25	19/64①	⑤	3/8	5/8	1/32
1942-46 Six	W1	545S	476		11/16	1/2–1 1/2	T109-25	19/64①	⑤	7/32	5/8	1/32
1942 Eight	WD0	540S	306	1086C	5/16	1/4–1 1/4	T109-27	19/64②	⑥	3/16	.026	None
1942-47 Eight	WD0	548S	306	1351C	5/16	1/4–1 1/4	T109-27	19/64②	⑦	3/16	.026	None
1946-48 Six	WA1	537S	388	1366A	7/16	1–1 3/4	T109-102	17/64①	⑤	5/16	5/8	1/32
1947-48 Eight	WCD	630S	373	1369B	3/16	3/4–1 3/4	T109-163	30/64	None	1/8	.026	None
1947–48 Eight	WCD	630SA-SB	550	1369B	3/16	3/4–1 3/4	T109-163	30/64	None	1/8	.026	None
1948 Six	WA1	652S	592	1388A	7/16	1–1 3/4	T109-102	17/64①	⑤	5/16	5/8	1/32
1948 Eight	WCD	653S	558	1369B	3/16	3/4–1 3/4	T109-163	30/64	None	1/8	.026	None
1949–50 Six	WA1	717S	388	1366A	7/16	1-1 3/4	T109-102	17/64①	⑤	5/16	5/8	1/32
1949–52 Eight	WCD	719S-SA	550	1507A	3/16	3/4-1 1/4	T109-163	"32"②	None	1/8	.026	None
1949 Six	WA1	718S	592	1388A	7/16	1–1 3/4	T109-102	17/64①	⑤	5/16	5/8	1/32
1949–52 Eight	WCD	720S-SA	558	1507A	3/16	3/4–1 1/4	T109-163	"32"②	None	1/8	.026	None

① Medium stroke.

② Short Stroke.

③ Long stroke.

④ Holes in pump arm provide pump adjustment. Set for longest stroke in cold weather; shortest in hot weather.

⑤ With throttle valve open .030", there should be .005" to .015" clearance between rocker arm and pump arm.

⑥ With throttle closed, indicator lines should be flush with top of anti-percolator plug. Do not use gauge.

⑦ With throttle closed and .015" gauge inserted between anti-percolator stem and lip of arm, indicator lines should be flush with top of anti-percolator plug.

⑧ With throttle and choke valves wide open, adjust lip on choke lever to hold choke open. Choke releases when throttle is closed.

STUDEBAKER (See Stromberg for additional applications)

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
1937 Six	W1	371S	313		3/8	1/2–1 1/4	T109-25	③	④	1/4	None	1/16
1939 G	W0	444S	229	1066A	3/8	3/4–1 1/4	T109-26	12/64	None	None	None	None
1939, G	W0	453S	229	1066A	1/4	3/4–1 1/4	T109-26	12/64	None	None	None	None
1940, 2G	W0	468S-SA	229	1066A	1/4	3/4–1 1/4	T109-26	12/64	None	None	None	None
1940-42 Com.	WA1	410S	191		1/4	1/2–1 1/4	T109-102	18/64①	⑤	1/4	5/8	1/32
1940, 6C	WD0	409S	211		3/16	1/4–1 1/4	T109-27	16/64②	⑥	3/16	.018	None
1941-42 Champ.	WA1	496S	356	1301A	5/16	1/2–1 1/2	T109-102	11/64	⑤	1/4	5/8	1/32
1946-48 Champ.	WE	532S	375	1356C	1/4	1/2–1 1/2	T109-102	17/64	⑤	3/16	.054	None
1948 Champ.	WE	661S	375	1356C	3/8	1/2–1 1/2	T109-102	17/64	⑤	3/16	.054	None
1949-52 Champ.	WE	715S	620	1504	3/8	1/2–1 1/2	T109-102	14/64	⑦	3/16	.046	None
1950 Comm.	WE	627S-SA	511	1520	7/16	1/2–1 1/2	T109-102	20/64	⑤	17/64	.054	None

① Medium str ke.

② Long str ke.

③ Holes in pump arm provide pump adjustment.. Set for longest stroke in cold weather; shortest in hot weather.

④ With throttle closed, indicator lines should be flush with top of anti-percolator plug. Do not use gauge.

⑤ With throttle valve open .030", there should be .005" to .015" clearance between rocker arm and pump arm.

⑥ With throttle closed and .015" gauge inserted between anti-percolator stem and lip of arm, indicator lines should be flush with top of anti-percolator plug.

⑦ With throttle valve open .030", there should be .025" clearance between rocker arm and pump arm.

WILLYS

Car and Model	Carb. Model	Part No.	Casting No. Note A	Repair Kit No. Note B	Float Level, Inch	Idle Screw Setting, Turns Open	Metering Rod Gauge	Pump Travel, Inch	Anti-Percolator Setting	Unloader Setting, Inch Note C	Fast Idle Setting, Inch Note D	Choke Lockout Adjustment, Inch Note E
1940	W0	450S-SA	200	1087B	3/8	1/2–2 1/2	T109-26	17/64	None	None	None	None
1941-42	W0	507S-SA	229	1304A	3/8	1/2–1 1/2	T109-26	14/64	None	None	None	None
1946-50 Four	WA-1	613S	485	1360B	5/16	1/2–1 1/2	T109-102	11/64	①	None	None	None
1948-50 Six	WA-1	645S	485	1385A	5/16	1–2	T109-102	11/64	①	None	None	None
1948-49 Jeepster	WA-1	613S	485	1360B	5/16	1/2–1 1/2	T109-102	11/64	①	None	None	None
1950	YF	738S		1546B	9/32	3/4–1 3/4	②	None	None	None	③	None
1950–51	YF	768S-SA	630	1557A	5/16	1–2	②	None	None	None	③	None
1950–51	YF	832S	630	1559B	5/16	1–2	②	None	None	None	None	None
1952, 685	YF	924S			9/32	1–2	②	None	None	None	None	None

① With throttle valve pen .030" there should be .005" to .015" clearance between rocker arm and pump arm.

② No gauges are necessary. See text for procedure.

③ With choke in wide open position, lip on fast idle arm should contact boss on body casting.

THE perfect carburetor delivers the proper gasoline and air ratios for all speeds of the particular engine for which it was designed. By proper cleaning and replacing of all worn parts, the carburetor can again function as when new, and will then deliver the proper air-fuel ratio for all conditions of operation.

It is well to remember that any change in carburetor action will usually come gradually. Therefore, if the carburetor operated properly when last used, it is reasonable to assume that some other part of the engine is at fault, and the trouble should be located and corrected before attempting alterations to the carburetor.

Dirt is the great enemy of good carburetion. It not only fills up air and gasoline passages, but it also accelerates the wear of delicate parts. How often a carburetor should be cleaned depends upon the conditions under which it is used. In dusty areas, it should get more frequent attention than in parts of the country where this condition is not prevalent.

Caution—Never use wire to clean out restrictions in jets as this practice will destroy the calibration of these parts. Use compressed air or blow out with the mouth.

In servicing a carburetor, it is essential to keep the parts that make up the various systems or circuits in separate pans. In this way, much time can be saved and the possibility of improper installation will be largely eliminated. Use a separate pan for (a) float system, (b) low speed system, (c) high speed system, (d) pump or accelerating system, (e) choke system.

Carburetor manufacturers make available repair kits that usually contain all parts of the carburetor which are subject to wear. The use of these kits, together with the proper tool kit for the unit being serviced, will insure a good job. If the carburetor is to be taken apart merely for cleaning, be sure to obtain the proper gasket kit. Don't take a chance with used gaskets. Once compressed, gaskets usually will not provide a good seal.

If any of the parts are too tight to remove without damaging the screwdriver slots, place the proper size screwdriver in the slot and rap its handle with a hammer. This will loosen the part in its seat so that it can be removed. *When this is done to jets, however, it generally changes the size of the metering hole, and such parts should be replaced.*

After the parts have been removed, clean castings and all parts thoroughly with gasoline or an approved carburetor cleaner, being sure all openings are clean and free from carbon and other foreign matter.

CARTER CARBURETORS

Regardless of the features included in the various carburetor models, their basic function is the same so that the following description, while being that of the W-1 Model, will apply to the WA-1, WE, WO, WCD, WDO, WGD and YF.

CARTER W-1 SERIES

Fig. 1 is a diagrammatic view of the W-1 carburetor, while Fig. 2 shows the passages for both gasoline and air for normal operation from idle speed to maximum speed. The gasoline enters at the top of the float chamber through the float needle valve. The float controls this valve, allowing only enough gasoline to enter to maintain the gasoline to the correct level.

The gasoline passes from the float chamber through the main fuel supply jet, through the passages in the carburetor body to the main nozzle and also into the idle jet. The mouth of the main nozzle and idle jet are slightly higher than the normal level of fuel in the float chamber so that fuel will stand near the end of the nozzle but will not run out.

LOW SPEED OPERATION—When the engine is cranked with the throttle in the position shown in Fig. 2 (idle setting) a vacuum is created below the throttle. This causes air under atmospheric pressure to push past the edge of the throttle. However, the volume that can pass is so small that it will not cause high enough velocity past the main nozzle to pick up any fuel.

The vacuum below the throttle valve, however, also causes air to flow at high velocity past the idle port, causing a low pressure area within the low speed circuit. Atmospheric pressure acting on the gasoline in the bowl pushes it through the idle jet, and also air is allowed to enter the low speed passage through the by-pass and idle bleed. This forms the gas-air mixture which is delivered into the carburetor throat through the upper idle port just below the throttle and the lower port in which the idle adjustment screw is located.

The quality of the mixure is determined by the setting of the idle adjusting screw, while the quantity is determined by the amount the upper outlet port is exposed to the air passing around the throttle valve.

As the throttle is opened, more of the upper idle port is exposed, allowing more mixture to enter the carburetor and also increasing the amount of air passing the throttle. This increases the engine speed.

As the amount of air passing the throttle increases, the velocity of the air past the main nozzle is increased so that fuel is drawn out of the nozzle into the air stream.

The opening of the throttle allows a less concentrated flow of air past the idle port, increasing the pressure within the low speed passage, thus allowing the low speed circuit to fade out as the high speed circuit begins delivery of fuel. At speeds above approximately 20 mph, very little fuel is supplied through the idle circuit. *The idle adjustment, therefore, has no effect on performance or gasoline consumption at speeds above 20 mph.*

HIGH SPEED OPERATION—The fuel from the main nozzle is atomized in the primary venturi, Fig. 3, and kept centrally located in the air stream by the surrounding blanket of air passing into the secondary venturi—offering a triple protection against liquid fuel coming into contact with the walls of the carburetor where it is hard to atomize. This insures against liquid being drawn into the manifold.

In Fig. 2, it will be noted that with the throttle in the idling position, the metering rod is at its lowest position, while with the throttle wide open as in Fig. 3, the metering rod has been raised to its highest position. In the lowest position the largest section of the metering rod is in the main jet so that fuel flow is restricted to give an economical

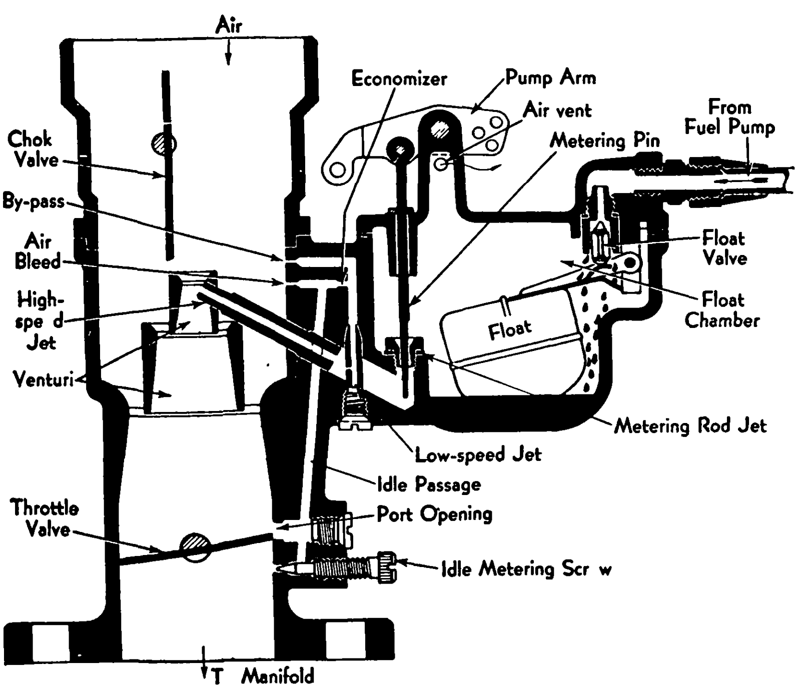


Fig. 1 Cart r W-1 Carburet r

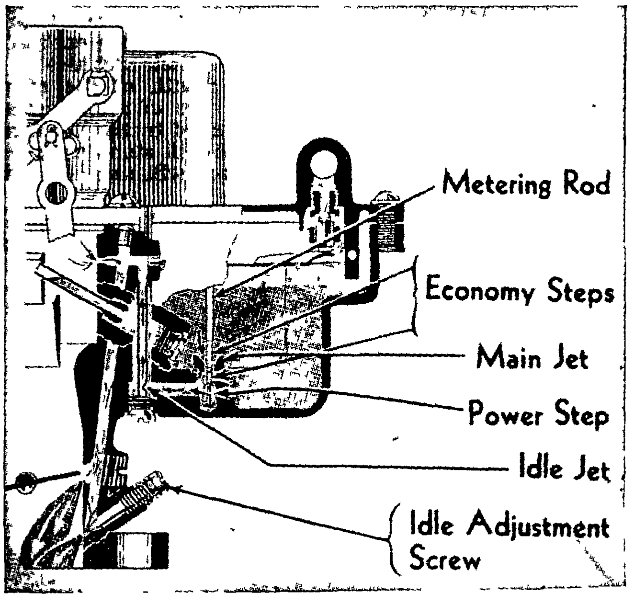


Fig. 2 CARTER
Sh wing passages for both gasoline and air for n rmal peration from idle to maximum speed

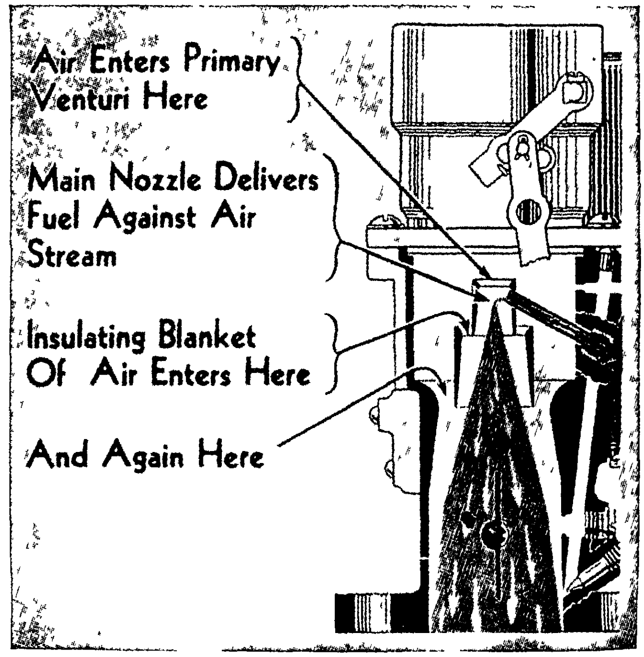


Fig. 3 CARTER
Showing how fuel from the main nozzle is atomized in the primary venturi

mixture for normal running. As the metering rod is raised by opening the throttle, the smaller section of the rod comes into the jet for proper fuel delivery for average road driving speeds, while with wide open throttle the smallest section of the rod is in the main jet, giving a mixture for maximum power for acceleration, hill climbing and maximum speed. (Some metering rods have only two steps.)

The position of the metering rod in respect to throttle opening is very important. If the change from one step to the other is not at the correct throttle opening, it will cause poor gasoline mileage or poor performance.

ACCELERATING PUMP OPERATION—When the throttle is suddenly opened at low speeds, an additional charge of fuel is necessary for good performance so provision is made by means of an accelerating pump to force extra fuel into the main venturi when the accelerator is depressed rapidly. Fig. 4 shows a sectional view through the accelerating pump.

As the throttle is closed, the plunger moves upward, drawing gasoline out of the float chamber through the screen, through the inlet ball check and into the pump cylinder, the air pocket always remaining between the fuel and the plunger.

The slightest opening of the throttle moves the plunger down, compressing the air and causes an immediate discharge of fuel past the outlet ball check valve and through the jet which points downward into the main venturi. When the throttle is fully opened, the discharge is continued for a few seconds by the air compressed between the plunger and the fuel.

When the pump is not delivering fuel, a disc check valve, in the upper passage plug above the accelerating jet, opens, allowing air to be drawn from the float chamber, preventing a vacuum in the pump passages so that no fuel can be delivered from the accelerating pump jet except by the pump action.

NOTE—The accelerating pump used on 1949-51 Nash carburetors discharges into the passages between the main jet and the high speed nozzle, Fig. 4A. This arrangement smooths out the fuel delivery more nearly in accord with engine demands, and without the abrupt shot of extra fuel through a separate jet, as shown in Fig. 4.

As the passages for the "high-speed" fuel and for the "accelerating" fuel are combined in this new design, several modifications are needed in related parts to coordinate the over-all action. For example, a lightly loaded ball check valve is used in the discharge passages from the accelerating pump to prevent fuel "pull-over" during steady speed operation. Such pull-over would upset the metering of liquid fuel through the main jet, and could tend to waste fuel. The extra fuel pressure created by the accelerating pump is sufficient to force this check valve from its seat and discharge fuel through the main nozzle. At other times, this check valve isolates the two fuel systems.

Developed by Nash engineers but built by Carter, this carburetor is simpler in that it eliminates a separate jet, plug and vent.

ANTI-PERCOLATING UNIT—While the car is being driven, the carburetor is kept cool by the large volume of air passing through it and by the heat absorbed by the atomization of the fuel.

When the car and engine is stopped the cooling system is not able to carry off the heat stored up in the engine parts and it is radiated into the air under the hood. The carburetor absorbs this heat so that in hot weather or after hard driving, the fuel in the high speed passage may boil. The vapor bubbles rise and those being trapped in the passage to the main nozzle push gasoline ahead of them and out of the nozzle into the venturi. As the bubbles continue to the main nozzle gasoline collects in the manifold until the float chamber is empty. This flooded manifold condition makes re-starting of the engine difficult.

To prevent this action, which is known as percolation, an anti-percolating valve, Fig. 5, is incorporated in most Carter carburetors. The valve opens a vent which connects directly to the bottom of the main nozzle and carries off any vapor bubbles which may form so that gasoline is not forced out of the nozzle.

The valve is opened by the throttle linkage when the throttle closes to the idling position and closes with the slightest opening of the throttle.

An anti-percolating valve that opens early upon deceleration may allow a quantity of air to be drawn into the high speed system, which will result in a flat spot as the car is accelerated immediately after deceleration. If the valve does not open at all, it will fail to relieve the vapor pressure and hard starting will result with a hot engine.

THE SLOW CLOSING THROTTLE—On some cars it is desired that the throttle should close slowly on deceleration. This is accomplished in the manner illustrated in Fig. 6. The plunger with a ball check in it is seated in a cylinder in the bottom of the float bowl. The upper end of the plunger is connected through linkage with the throttle shaft and thus controls the closing of the throttle valve when the foot is suddenly removed from the accelerator.

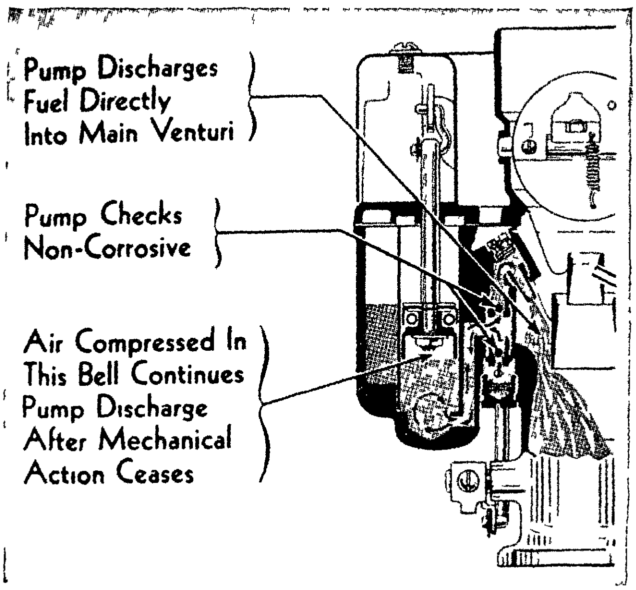


Fig. 4 CARTER Showing accelerating pump operation

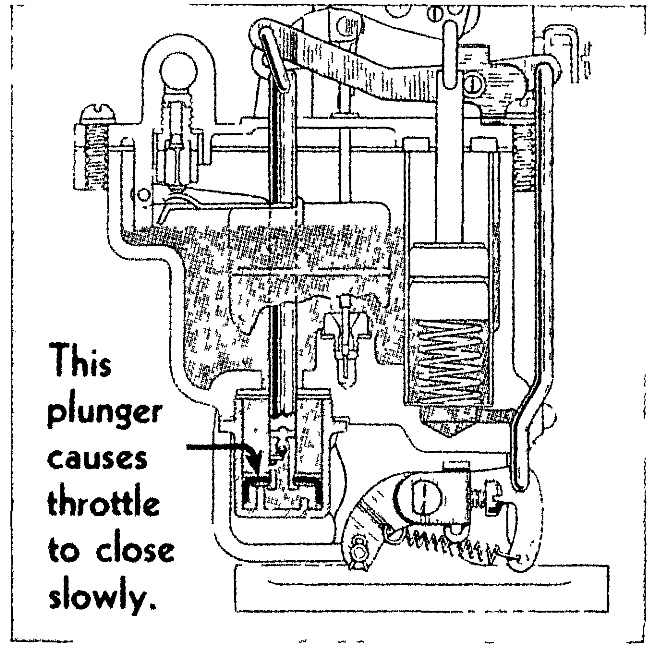


Fig. 6 CARTER Slow closing thr ttle

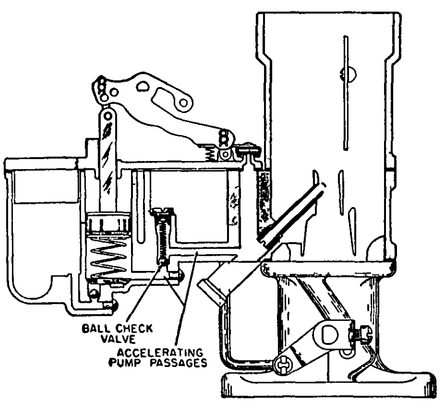


Fig. 4A Sh wing accelerator pump passag s in 1949-51 Nash carburetors

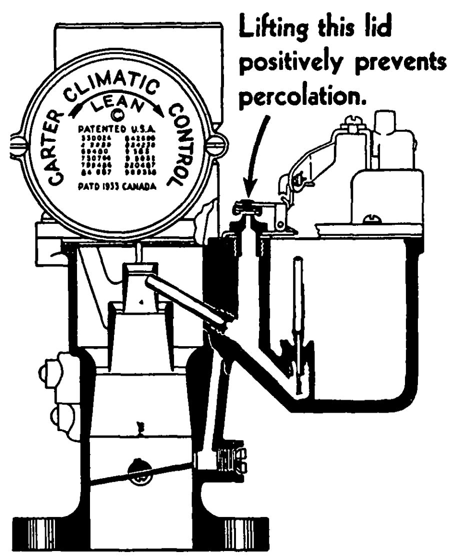


Fig. 5 CARTER Anti-percolating unit

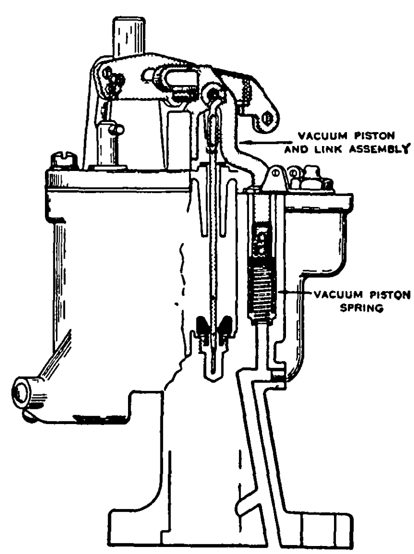


Fig. 7 CARTER
Showing vacuum operated met ring r d

VACUUM CONTROLLED METERING ROD—For 1937 and later W-1 carburetors having this device, Fig 7, the operation is as follows. Under part throttle acceleration and for hard pulling at part throttle, the power mixture is required for a short time This requirement always coincides with a drop in manifold vacuum. The carburetor meets this demand by allowing the drop in manifold vacuum to permit a spring to move the metering rod to the proper step and give the required richer mixture the instant it is needed, regardless of throttle opening As soon as the demand is past, as shown by the rise in manifold vacuum, the metering rod moves down against the pin attached to the pump arm, and it is then controlled mechanically until another such demand arises.

UNLOADER OPERATION—There are occasions during the starting of the engine when it can and would become flooded with too much fuel The throttle lever and choke linkage on climatic control carburetors are so arranged that the depressing of the accelerator pedal to the floor board forces the choke open sufficiently to allow the engine to clean out the intake manifold.

LOCKOUT OPERATION — When the throttle is wide open on climatic control carburetors, the choke valve is held in wide open position by the lockout to prevent the accidental closing or fluttering of the choke valve.

FAST IDLE OPERATION—During the warm-up period, it is desirable to run the engine faster to keep it from stalling. This is accomplished by having the fast idle cam come between the idle speed adjusting screw and its stop, thus holding the throttle sufficiently open to give the necessary engine speed

When the engine warms up sufficiently to run at the regular idle speed without stalling, the operation of the choke moves the fast idle cam out from between the idle adjusting screw and its stop.

SERVICE PROCEDURE

CARTER W-1 CARBURETOR WITHOUT CLIMATIC CONTROL

Courtesy Carter Carburetor Corp

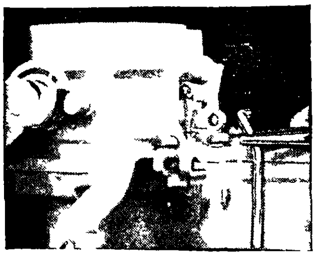


Fig. 8 Disc nnect throttle connect r r d at pump arm. Check for wear at upper end of rod and h l in pump arm

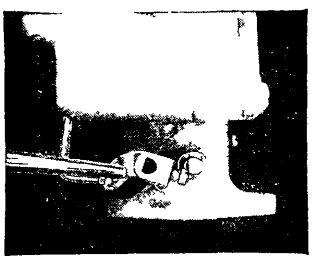


Fig. 9 R m ve throttle shaft arm and c nn ct r rod. Check f r wear at l wer end of rod and h le in arm

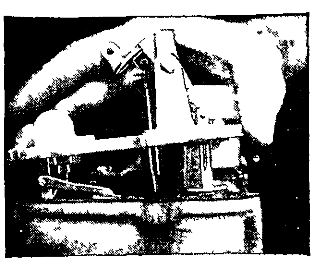


Fig. 10 R move bowl cover with all parts attached

Fig. 11 Remov n zzl passag plug and n zzl s, and n zzle gask t fr m casting

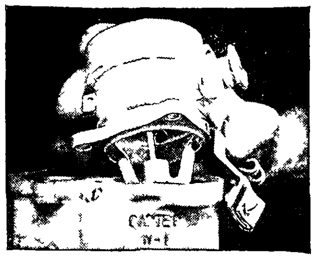


Fig. 12 Remove air horn

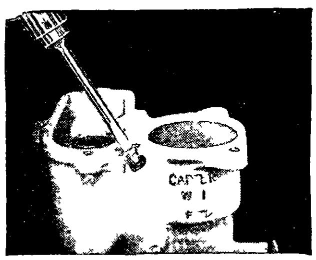


Fig. 13 Remove pump jet plug and pump jet, and copper washer from casting

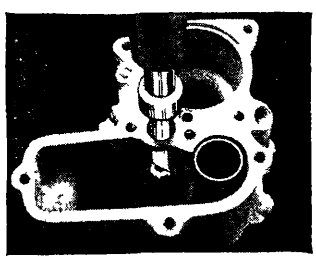


Fig. 14 Remove metering rod jet and gasket

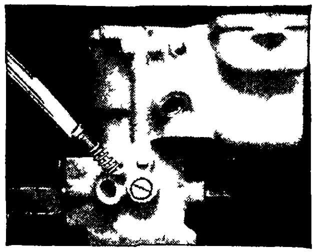


Fig. 15 Rem v idle adjustm nt screw and spring. Check f r gr v n seating surfac

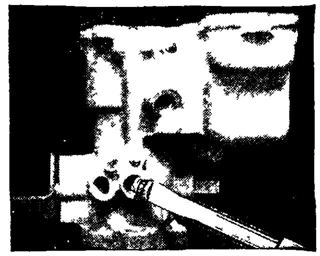


Fig. 16 Remove idle port plug, and copper washer from casting

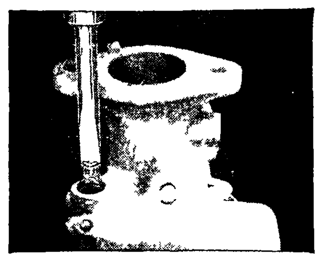


Fig. 17 Remove check valve passage plug, strainer, intake and discharge check valves, and copper washer from casting

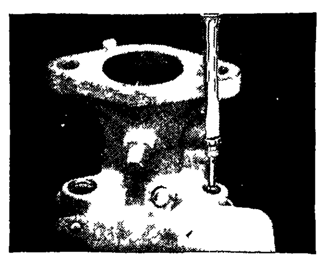


Fig. 18 Remove low speed jet, and copper washer from casting

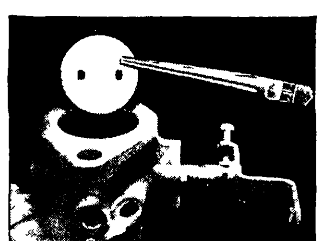


Fig. 19 Remov thr ttle valv , thr ttle shaft and lever. Check shaft and h l in lev r f r w ar, and for l os lever n shaft

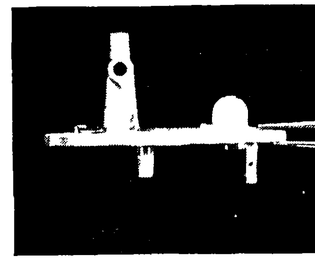


Fig. 20 Remove all parts fr m bowl c ver

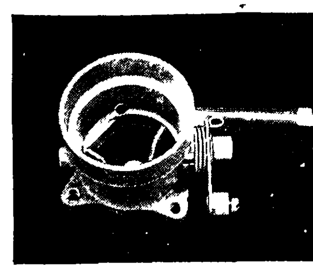


Fig. 21 Remove all parts fr m air h rn

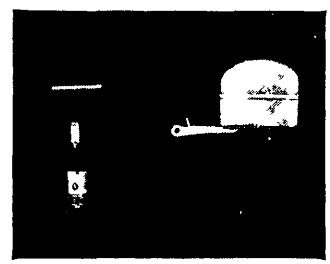


Fig. 22 Assembl parts that control gasoline level. Check float for dents and wear on lip, and float pin f r wear. Check bowl c v r f r warpage, wear in c untershaft r countershaft h le. If seating surface of n dl indicat s wear, replace b th needle and seat

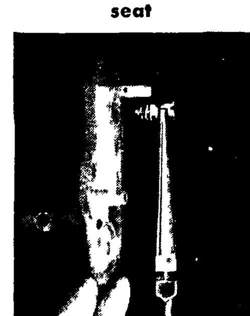


Fig. 23 Install needl seat and gasket

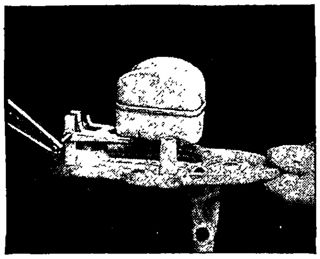


Fig. 24 Install needle, float and lever and float pin

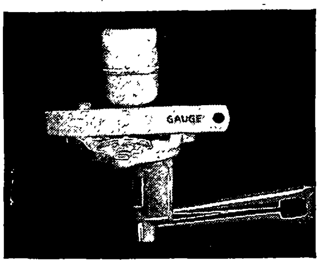


Fig. 25 Set fl at l vel to specificati ns. See *Carter Specifications* table and m asure from machin d surface of bowl cover. Adjust by bending lip —n t fl at

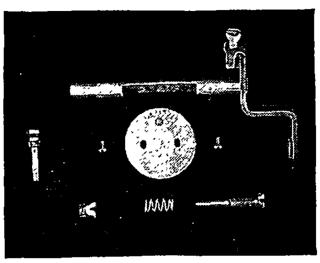


Fig. 26 Ass mble idle circuit parts as sh wn. Never reinstall a used l w speed jet. Rem ve all carbon from bore of casting

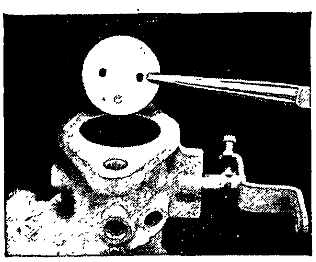


Fig. 27 Install throttle shaft and lever, and throttle valve. Back ut thr ttle lever s t scr w. Small "c" r part number on fac f valve sh uld b t ward idl port wh n view d fr m manif ld side of flang . Cent r thr ttl valve by tapping lightly b f re tightening screws. Always use new screws

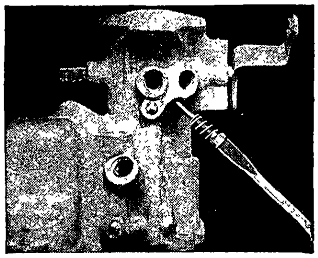


Fig. 28 Install idle adjustment screw and spring. Back out from seated position to specifications as given in *Carter Specifications* table

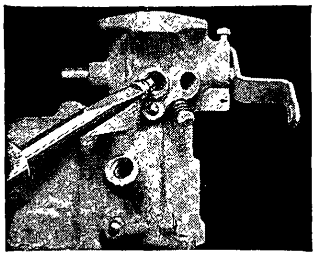


Fig. 29 Install idle port plug, using new copper washer

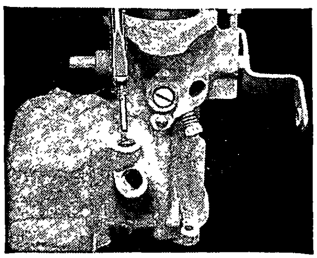


Fig. 30 Install new low speed jet, using new copper washer

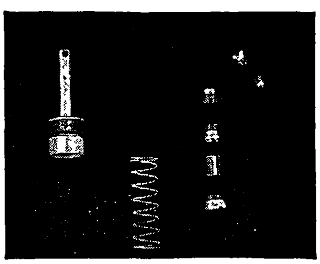


Fig. 31 Assemble parts for pump circuit. Check leather for damage. Soak leather in oil before installing

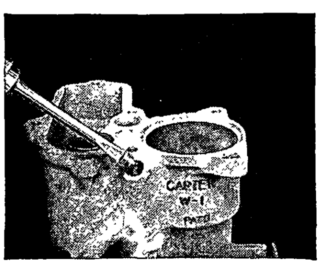


Fig. 32 Install pump j t and pump j t plug. Be sure jet is clear of all r stricti n and seats in casting. Use new c pper wash r under plug

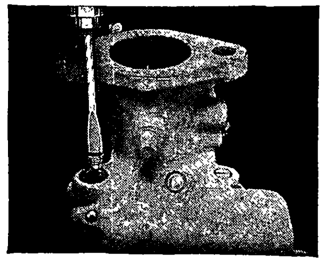


Fig. 33 Install discharge check, being sure assembly seats in casting

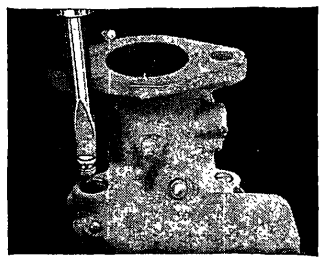


Fig. 34 Install intake check, being sure it seats in casting

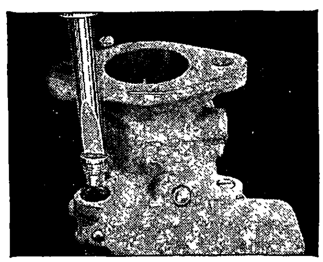


Fig. 35 Install check valve passage plug and strainer, using new copper washer

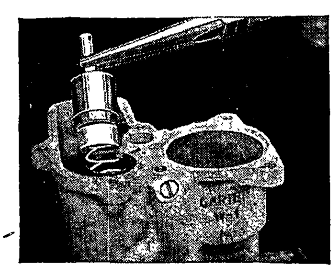


Fig. 36 Install pump spring and plunger. Use l ading t l to av id damage to plunger l ather

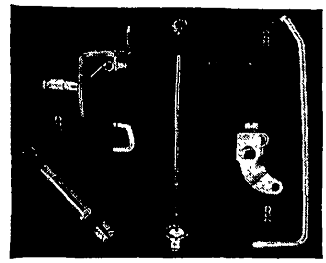


Fig. 37 Ass mbl parts c ntrolling high speed circuit. Check pump arm and c untershaft for wear, and for l se lever. If metering r d shows wear, *replac b th r d and jet.* New nozzles sh uld b used whenever carburet rs ar s rviced

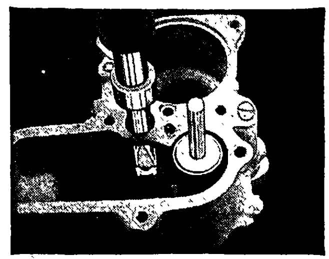


Fig. 38 Install metering r d jet and gasket

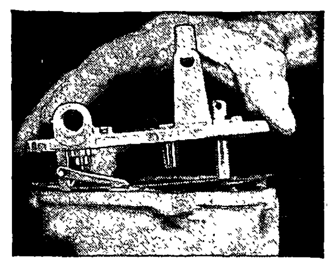


Fig. 39 Install b wl c ver as assembled, and gasket. Pr ss pump cylinder gasket (c rk ring) in recess d p rti n f bowl cover bef re installing. Use new b wl c ver gasket

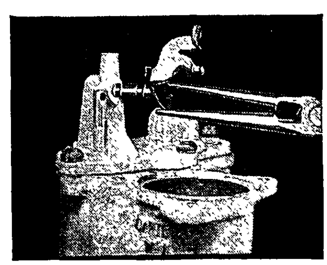


Fig. 40 Install pump arm assembly, and pump c nnect r link

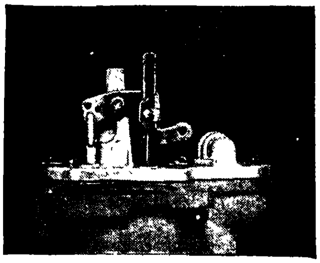


Fig. 41 Install metering rod gaug . Pin in pump arm should rest n shoulder of notch in gaug . See *Cart r Specificati ns* table f r correct gauge number

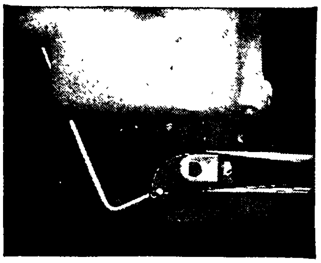


Fig. 42 Install throttle shaft arm and throttl c nnector rod

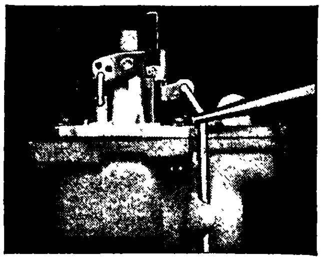


Fig. 43 Throttl c nnector rod sh uld just fit in hole in pump arm. Adjust by bending connect r r d at l wer angle. Remove gaug and c nn ct top end of r d in pump arm

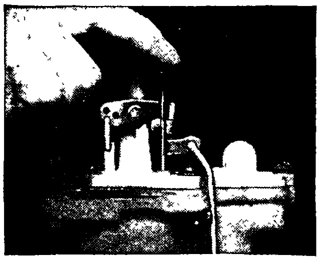


Fig. 44 Install metering rod and disc. Make certain rod is in jet. Hook metering rod spring to rod

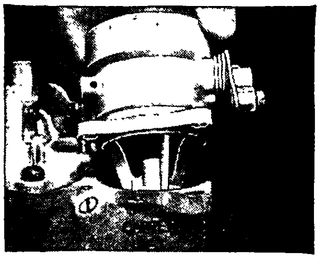


Fig. 45 Install air horn and choke tube bracket. Use new air horn gasket in all balanced bowl vent carburetors

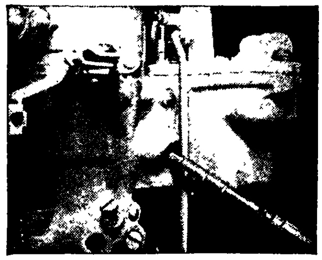


Fig. 46 Install nozzles and passage plug. Put new gasket in nozzle before installing. Slip nozzles should always be installed with flat surface upward. Insert new copper washer in casting before installing plug

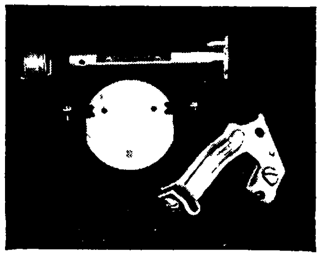


Fig. 47 Assemble parts controlling choke circuit. Check for loose lever on shaft

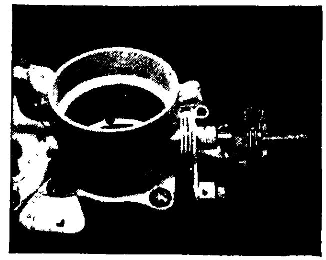


Fig. 48 Install ch ke shaft and lever and spring

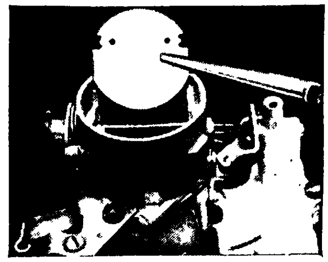


Fig. 49 Install chok valv . Center valve in air h rn b f re tightening screws. Use n w screws. Lubricat pump arm and countershaft with graphit grease inserted thr ugh dust cover attaching scr w h l in bowl cover. Use several dr ps of oil on felt packing n later type units to lubricat c unt r-shaft. Do n t lubricate other carburetor linkage as th increased accumulati n f grit will accelerat wear

SERVICE PROCEDURE

CARTER W-1 CLIMATIC CONTROL CARBURETOR

Courtesy Carter Carburetor Corp.

Fig. 50 R m v thr ttle c nnect r r d at pump arm. Check for wear at upper end f r d and h le in pump arm

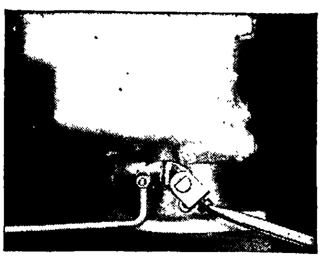


Fig. 51 Rem v thr ttle c nn ct r rod and thr ttle shaft arm. Check for wear at lower nd f r d and hol in arm

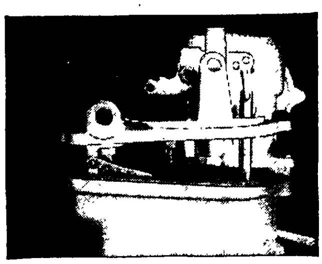


Fig. 52 Remov b wl c ver with all parts attached. (On 1934-35 m dels, air h rn must b remov d befor c v r)

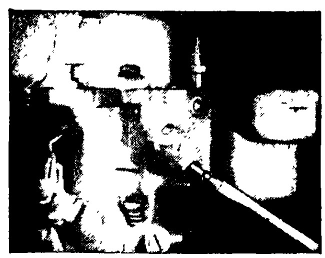


Fig. 53 R move n zzl passag plug and n zzl . R m v n zzl gasket fr m casting

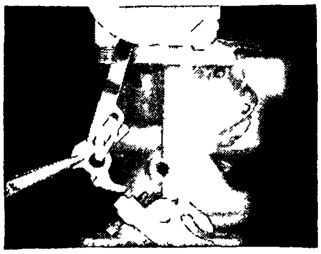


Fig. 54 R m v fast idle cam and pin, and scr w. Disconnect fr m fast idle link

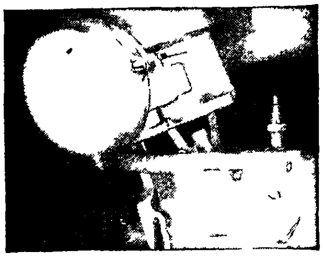


Fig. 55 Rem ve air horn and climatic c ntrol

Fig. 56 R m v anti-percola- t r unit

Fig. 57 R mov pump jet passage plug and pump jet. Remove c pp r washer from casting

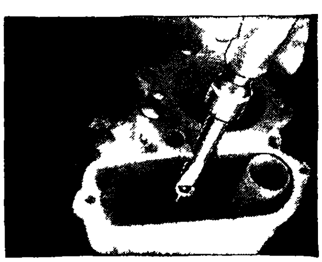


Fig. 58 R m v met ring rod j t and gask t

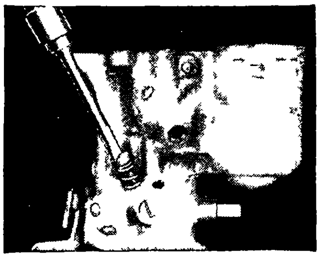


Fig. 59 Remove idle adjusting screw and spring. Check for groove on seating surface

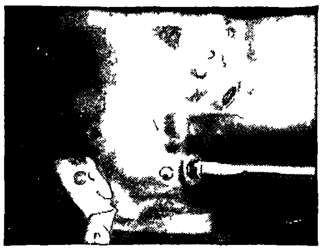


Fig. 60 Remove idle port plug

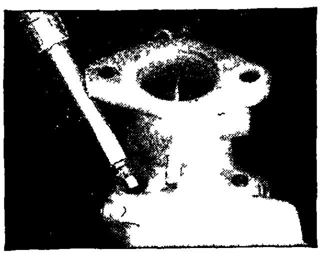


Fig. 61 Remove check valve passage plug, strainer, intake and discharge check valves. Remove copper washer from casting

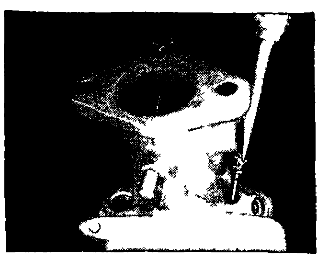


Fig. 62 Remove low speed jet, and copper washer from casting. On some carburetors, low speed jet is pressed in place and cannot be removed

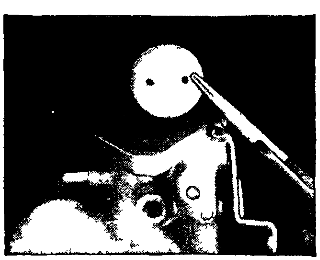


Fig. 63 R m v throttl valv

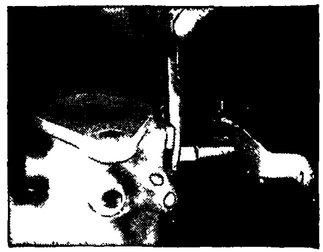


Fig. 64 Remove throttle shaft and lever. Check shaft for wear and loose lever, and throttle rod hole in lever for wear

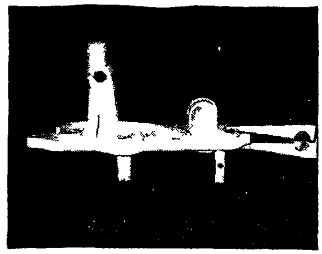


Fig. 65 Remove all parts from bowl cover

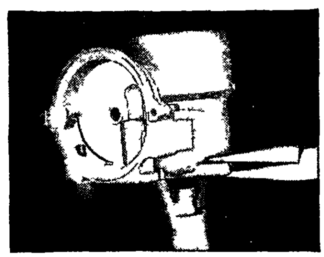


Fig. 66 Remove all parts from air horn. Do not remove piston housing attached to air horn with rivet

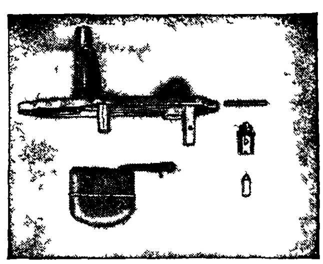


Fig. 67 Assemble parts that c ntrol gasolin l vel. Ch ck fl at for d nts and w ar n lip and float pin for w ar. Check b wl c v r f r warpag and wear in countershaft h l . If needl sh ws gro v n s ating surfac , r plac b th ne dl and seat

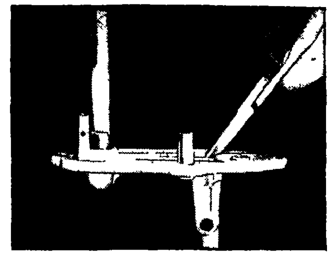


Fig. 68 Install n dl s at and gask t

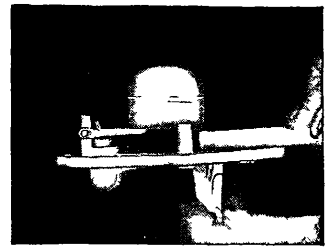


Fig. 69 Install n edl , fl at and lever, and fl at pin. S t float level t specificati ns given in *Carter Specification* table. Bend lip — n t fl at

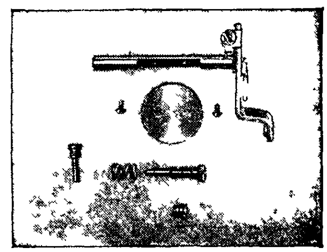


Fig. 70 Assembl idl circuit parts. Never r install a us d low speed j t. Us new jet and washer. B sur t scrap all carbon fr m casting

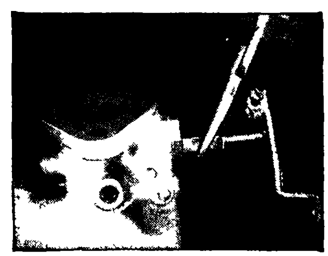


Fig. 71 Install thr ttl shaft and lever. Back ut thr ttl lever adjusting scr w

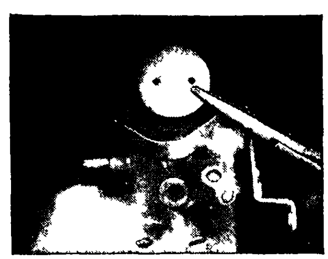


Fig. 72 Install thr ttl valv . Small "c" in circl r part

numb r should b toward idl p rt when viewing casting from manif ld side. C nter throttle valve by tapping lightly and hold in place with fing r b f r tightening screws. Use new screws

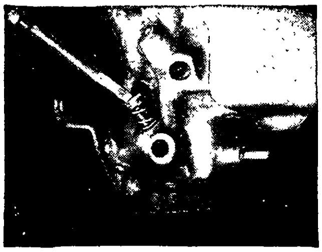


Fig. 73 Install idle adjusting screw and spring. Back screw out fr m seated position to specificati ns given in *Carter Specification* table

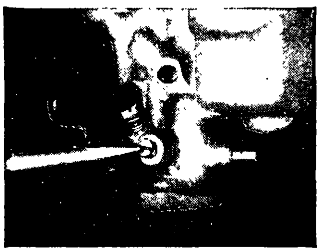


Fig. 74 Install idle port plug

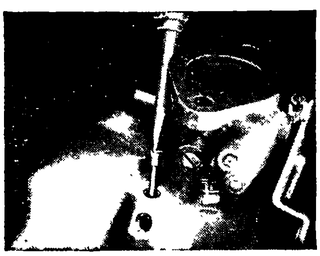


Fig. 75 Install low speed jet, using n w c pp r washer. On s me units, l w speed jet is pressed in place and cannot b removed

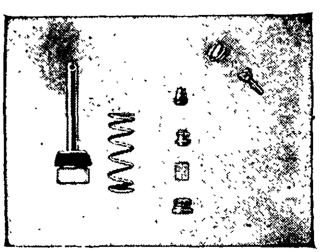


Fig. 76 Assemble parts f r pump circuit. R place b th spring and l ather if leather sh ws wear r damag . Test check valves by blowing f r fre perati n

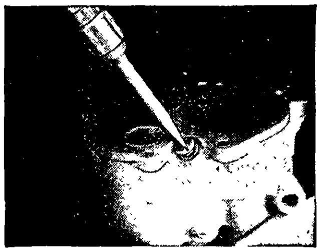


Fig. 77 Install pump discharge jet and plug. Be sure jet is clear of all restrictions and seats properly. Use new copper gasket

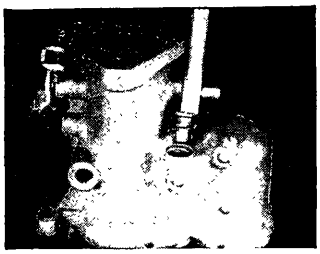


Fig. 78 Install discharge and intake checks, strainer and plug. Use new copper washer before installing strainer and plug

Fig. 79 Install pump spring and plunger. Use loading tool to avoid damage to leather

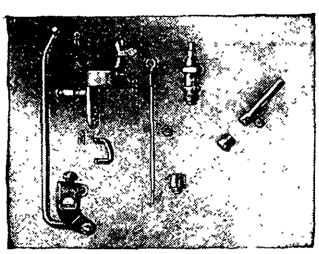


Fig. 80 Assemble parts controlling high speed circuit. Check pump arm and countershaft f r w ar n shaft, and f r lo s lever. If metering r d sh ws wear, r place b th r d and jet. New n zzl s sh uld be us d whenever carburet rs are s rviced. Check anti-percolat r valv cl s ly f r dirt and wear

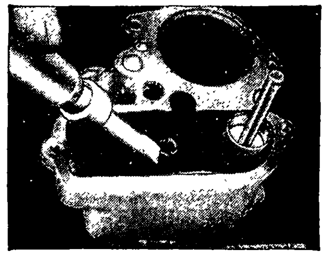


Fig. 81 Install metering rod jet and gasket

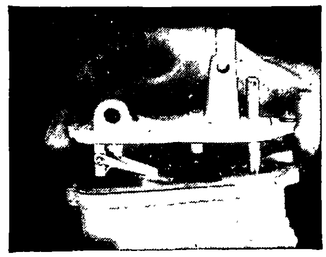


Fig. 82 Install bowl cover and gasket

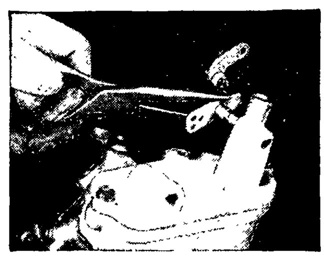


Fig. 83 Install pump arm and countershaft. Connect pump shaft to pump arm with connector link

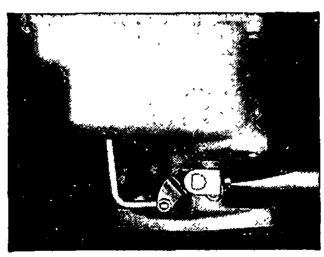


Fig. 84 Install throttle shaft arm and connector rod

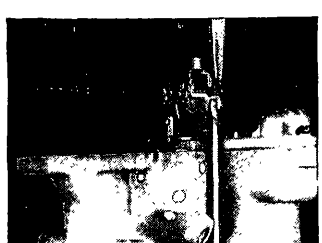


Fig. 85 C nnect upper end of thr ttl connect r r d t pump arm

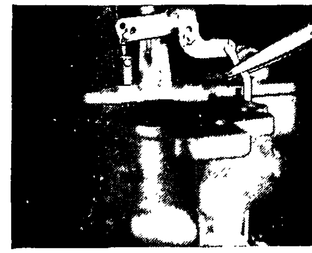


Fig. 86 Bend thr ttle c nnector rod at l w r end t giv specified pump plung r travel. (This adjustment nly f r carburetors with specifi d pump stroke.) Do n t bend thr ttl connector rod at p int sh wn by pliers. Bend at l wer angle for adjustment

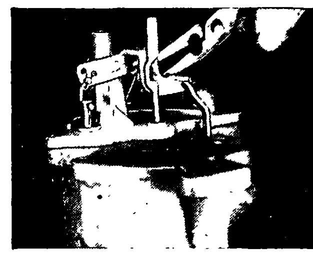


Fig. 87 Install m t ring r d gauge. Hold gaug vertical to insure seating. F r carburetors with adjustable metering rod pin, lo s n nut n pin and rest pin in n tch f gauge and tighten nut (T l N. T109-76). F r carbur tors with fixed pin, bend throttl connector rod so upper nd centers freely in pump arm h le

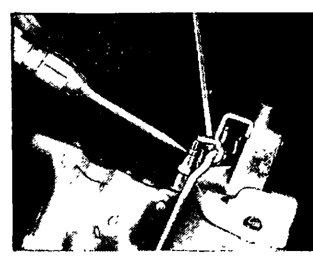


Fig. 88 Install anti-perc lat r valve. Seat tightly. Adjust lip on pump arm s indicat r lin is flush with t p f anti-p r-colator. Then install m tering r d

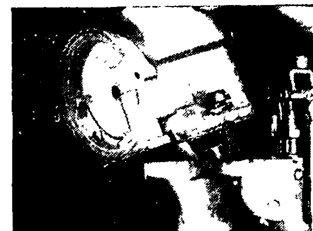


Fig. 89 Install air h rn

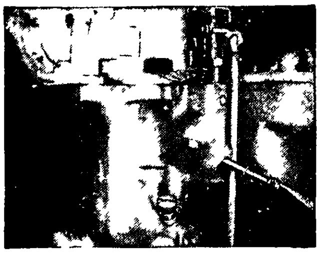


Fig. 90 Install n zzle and nozzl passage plug. Put new gask t n nozzl before installing. Slip n zzles should always be installed with flat surfac upward. Insert new c pper washer in casting before installing plug

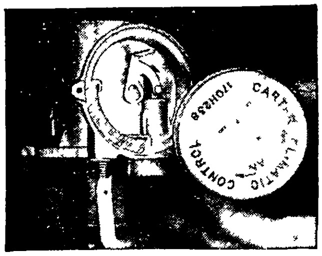


Fig. 94 Install strainer and thermostatic coil and housing. Install coil housing with indicator mark to bottom. Then revolve housing ½ turn counter-clockwise and set indicator as specified in *Automatic Choke* chapter

Fig. 95 Install fast idle cam and pin. Attach to body with screw

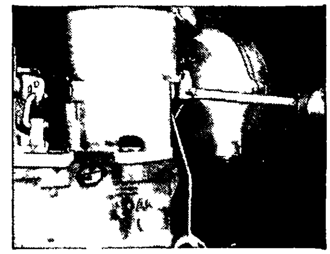


Fig. 96 Tight n ch ke lev r screw. Be sur linkage d es not bind in any p siti n. Then make fast idle, unl ad r and lockout adjustm nts

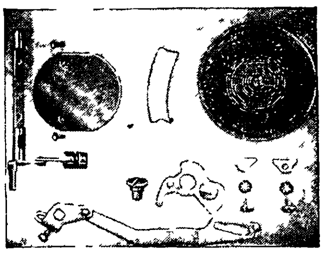


Fig. 91 Assemble choke parts. Ch ck f r l s lever on shaft

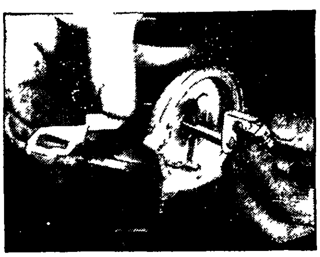


Fig. 92 Install ch ke shaft and lever with pist n attached. Be sur to install choke lever, screw and link when installing ch k shaft

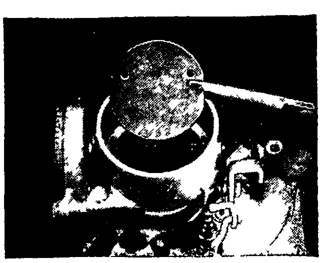


Fig. 93 Install choke valv . Us new screws. Cent r valv by tapping lightly. H ld in place with fing r bef re tightening screws

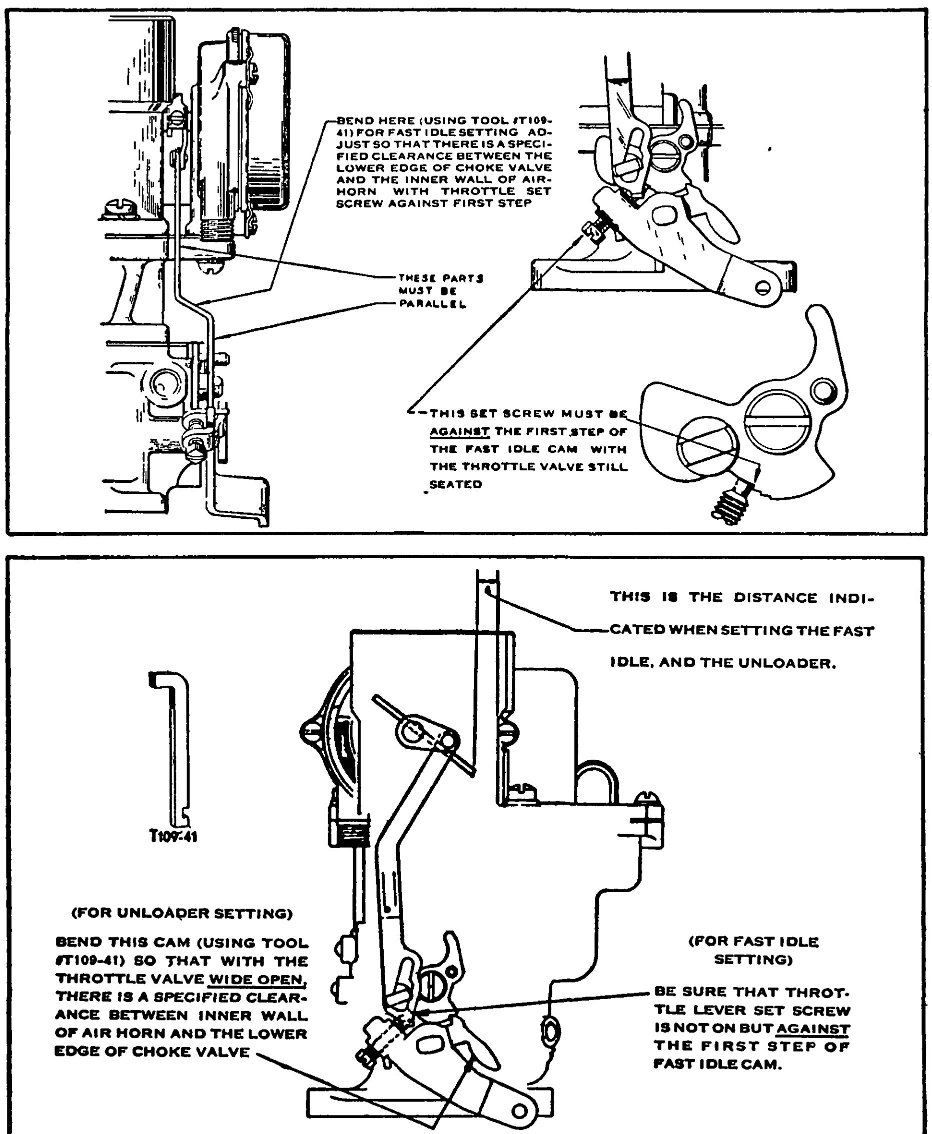


Fig. 97 CARTER W-1. Fast idl and unl ader s ttings

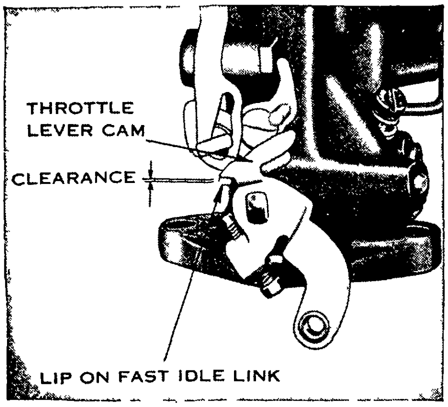


Fig. 98 CARTER W-1

Ch ke l ck ut. To adjust, bend lip of l wer end of fast idle link to give 1/32" clearance as shown when thr ttle and choke valves are held wide open

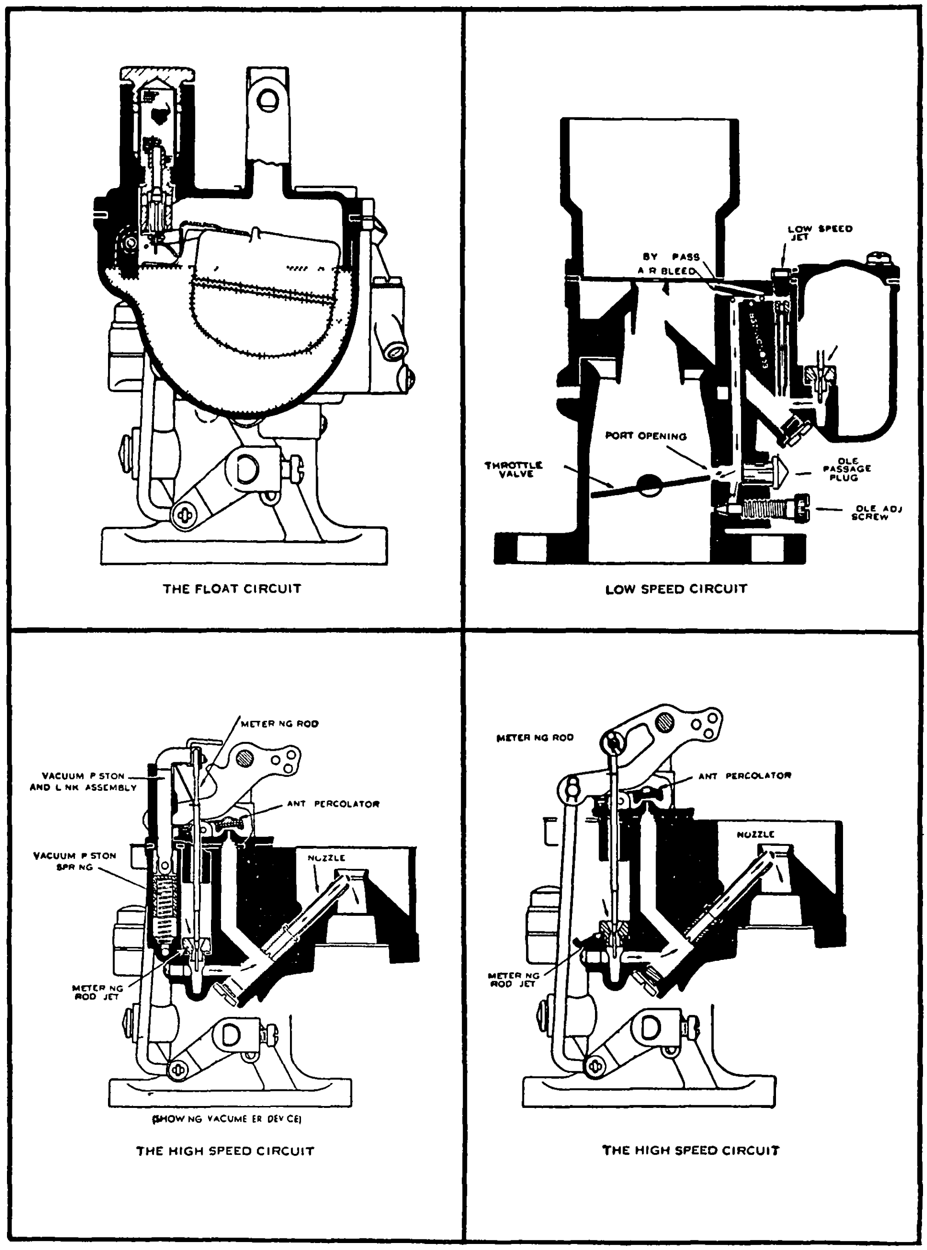


Fig. 99 CARTER WA-1
Showing details of construction

CARTER WA-1 SERIES

While this model differs somewhat in appearance from the W-1 carburetor, it contains all its desirable features, including the vacuum-operated metering rod (some units) Fig 99 shows details of construction

The air horn contains only the choke mechanism The sides of the choke valve are not quite parallel, and there is a ridge in the air horn which acts as a stop for the valve in the wide-open position This new construction makes assembly easier and eliminates the possibility of the valve rubbing on the inside of the air horn when it is not carefully assembled, thus minimizing the possibility of sticking choke valves

The accelerating pump system consists of a die-cast cylinder in the carburetor body, and intake and outlet ball checks seated in the body The intake ball is held in place by a screen under the pump spring, and the outlet ball by an extension on the plug above the ball

The low speed jet is inserted through the top of the float bowl These details in construction have removed two external screw plugs below the fuel level, leaving only the plug behind the nozzle

The bowl cover carries the complete anti-percolator, pump arm, and the vacumeter arm (if equipped) The seat of the anti-percolator is cast as a part of the cover, and is located to cover the vertical passage through the body

The anti-percolator valve is of the saxophone key type and is held on its seat by a coiled spring in tension The anti-percolator cap has a special leather seat and a resilient felt pad beneath the leather

Besides the step-by-step service procedure which follows, Fig 100 shows adjustment details After adjusting the metering rod, always lubricate the pump arm shaft with graphite grease

SERVICE PROCEDURE

CARTER WA-1 CLIMATIC CONTROL CARBURETOR

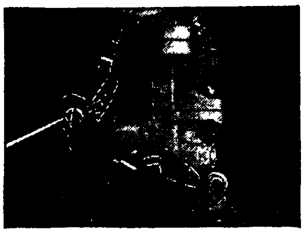


Fig. 101 R m ve fast idle cam and pin

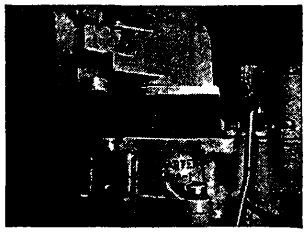


Fig. 102 Remove air horn and climatic control

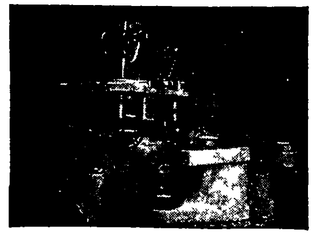


Fig. 103 Disconnect throttle connector rod, then remove bowl cover with all parts attached. Rem v throttl shaft arm. Check throttl c nnect r rod for wear at both ends, and hole in pump arm. R - move bowl c v r gasket and pump spring

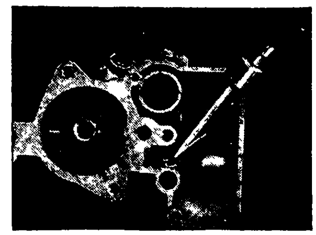


Fig. 104 Rem ve met ring rod jet and gasket

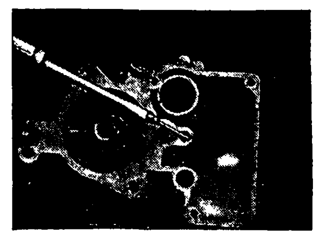


Fig. 105 R mov l w sp d jet

Fig. 106 R m v pump j t plug, gasket and pump jet

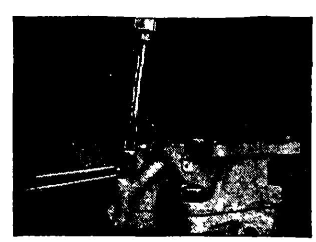


Fig. 107 R m v pump discharg ball retainer and gas- k t, and ch ck ball

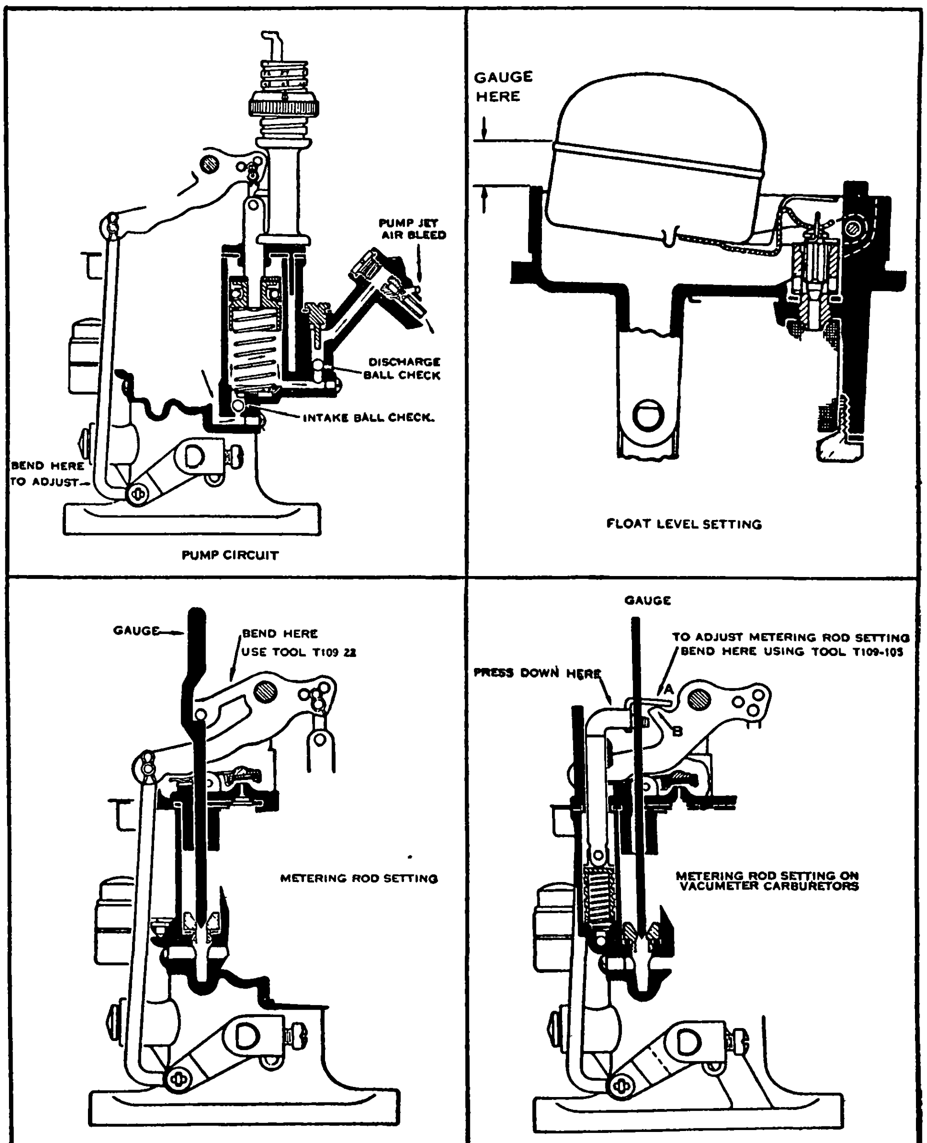


Fig. 100 CARTER WA-1. Sh wing adjustments

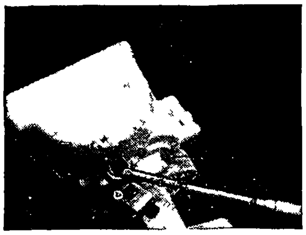


Fig. 108 Rem ve nozzle passage plug, n zzle retainer plug and n zzle. Take out nozzle gask t fr m casting

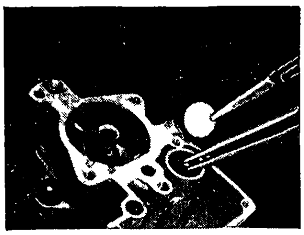


Fig. 109 Remove pump strainer, and pump intake check ball

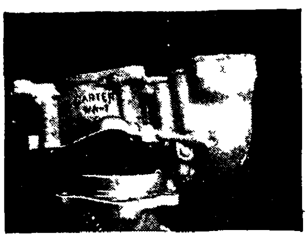


Fig. 110 Separat body from flang , and tak off flange gasket

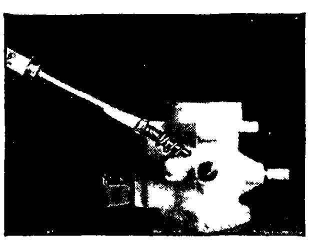


Fig. 111 R m ve idle adjustm nt screw and spring. Check f r gro ve n seating surface

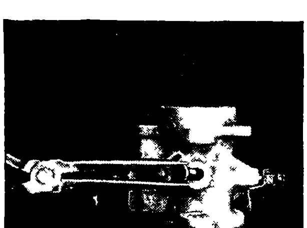


Fig. 112 Remov idl p rt rivet plug

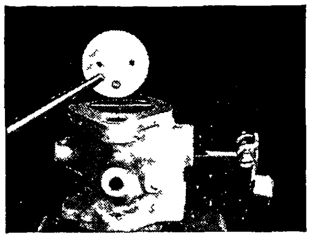


Fig. 113 Remove throttle valve screws, valve and throttle shaft and lever. Do not remove baffle plate from casting. Check shaft for wear, loose lever and throttle rod hole in lever for wear

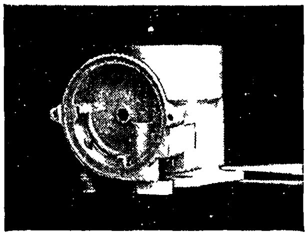


Fig. 114 Remove all parts from air horn. Do not remove piston housing attached to air horn with rivet

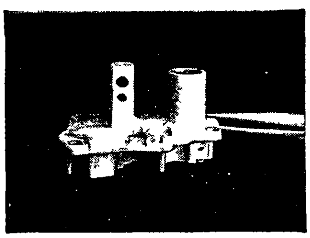


Fig. 115 Remove all parts from bowl cover

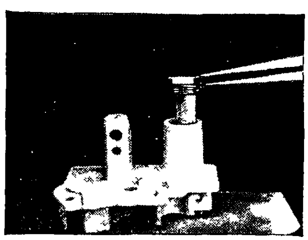


Fig. 116 To assemble, install strainer and strainer nut and new gasket

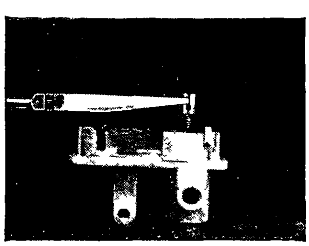


Fig. 117 Install needle s at and gasket. If ither needle r seat sh ws wear, replac both

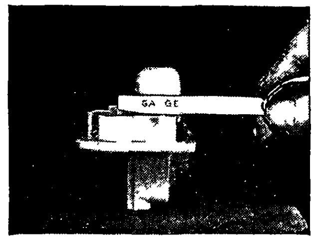


Fig. 118 Install needle, float and lever, and float pin. Check float for dents and wear on lip, and float pin for wear. Check bowl cover for wear in countershaft hole. Set float level to specifications by bending lip — not float. Measure distance from projection on bowl cover to soldered seam of float

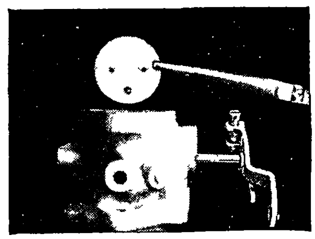


Fig. 119 Install throttle shaft and lever, and throttle valve. Small "c" in circle should be toward idle port facing manifold side of flange. Center valve by tapping lightly before tightening screws. Use new screws. Back out throttle lever adjusting screw before installing

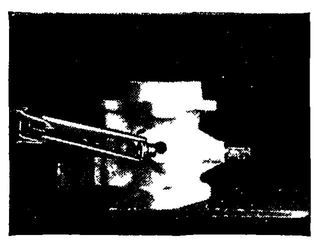


Fig. 120 Install idle port rivet plug

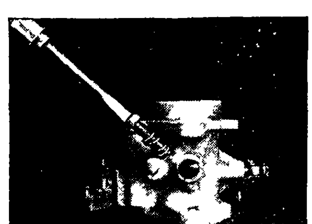


Fig. 121 Install idle adjustment screw and spring. Back out from seated p siti n to specificati ns given in *Carter Specification* table

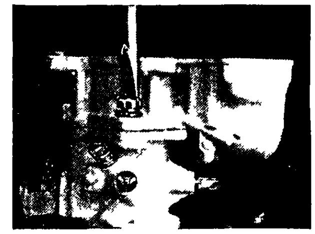


Fig. 122 Assembl b dy and body flange, using new gasket. Pull scr ws d wn v nly. Don't forg t l ck wash rs

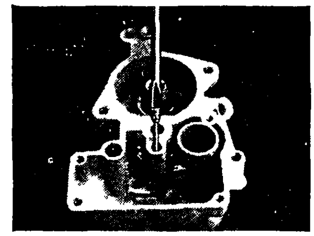


Fig. 123 Install l w spe d j t, being sure it seats firmly

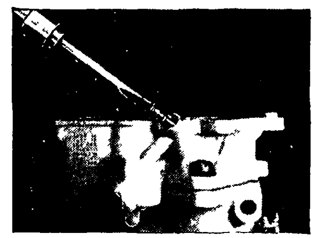


Fig. 124 Install pump j t and pump jet passage plug and gasket. Be sur jet is cl ar f all restrictions and seats pr perly. Use new gasket f r passag plug

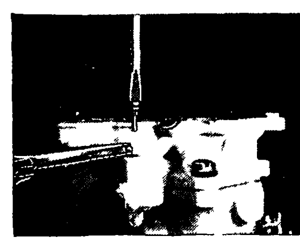


Fig. 125 Install pump check ball and pump discharg ball retainer and a n w gasket

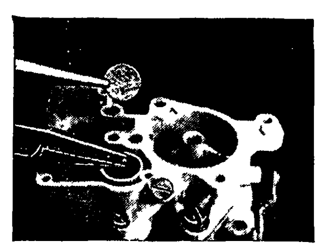


Fig. 126 Install pump intake check ball and pump strain r

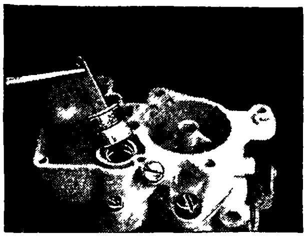


Fig. 127 Install pump spring and pump plunger and rod. If leath r is n t in good condition, replac entire assembly

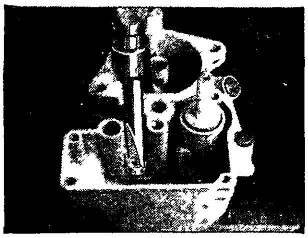


Fig. 128 Install metering rod jet and gasket. If jet is worn, replace b th m tering rod and j t. Us new gasket

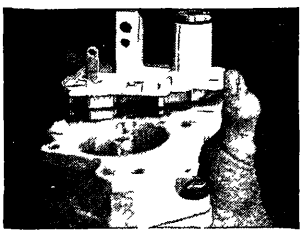


Fig. 129 Install bowl cover, using new gasket. Pull screws d wn ev nly. Install idle passag plug and gasket (center of b wl cover)

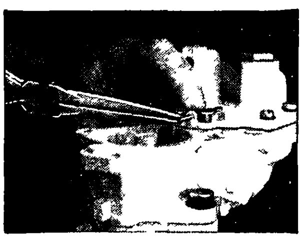


Fig. 130 Install anti-percolator cap and r ck r arm and spring. Make certain that leather is in g d c nditi n and that pin is n t worn

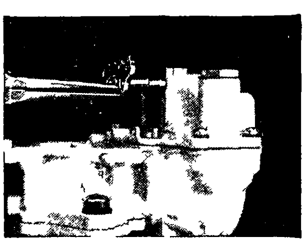


Fig. 131 Install pump arm and c untershaft. Install c n n ct r link n pump shaft and in pr p r h le in pump arm

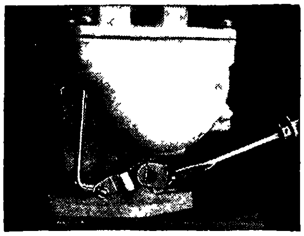


Fig. 132 Install throttle shaft arm, screw and throttle rod

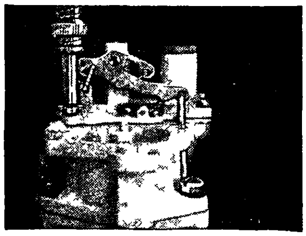


Fig. 133 With throttle connector link in place, adjust pump stroke. With connector link in proper pump arm hole, stroke can be measured by using universal pump stroke gauge T109-117S. Place gauge on ridged portion of bowl cover with indicator ear on top of pump shaft (also see Fig. 100). Measure distance between closed and wide open throttle. Adjustment is made by bending throttle connector rod at lower angle (see *Carter Specification* table

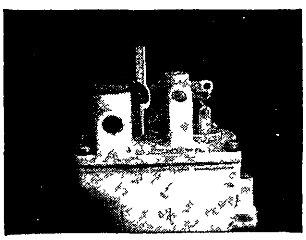


Fig. 134 (see Fig. 100). Adjust metering rod after pump adjustment is made. Insert metering rod gauge in place of metering rod, seating tapered end in jet. With throttle valve seated there should be less than .005" clearance between metering rod pin and shoulder of notch in gauge. Adjustment can be made by bending metering rod pin portion of pump arm up or down as shown in Fig. 135

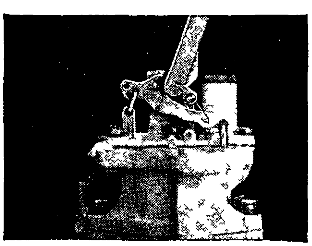


Fig. 135 Metering r d adjustment (se Figs. 100 and 134). N t —For carbur t rs with vacuum - perated m t ring rods, adjust m t ring r d after pump adjustment is made. Insert m t ring rod gaug in plac f m t ring rod, seating tapered end in jet. With throttle valve *seated*, press down lightly on piston link directly over piston. There should be less than .005" clearance between metering rod pin and shoulder of notch in gauge. Adjust by bending lip on piston link so it contacts hump on pump arm

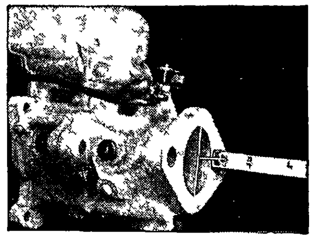


Fig. 136 Adjust anti-percolator. Open throttle the specified distance (see *Carter Specification* table) by placing gauge between valve and bore of carburetor (side opposite idle port)

Fig. 137 Anti-percolator adjustment. Bend anti-percolator rocker arm until there is a clearance of .005" to .015" between rocker arm and pump arm

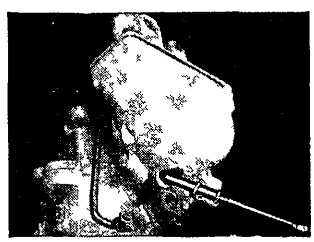


Fig. 138 Install nozzle, nozzle retainer plug and nozzle passage plug and new gaskets

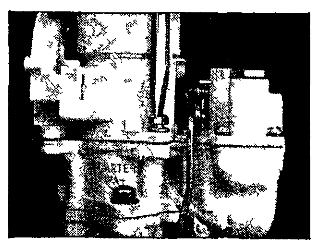


Fig. 139 Install air h rn and pist n h using, using new gasket. Tight n screws evenly. D n't f rget l ck washers

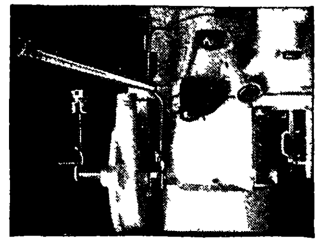


Fig. 140 With ch k l v r, screw and link in place, install choke shaft and pist n.

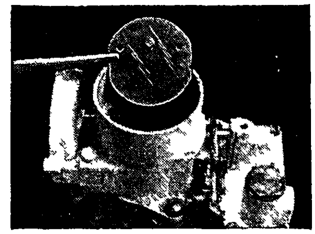


Fig. 141 Install ch k valve. Use new scr ws. Center valve by tapping lightly.

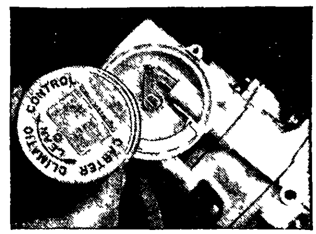


Fig. 142 Install strainer and thermostatic c il and h using. Install housing with indicat r marks on b tt m. Then r volve housing c unter-cl ckwise and set as specifi d in *Ch ke chapt r*

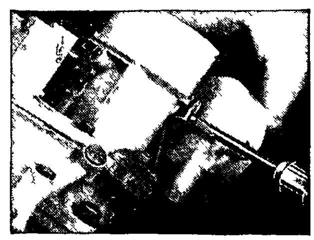


Fig. 143 H ld ch k valv wide open, then tighten ch k lever screw

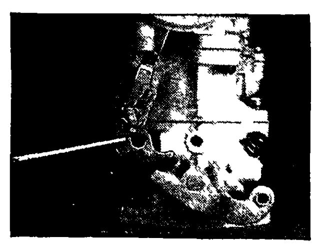


Fig. 144 Install fast idle cam and pin. Th n adjust fast idl , unl ader and l ck ut acc rding t th specificati ns given in th *Cart r Specificati n* tabl , and as sh wn in Figs. 97 and 98 f r W-1 carburet rs

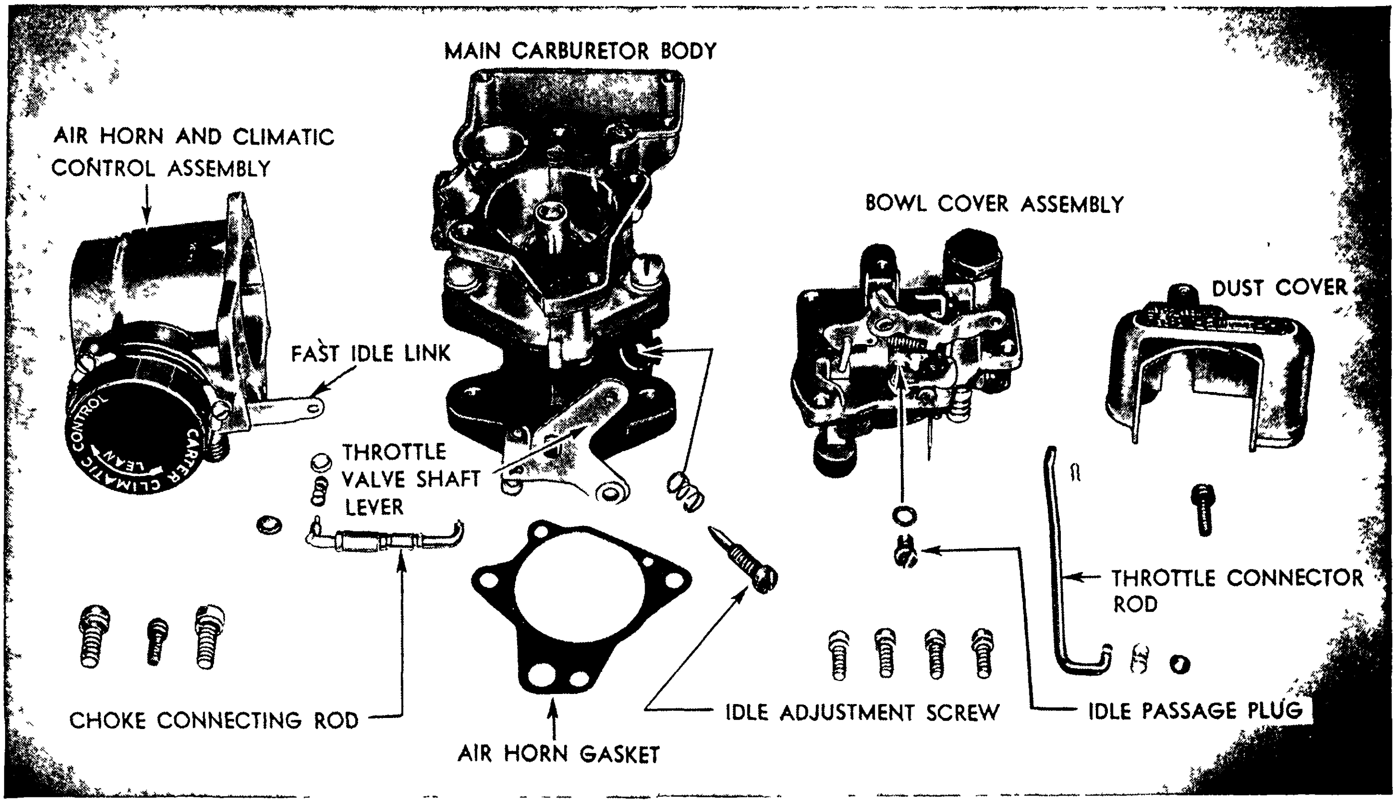


Fig. 146 CARTER WE

CARTER WE SERIES

The Carter WE carburetor is essentially the same as the WA-1 series. However, there are several changes in the location of the parts in the climatic control mechanism. As shown in Fig. 145, the fast idle cam assembly, choke trip lever, unloader mechanism, etc., are located in the climatic control housing. In this way, all these parts are protected from dirt and other foreign matter.

DISASSEMBLE—Fig. 146. Remove the dust cover and air horn, tilting the latter during removal so that the choke connecting rod can be removed from the throttle valve shaft lever. Take off the air horn gasket and detach the choke connecting rod from the fast idle link.

To disassemble the bowl cover, Fig. 147, turn the vacuum piston 90° counterclockwise and unhook it from the vacuum piston link. Then, after removing the pin spring and pump connector link, remove the pump plunger and rod. Take out the float pin and remove the float and lever and needle. Remove the float needle and seat.

Remove the vacuum piston link with the metering rod spring and metering rod and disc. Then remove the fuel bowl strainer nut, gasket and strainer, Fig. 148.

See Fig. 149 and remove the vacuum piston spring and the accelerating pump spring. After removing the pump strainer, remove the retainer ring, turn the carburetor upside down and take out the inlet check ball. Remove the pump discharge jet passage plug, gasket and pump jet. Then unscrew the discharge check ball retainer plug and gasket, and remove check ball. Unscrew the low speed jet and the metering rod jet and gasket.

See Fig. 150 and separate the main carburetor body from the throttle body. Unscrew the main nozzle passage plug and retainer plug and extract the nozzle and its gasket.

See Fig. 151 and remove the climatic control housing and gasket. Then, after removing the screw, take out the baffle plate, choke trip lever and fast idle link. Remove the valve from the choke shaft, turn the shaft counterclockwise and remove the choke piston from the cylinder. Pull the shaft out of the climatic control body and remove the fast idle cam from the shaft.

Clean all parts thoroughly with approved carburetor cleaner and blow dry with compressed air. *When blowing out the climatic control housing with compressed air, support the thermostat coil with a finger to prevent distorting the thermostat.*

Inspect all parts for wear or damage. If a replacement of parts is necessary, use the Carburetor Repair Kit for the model being serviced. When reassembling, replace all gaskets with new ones.

Assemble the carburetor in the reverse order of disassembly, making the necessary adjustments as given below. Before assembling the float bowl cover, lubricate the pump operating countershaft with graphite grease.

FLOAT SETTING—Fig. 152. Adjust by bending the lip of the float lever. After setting float, adjust tops on float bracket so the free end of the float can move ½ inch, plus or minus ⅛ inch.

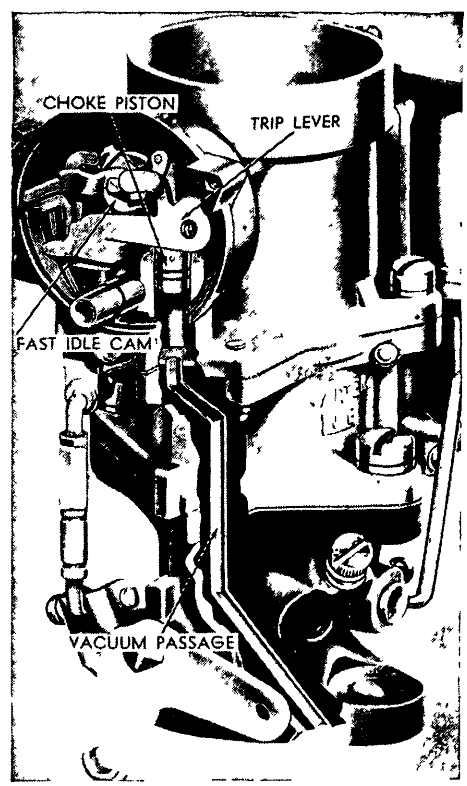


Fig. 145 CARTER WE Ch ke system

PUMP ADJUSTMENT—Fig. 153. This adjustment must be made before setting

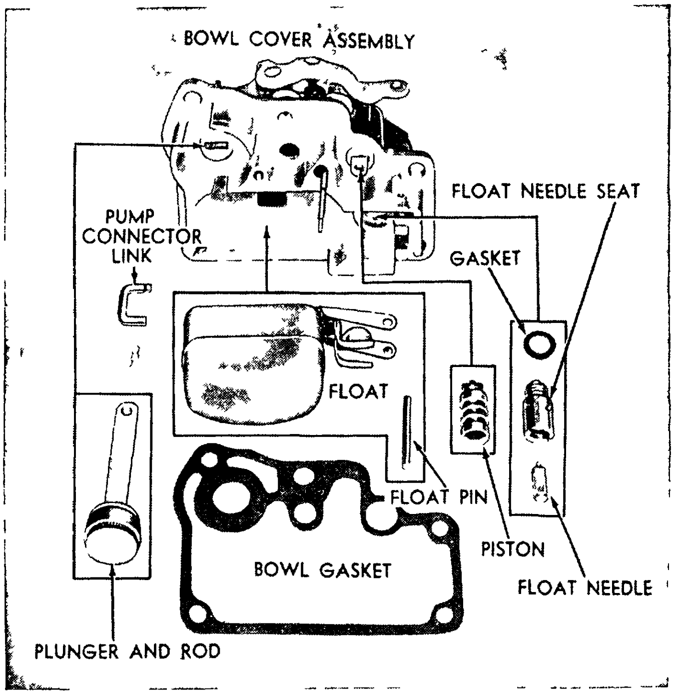


Fig. 147 CARTER WE

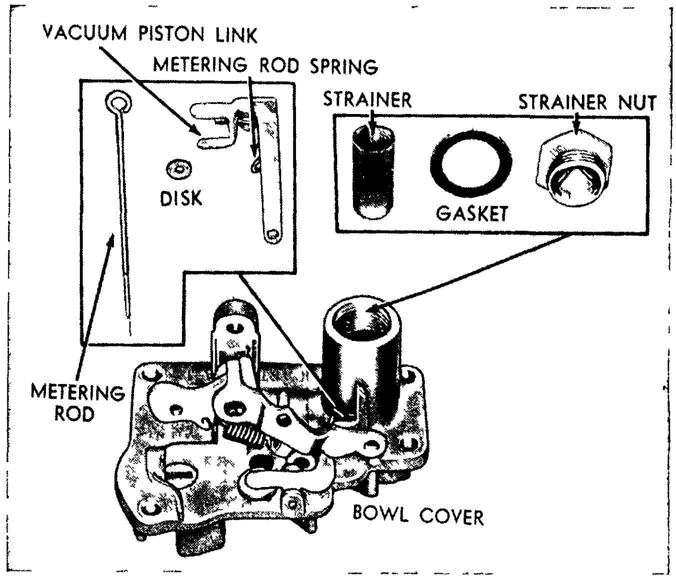


Fig. 148 CARTER WE

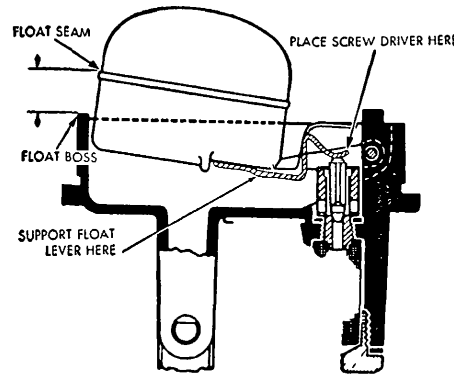


Fig. 152 CARTER WE Fl at setting

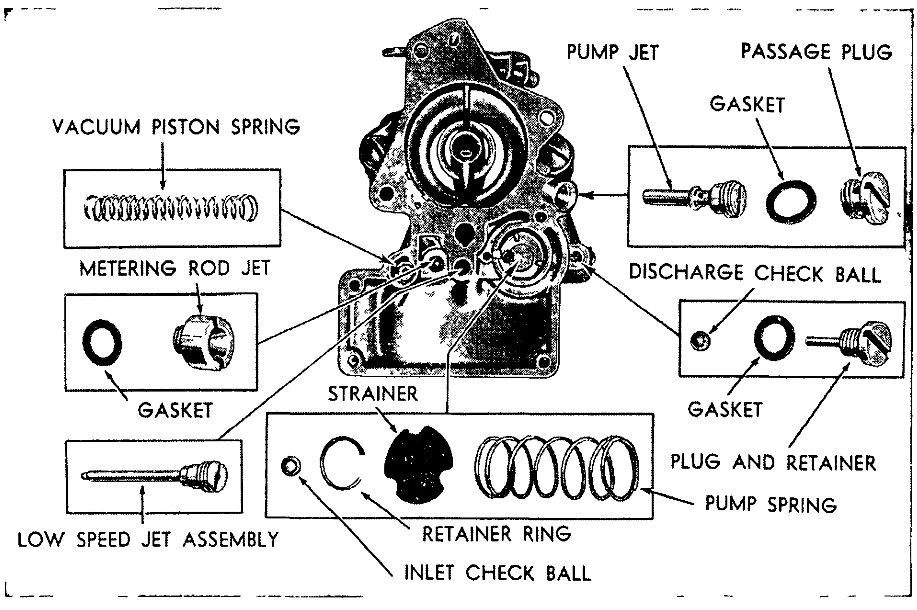


Fig. 149 CARTER WE

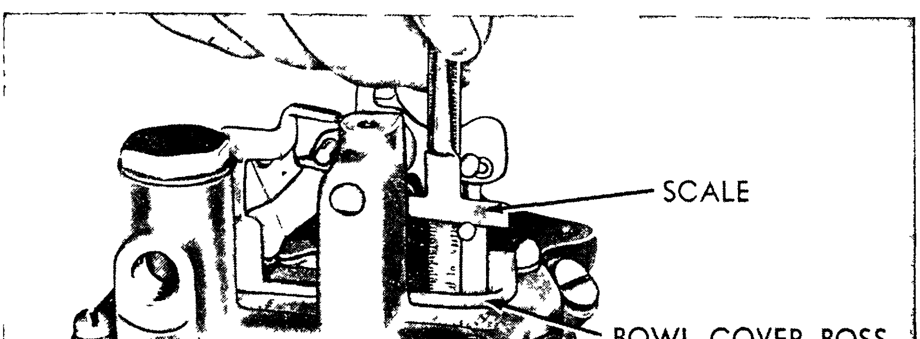


Fig. 153 CARTER WE Measuring Pump Str k

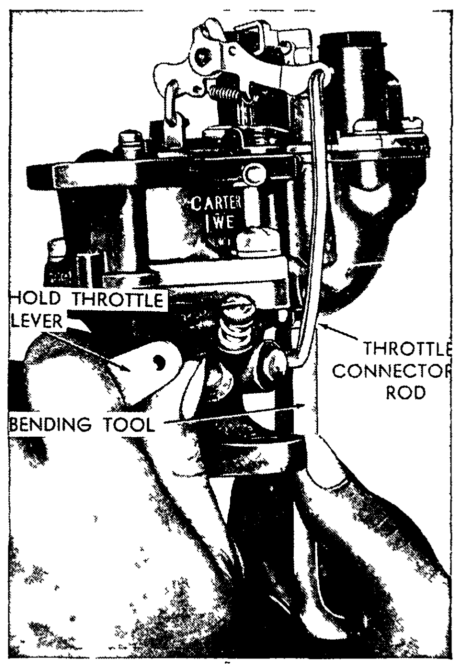


Fig. 154 CARTER WE
Bend thr ttle c nnect r r d at p int in-dicated to adjust pump str k

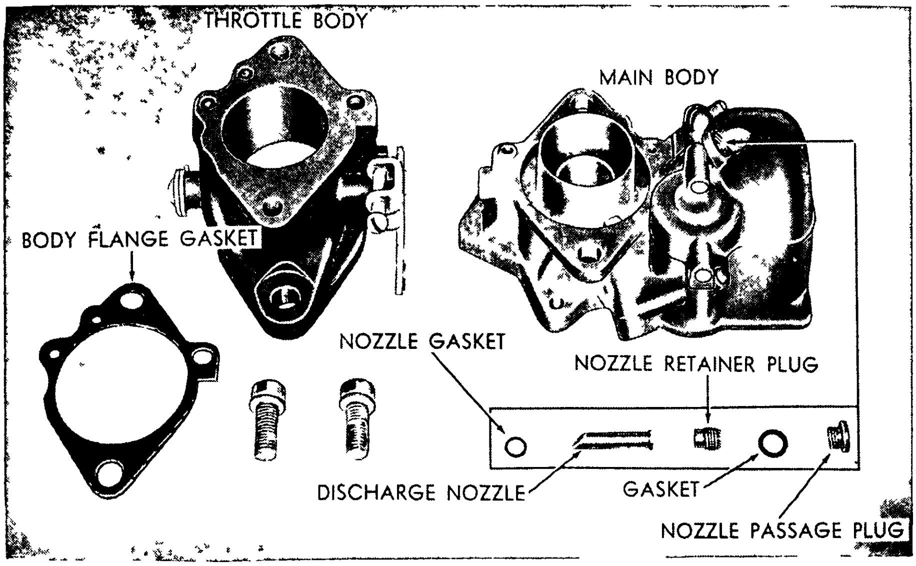


Fig. 150 CARTER WE

Fig. 156 CARTER WE
Metering rod adjustm nt

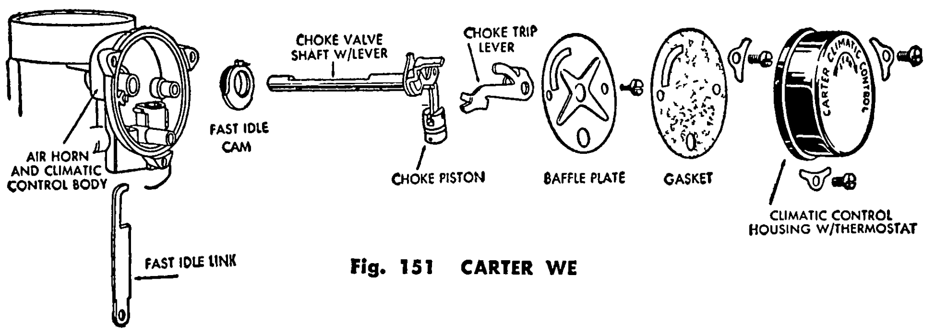


Fig. 151 CARTER WE

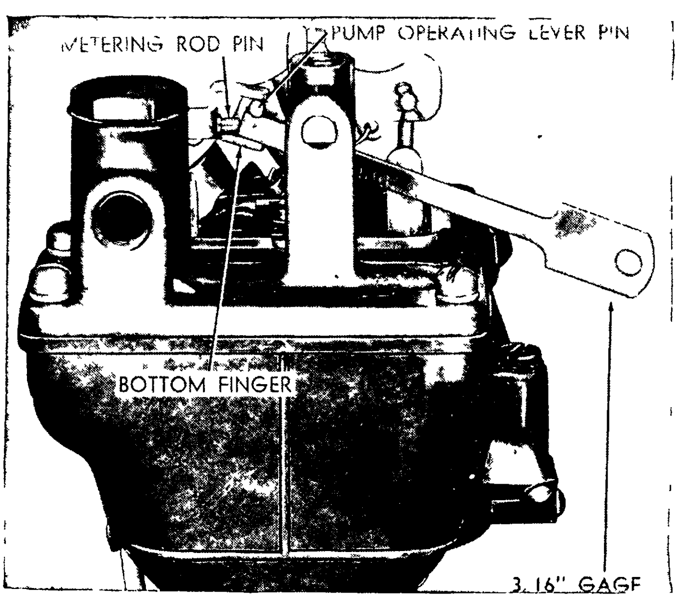


Fig. 157 CARTER WE
Gauging clearance b tween pump lever pin and bott m
lip r finger

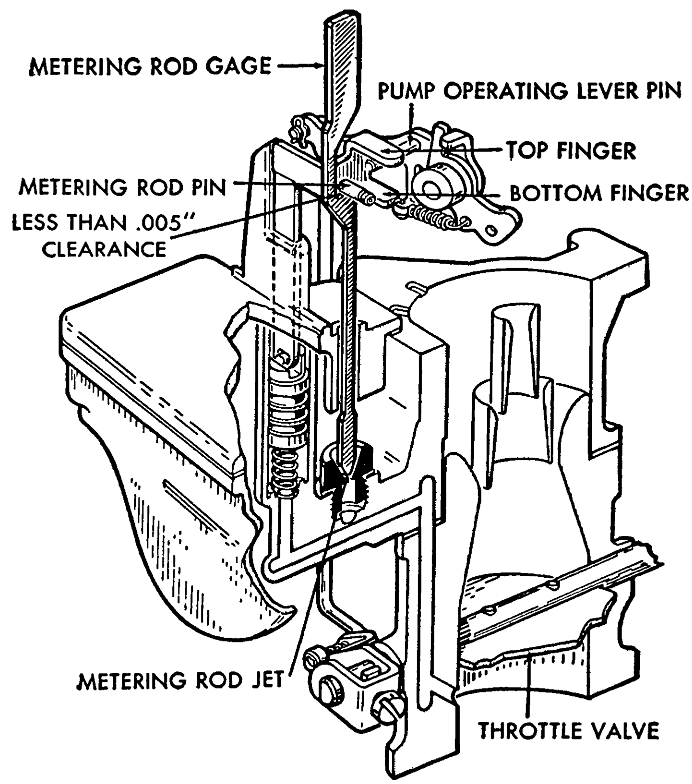


Fig. 155 CARTER WE
auging met ring rod s tting

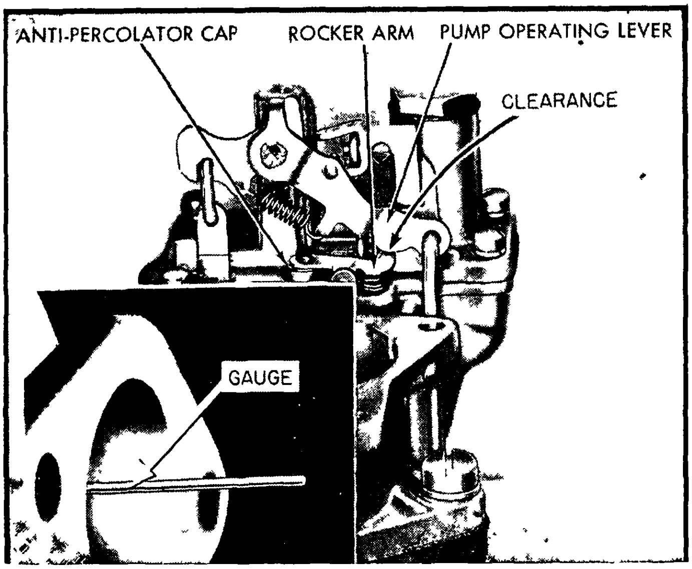


Fig. 158 CARTER WE. Anti-percolator setting

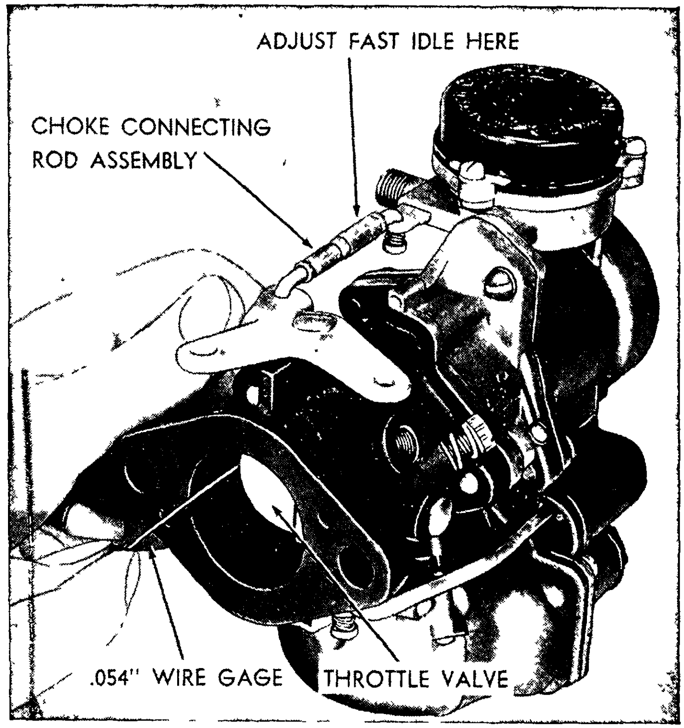


Fig. 159
CARTER WE
Fast idle setting

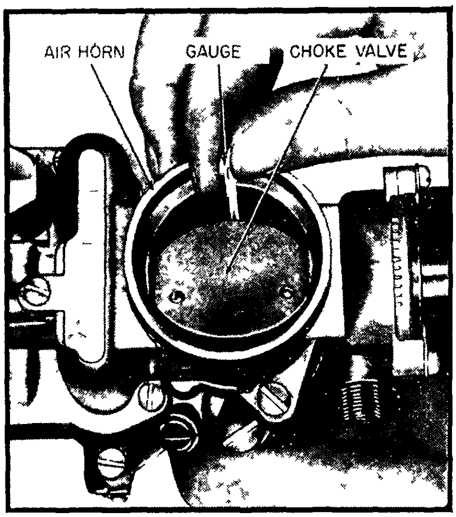


Fig. 160
CARTER WE.
Unloader setting

Fig. 161 CARTER WE
Unloader adjustment

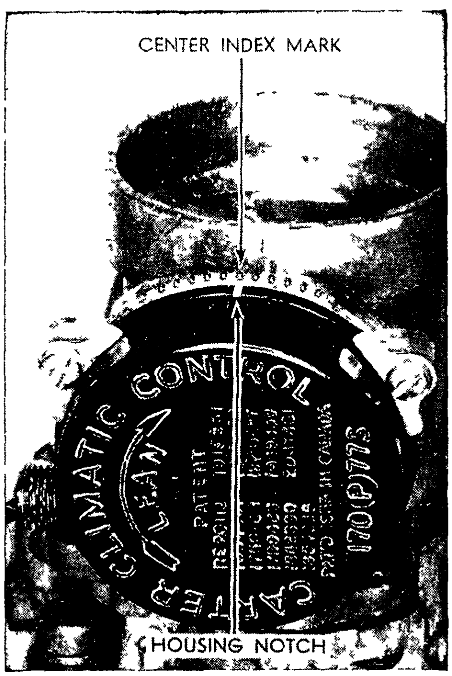


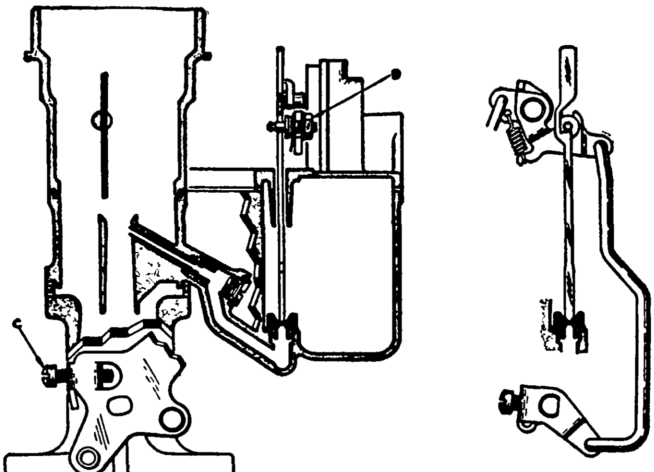
Fig. 162 CARTER WE Ch ke setting

the metering rod and anti-percolator. To make the adjustment, back out the throttle lever adjusting screw to allow the throttle valve to seat in the carburetor bore. Place the pump travel gauge on the bowl cover with the lip of the gauge extending over the top of the plunger shaft. Measure the distance between closed and wide open throttle, which should be as specified in the *Carter Specification* table. Adjustment is made by bending the connector rod at the lower angle, Fig. 154.

METERING ROD ADJUSTMENT—Fig. 155. Remove the metering rod and disc and install the proper metering rod gauge in place of the metering rod, seating the end of the gauge in the metering rod jet. Back out the throttle lever set screw so throttle valve seats in carburetor bore. Press lightly on the top of the metering rod arm until the *upper* lip or finger of the arm contacts the pin in the pump arm. There should be less than .005 inch clearance between shoulder of notch in gauge and metering rod pin. Adjust by bending upper lip or finger on metering arm, Fig. 156.

NOTE—This carburetor provides an added economy measure by means of the lower lip or finger which extends below the pin in the pump arm, and should be adjusted as follows: With the throttle valve seated and finger pressing down on metering rod arm so that the upper lip contacts the pin on the pump arm, adjust the lower lip or finger to specified clearance between the *bottom* of the pump arm pin and *upper* surface of lower lip, Fig. 157. Adjust by bending lower finger.

ANTI-PERCOLATOR ADUJSTMENT—Fig. 158. Do not disturb pump or metering rod adjustments. Insert specified



METERING ROD GAUGING

Fig. 165 CARTER W-O

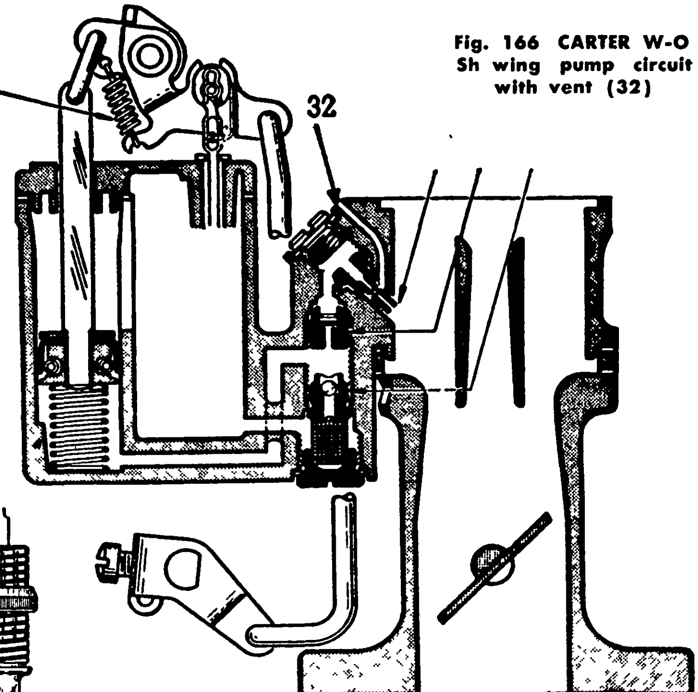


Fig. 166 CARTER W-O Sh wing pump circuit with vent (32)

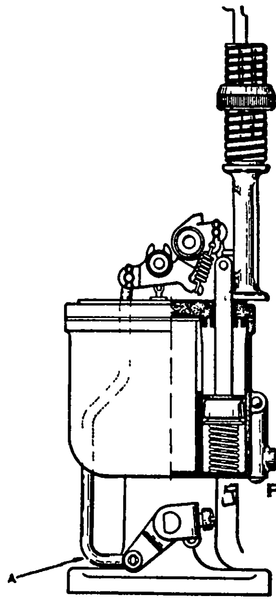
gauge between throttle valve and carburetor bore on the side opposite idle port. Bend the anti-percolator rocker arm to allow specified clearance, plus or minus .005 inch, between rocker arm lip and pump arm.

NOTE—When assembling the parts in the climatic control housing, slide the fast idle cam onto the choke shaft. Install the choke shaft into the air horn and revolve the cam to allow the piston to slide freely into the cylinder. Then lock the fast idle cam spring ends around the nib of the cam and the projecting nib of the choke shaft. Install the choke valve with the trade mark to the top, seating the valve before tightening the screws. The valve must not bind in any position, but must fall free of its own weight. Install the fast idle link and choke trip lever. Place washer on choke connector rod before attaching to the fast idle link. Install the spring and retainer. Before going any further with the assembly, adjust the fast idle and unloader settings, as follows:

FAST IDLE ADJUSTMENT—Fig. 159. Crack the throttle valve, hold the choke valve fully closed, then close the throttle. This will allow the fast idle cam to revolve to the fast idle position. With choke valve held tightly closed and slight tension on the throttle lever, loosen the lock nut on the choke connector rod and turn the sleeve until there is .054 inch clearance between throttle valve and carburetor bore (side opposite idle port). Hold the sleeve in position and secure lock nut.

UNLOADER ADJUSTMENT—Fig. 160. This adjustment must be made after the fast idle adjustment. Hold the throttle valve in wide open position and close choke valve as far as possible without forcing. There should be $\frac{3}{16}$ inch clearance between lower edge of choke valve and inner wall of carburetor. Adjust by bending arm on choke trip lever as shown in Fig. 161.

NOTE—After setting the fast idle and unloader, install the baffle plate and attaching screw, and coil housing gasket. With the choke wide open, hold the coil housing with the notch revolved ¼ turn



PUMP TRAVEL GAUGE

Fig. 167 CARTER W-O

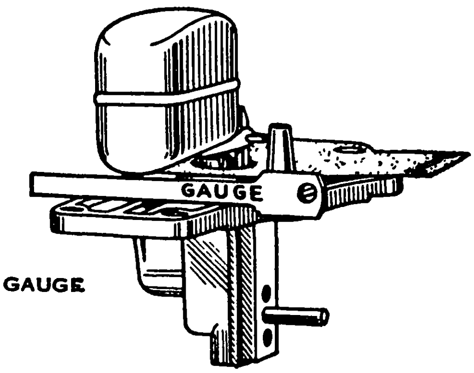


Fig. 163 CARTER W-O Gauging float having n dl with spring and pin

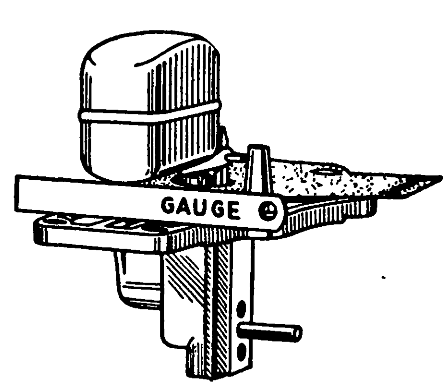


Fig. 164 CARTER W- Gauging float having regulation n dl

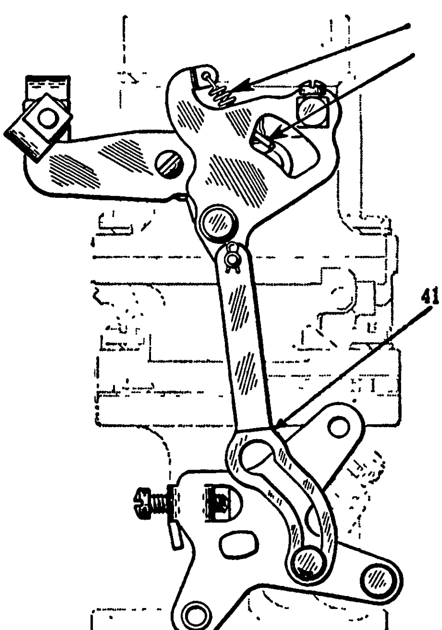


Fig. 168 CARTER W-O. Ch k and throttl linkag . Bend link at p int indicated by "41" f r fast idle adjustment

clockwise from the index mark on the housing. Place against the housing and revolve counterclockwise to center the index mark, Fig. 162. Lock the housing in place with screws and retainer.

CARTER W-O SERIES

Except for small differences in construction, this series is quite similar to the WA-1 carburetor.

FLOAT SYSTEM—Some models have the conventional needle and seat while others have a special needle in which is inserted a pin and spring. These needles are not interchangeable and should be used only with the proper needle seat.

In gauging the float with a needle which has a spring and pin, do not place any weight on top of the float. With the bowl cover in the position shown in Fig. 163, and gasket moved out of the way, the float with its own weight only should rest at the distance indicated by the gauge in the illustration. Be sure the spring and pin are in position and that the spring has not been stretched.

In adjusting the float level when the regulation needle is used, turn the gasket around so the gauge can be placed on the machined surface of the casting, Fig. 164. Adjustment is obtained by bending the float lip (which contacts needle). Do not bend float.

LOW SPEED SYSTEM — Gasoline for the low speed system does not come through the main metering jet but through the idle well jet, the opening of which is carefully calibrated, and if damaged should be replaced.

HIGH SPEED SYSTEM—The high speed system carries a vented nozzle. The vent is a small opening which must always be kept clean. The metering rod is gauged and adjusted as shown in Fig. 165. This must always be done only after adjusting the pump stroke. With throttle seated, loosen nut (B) and move the pin until it rests in the gauge notch. Tighten the nut securely, remove the gauge and install metering rod, disc and spring. Be sure to insert end of spring through small hole in metering rod. Lubricate the pump arm shaft with graphite grease.

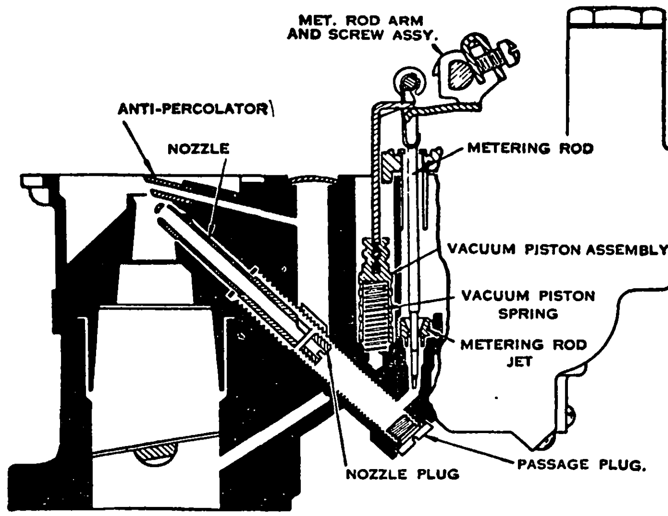


Fig. 168A Carter WDO with anti-percolator tube

PUMP SYSTEM—The pump system is made with and without a pump vent (32), Fig. 166. To adjust the pump stroke, back out the throttle lever set screw. The pump plunger should travel the specified distance from closed to wide open throttle (see *Carter Specification* table). Pump travel can be measured by placing universal gauge T109-117S in the position shown in Fig. 167. The distance between the numbers shown by the index mark on the gauge at closed and wide open throttle positions will be plunger travel in 64ths. To adjust the stroke, bend rod at "A", Fig. 167.

CHOKE SYSTEM—Fig. 168. The choke connector link (41) connects the choke and throttle levers and causes the throttle to be opened slightly when the choke valve is closed or partly closed, thus insuring quick starting and freedom from stalling during warm up periods.

To adjust the fast idle, hold choke fully closed and bend the connector link (41) at the offset to given proper throttle valve opening (see *Carter Specification* table). Be sure bending is done at the offset and the ends of the link are parallel so no binding occurs at either end.

CARTER WDO SERIES

The WDO series carburetor is in reality two W-1 units built together with one common float system, choke system and pump system. Since both sides of the carburetor are operated from a common shaft, the two metering rods and the two anti-percolators (when used) must be set exactly the same.

Prior to 1939, these carburetors were made with mechanically operated metering rods and valve type anti-percolators. On 1939 and later units, the vacuum operated metering rod was introduced, the operation of which is the same as described for the W-1 models. During 1939, also, some models were equipped with an anti-percolator in the form of a tube, Fig. 168A. The position of this tube is important and it should never be removed or changed in any way.

On some carburetors, a starting switch is incorporated. This device is fully described in the *Starter Switch* chapter.

SERVICE PROCEDURE

CARTER WDO DUAL CLIMATIC CONTROL CARBURETOR

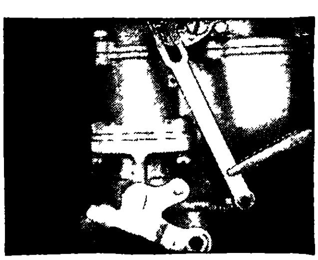


Fig. 169 Remov fast idl c n- nector link at l wer nd

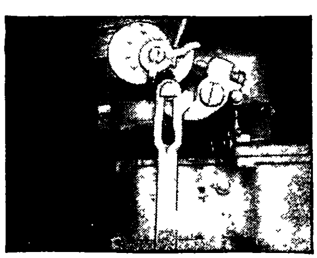


Fig. 170 R m v air h rn

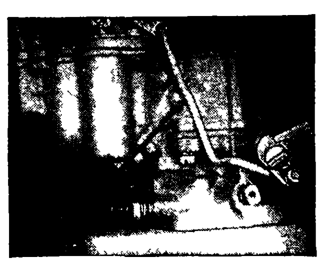


Fig. 171 Disc nn ct thr ttl conn ct r r d at thr ttl shaft

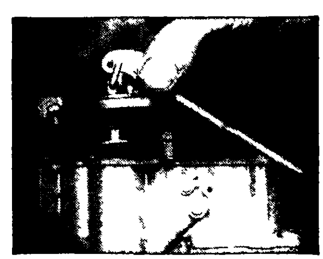


Fig. 172 R mov b wl c ver with all parts attached

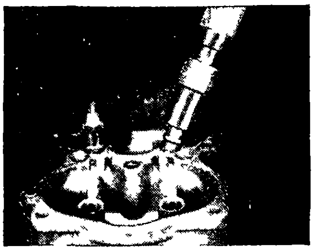


Fig. 173 Rem v both anti-perc lat r valves

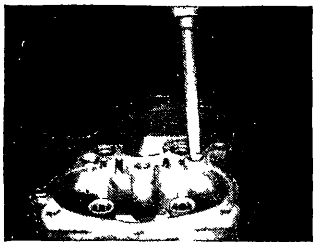


Fig. 174 Rem ve both pump jet plugs and pump jets. All metering j ts in these carbu-r t rs ar in duplicate. Illustrations sh w r m val of only n

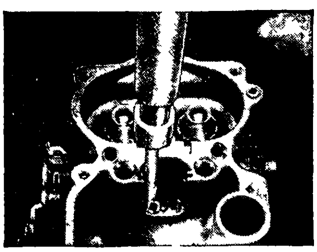


Fig. 175 Rem ve metering rod jets and gaskets

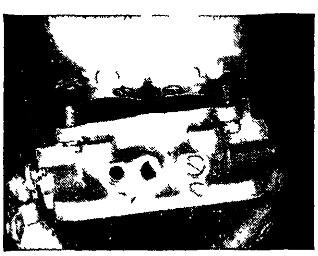


Fig. 176 Rem ve body flange and gask t. B sure to re-move tw small rubber idle passage gaskets

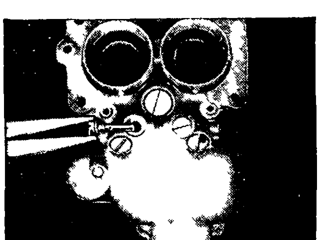


Fig. 177 R m v b th low speed j ts and gaskets.

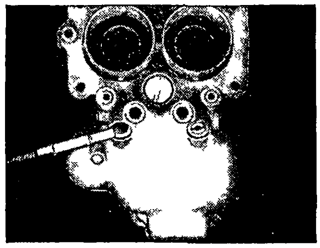


Fig. 178 Remove both nozzle plugs, nozzle retainer plugs and nozzles. See that nozzle gaskets are removed from casting

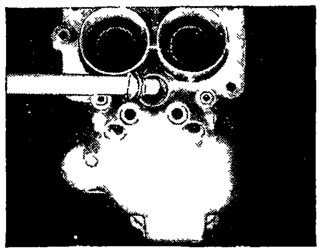


Fig. 179 Remove pump check plug, screen and both pump checks, and washer from cast-ing

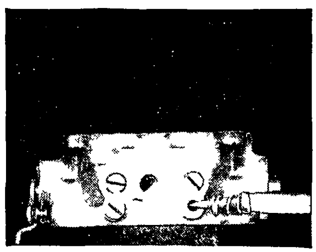


Fig. 180 Remove idle adjust-ment screws, springs and idle port plugs

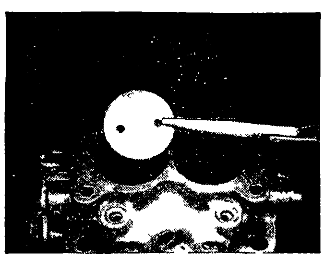


Fig. 181 Remove both throttle valves

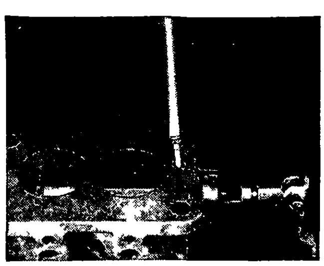


Fig. 182 Rem ve thr ttl c n-tering screw, th n thr ttle shaft and lever. Check shaft f r w ar, l se l v r, and thr ttle rod h l in lev r f r w ar. R move all parts from b wl c ver and fr m air h rn On 1937-38 mod l pumps, make sur reli f passag t outside is clear of all obstruc-tion

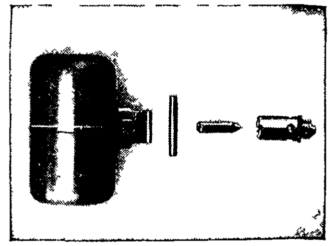


Fig. 183 Assemble all parts that control the gasoline level. Check float for dents and wear on lip, and float pin for wear. Check bowl cover for warpage and wear in counter-shaft hole. If needle shows groove on seating surface re-place both needle and seat

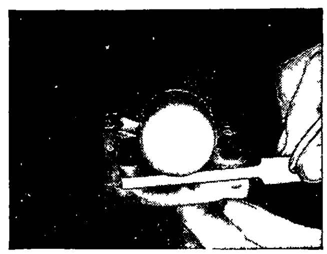


Fig. 184 *Install needle and* seat, float and lever, and float pin. Set float lever to speci-fications (see *Carter Specifica-tion* table) by gauging dis-tance between bowl cover and each end of float. Do not gauge from soldered seam

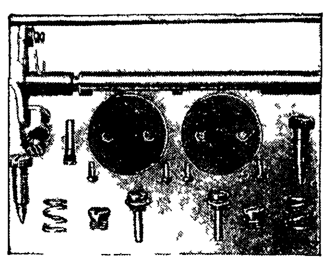


Fig. 185 Assemble idle circuit parts. Never reinstall used low speed jet. Use new jet and washer. Be sure to scrape all carbon from casting

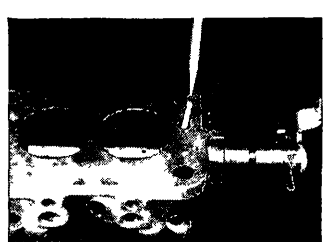


Fig. 186 Install thr ttl shaft and lever, and thr ttl c nt r-ing screw. Back ut thr ttle lever adjusting screw

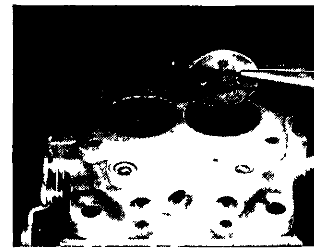


Fig. 187 Install thr ttle valves. Small "c" in circle r part number should be t ward idle port when viewing casting from manifold sid . Cent r throttle valv by tapping lightly and h ld in place with fingers bef re tight ning screws

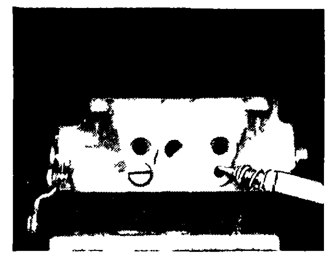


Fig. 188 Install idl adjust-ment screws and springs and idle port plugs. Back ut idle adjusting screws t specifica-ti ns

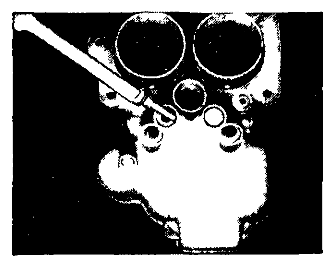


Fig. 189 Install tw new l w speed jets. Be sure t install small copper wash rs (wher used) before installing jets

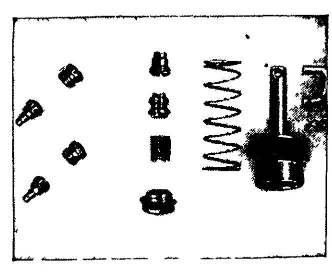


Fig. 190 Ass mbl parts f r pump circuit. Replace b th spring and leather if leather shows wear r damag . Test checks by bl wing f r fr e perati n

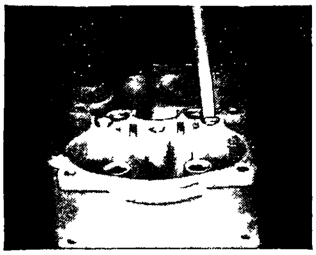


Fig. 191 Install pump discharge j ts and plugs. Make c rtain jets ar clear of all r stricti ns and seat properly. No washers are used beneath plugs

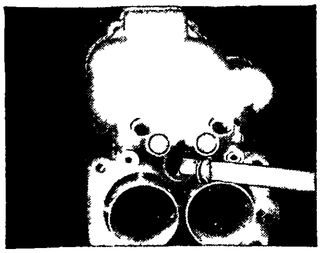


Fig. 192 Install both pump checks, strainer and plug. Plac new c pper washer in casting bef r installing plug and strainer (where used)

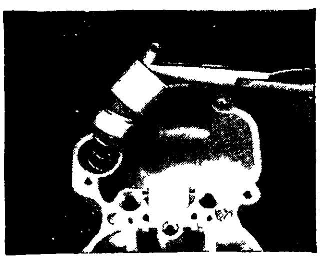


Fig. 193 Install pump spring and plunger. Use loading tool t av id damage to leather

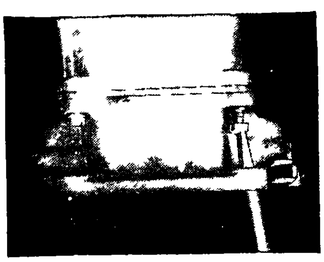


Fig. 194 Install flange and gasket on body. See that two new small black rubber idle passag gask ts are installed on body b f re installing flange

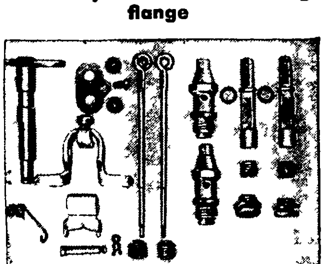


Fig. 195 Ass mbl parts c ntr lling high spe d circuit. Check pump arm and c untershaft for wear n shaft and f r l se l ver. If m t ring rods show wear, replace both rods and jets. New nozzles should be used whenever carburetors are serviced. Old nozzle gaskets must be removed from body. Check anti-percolator valves closely for dirt and wear

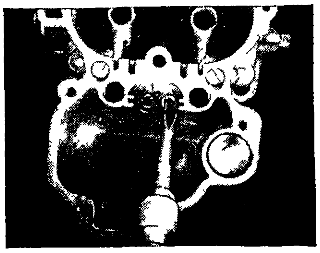


Fig. 196 Install metering rod jets and gaskets. Jets must be installed snugly but not so tight as to cause distortion

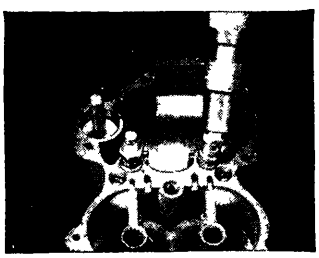


Fig. 197 Install both anti-percolator valves. No gasket are used

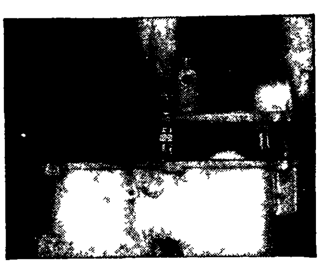


Fig. 198 Install bowl cover and gasket

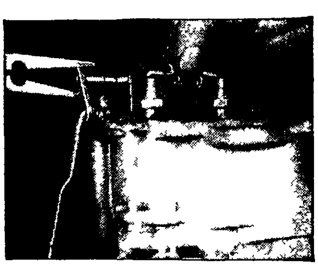


Fig. 199 Install pump arm and count rshaft, anti - perc lat r arm and m t ring rod arm. Install pump c nn ctor link. Check f r w ar n b th nds f thr ttl c nn ct r r d

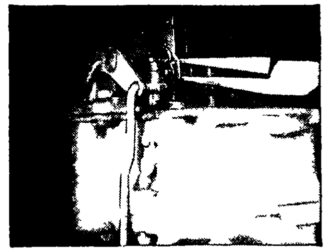


Fig. 200 Adjust metering rods. On 1935-36 carburetors, metering rod setting is made by bending throttle connector rod at lower end. On 1937 and later models, pump setting must be made before adjusting metering rods. Set pump by bending lower end of connector rod. Set metering rods by means of lock screw on anti-percolator arm. Both metering rods should be synchronized before making this adjustment. (See *Carter Specification* table and text for details)

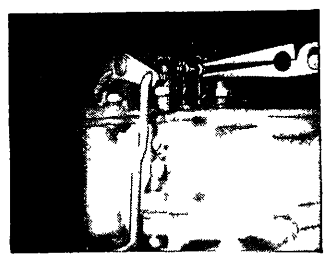


Fig. 201 Install metering rod disc, retainer and screw, and metering rods, spring and pin. Metering rod discs must be under retainer

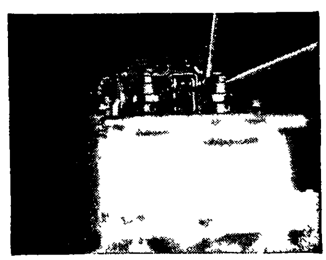


Fig. 202 Adjust anti-percolator valves. (See *Carter Specification* table and text for details

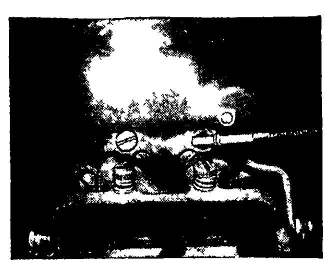


Fig. 203 Install n zzles, n zzle gask ts, r tainer plugs and nozzle passag plugs. Use n w copp r wash rs (wher used)

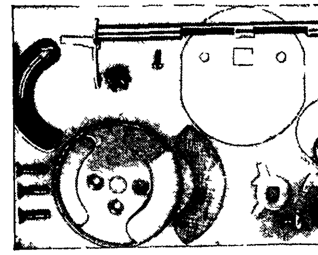


Fig. 204 Ass mbl ch ke parts. Check f r l se lever on shaft, br k n piston, burrs in cylinder and warped pist n plat

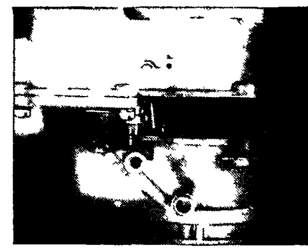


Fig. 205 Install air h rn. D not fail t install retainer screw or plug tightly in air horn beneath ch ke valve

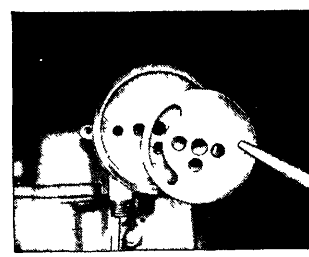


Fig. 206 Install pist n plate housing and new cork insulator. Be sure white pap r air horn gask t is installed b - tween air h rn and pist n h using

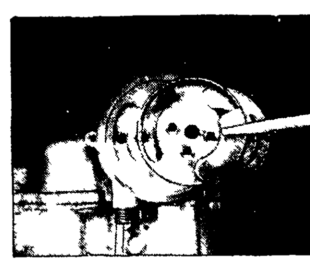


Fig. 207 Install p rt plat , piston plate and scre n

Fig. 208 Install ch k shaft and l v r and pist n

SERVICE PROCEDURE

CARTER WDO DUAL CLIMATIC CONTROL CARBURETOR

Type with Vacuum Operated Metering Rod and Carter Starter Switch

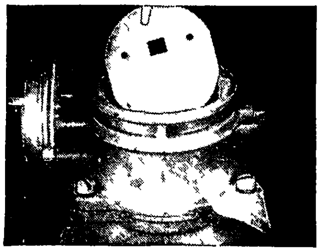


Fig. 209 Install ch ke valve. S at ch k valv by tapping lightly

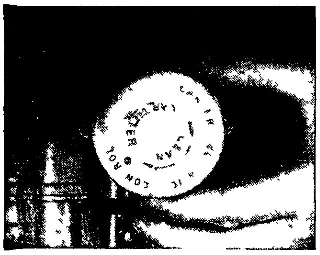


Fig. 210 Install thermostat c il and h using as shown, with indicat r mark to bottom. Then revolve housing ½ turn c untercl ckwise and set indicat r as given in the *Automatic Ch ke* chapter

Fig. 211 Install fast idle cam, washer and ch ke trip lever

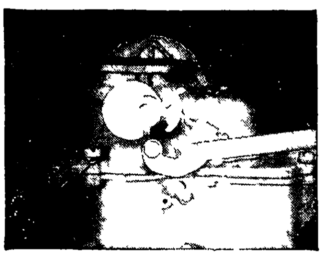


Fig. 212 Install fast idle arm and spring

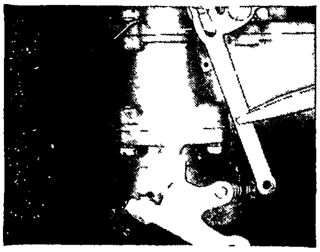


Fig. 213 Install fast idle c nnect r link, spring and r - tainer at l wer end

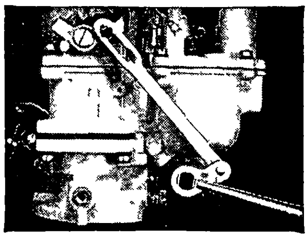


Fig. 214 Remove throttle shaft arm and screw and fast idle connector link

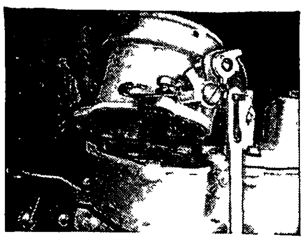


Fig. 215 Remove air horn with all parts attached. Attaching screw in air horn beneath choke valve must be removed

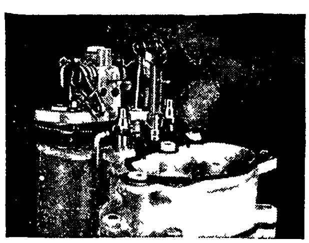


Fig. 216 Disc nn ct thr ttle c nn ct r r d at upp r nd and remov b wl c v r with vacuum pist n and link, and all attached parts. Rem ve b wl c ver gasket and vacuum piston spring

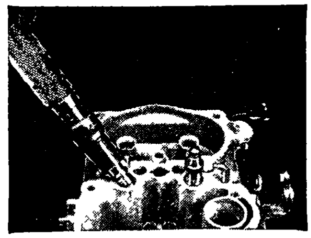


Fig. 217 Remove both antipercolator valves (where used)

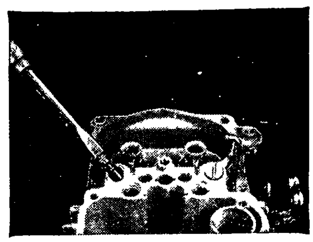


Fig. 218 Remove both pump jet plugs and pump jets. All metering jets in dual carburetors are in duplicate. Illustrations show removal of only one

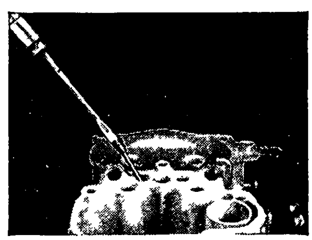


Fig. 219 Remove both by-pass bleeder plugs and low speed jets

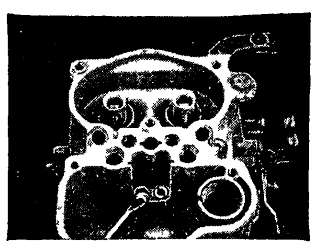


Fig. 220 R m ve b th metering r d jets and gask ts

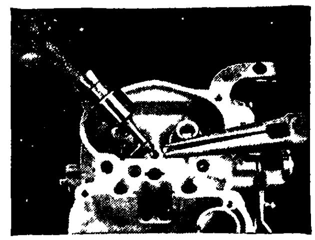


Fig. 221 Rem v pump discharge ball retain r plug and check ball

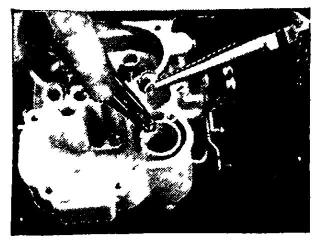


Fig. 222 R m v pump strainer, pump ch ck ball r - tainer ring and check ball

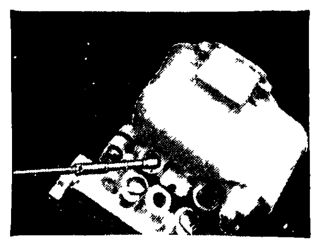


Fig. 223 Rem ve nozzle passage plugs, nozzle retain r plugs and n zzl s. S e that small nozzle gaskets are removed fr m casting

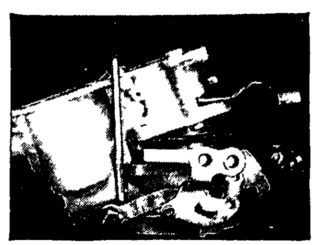


Fig. 224 Separate b dy flang fr m b dy

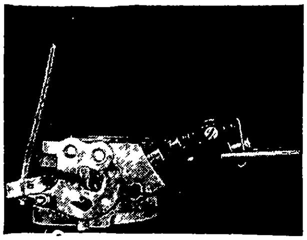


Fig. 225 On models with Cart r Starter Switch, loosen t rminal cap attaching screw and r m v switch from cast- ing

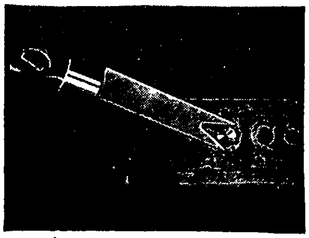


Fig. 226 R m v idle adjust- ment scr ws and springs and idl p rt plugs

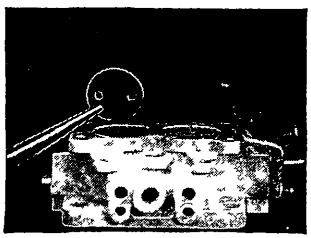


Fig. 227 R move throttle valv scr ws and valves

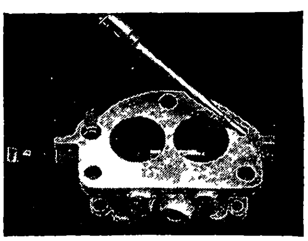


Fig. 228 Remove throttle cen- tering screw, then throttle shaft and l ver. Check shaft f r wear, l se lever and thr ttl r d h l s in lever for w ar

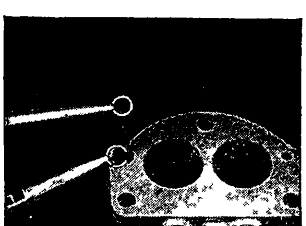


Fig. 229 Remov switch strain r retain r ring and strainer. Remov all parts from bowl c ver and fr m air h rn and pist n h using

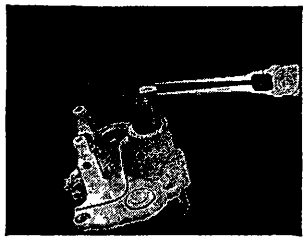


Fig. 230 Install bowl cover strainer gauze, strainer nut and gasket

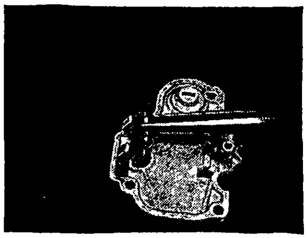


Fig. 231 Install needle seat and gasket

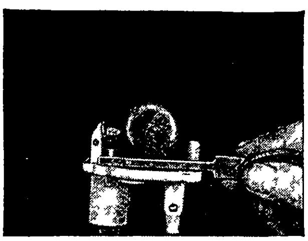


Fig. 232 Install needle, float pin and float and lever. Check float for dents and wear on lip, and float pin for wear. Check bowl cover for warpage and wear in countershaft hole. If needle shows groove on seating surface, replace both needle and seat. Set float level by gauging at both ends of float. Adjust by bending float lip — not float

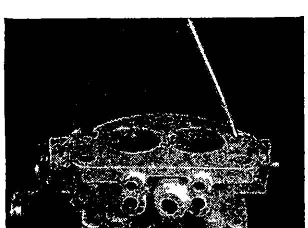


Fig. 233 Install thr ttl shaft and l v r, l se throttl l ver and throttl cent ring scr w. Back ut thr ttl lev r adjust- ing screw

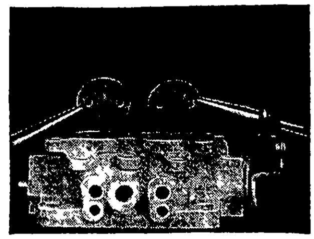


Fig. 234 Install throttle valves. Small "c" in circle or part number should be toward idle port when viewing casting from manifold side. Center throttle valves by tapping lightly and hold in place with fingers before tightening screws

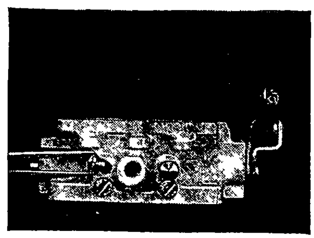


Fig. 235 Install idle port plugs, then idle adjustment screws and springs. Set idle screws to specifications

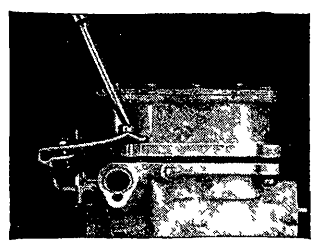


Fig. 236 Assemble body to body flange. Use new gasket. Be sure tube clamp is in place

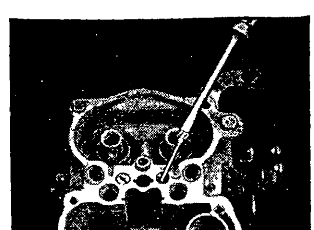


Fig. 237 Install low speed jet and by-pass bleed plugs. J ts must s at in casting

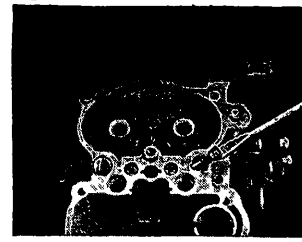


Fig. 238 Install pump jets and pump jet plugs. Make certain jets are clear of all r stricti n and seat prop rly. No wash rs are used ben ath plugs. Ch ck to see that utsid bl ed h le in casting is n t restrict d

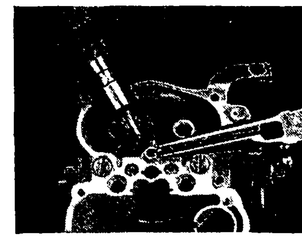


Fig. 239 Install check ball and pump discharge ball retain r plug

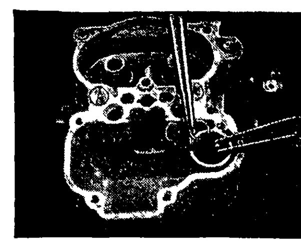


Fig. 240 Install intak check ball, pump ch ck ball retainer ring and pump strainer

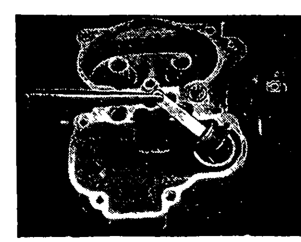
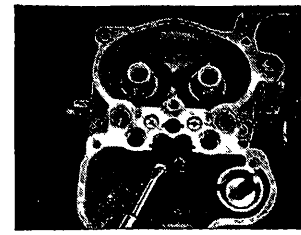


Fig. 241 Install pump spring and pump plunger and r d. Replace entire plunger as- sembly if leath r sh ws wear or damag

Fig. 242 →
Install m t ring r d j ts and gaskets. Met ring r d j ts



must b installed snugly, but n t s tight as t caus dis- t rti n

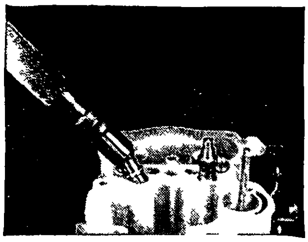


Fig. 243 If so equipped, install anti - perc lat r valves. N gaskets ar used

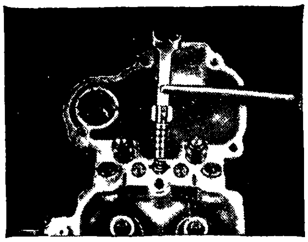


Fig. 244 Install vacuum piston spring and vacuum piston and link. If piston is loose on shaft, r place. It is usually advisabl to r place vacuum pist n spring ach time carburetor is serviced

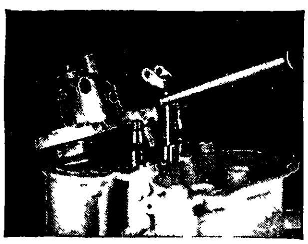


Fig. 245 Raise vacuum piston and link and install bowl cover with parts attached

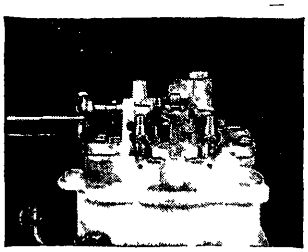


Fig. 246 Install anti-p rc la- t r arm (if used), pump p- erating l ver and c unter- shaft, and pump arm and c l- lar. Install pump link in pr per h l in pump arm

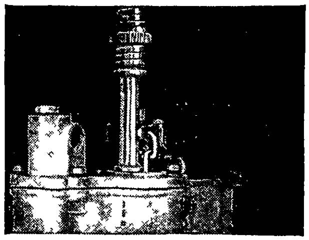


Fig. 247 Install throttle connector rod. Check throttle connector rod for wear at both ends. Gauge pump stroke as described in the text

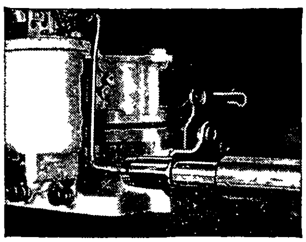


Fig. 248 Bend throttle connector rod as shown for pump stroke adjustment

Fig. 249 Adjust metering rods as described in text

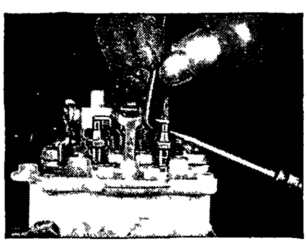


Fig. 250 Adjust anti-perc la- t r (if used), as d scrib d in t xt

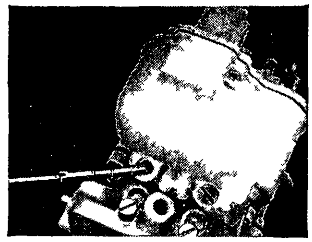


Fig. 251 Install nozzles, nozzle retainer plugs and nozzle passage plugs. Install with flat side of nozzle up. Use new gaskets

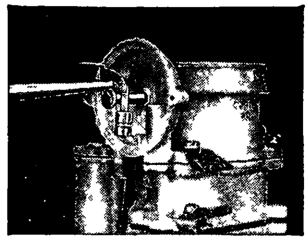


Fig. 252 Install air horn and piston housing on body. Then install choke piston lever, link and shaft

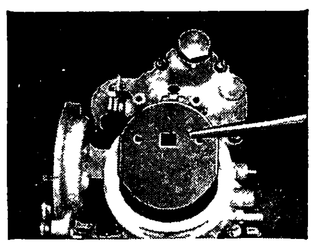


Fig. 253 Install choke valve. Seat valve by tapping lightly. Hold in place with fingers before tightening screws. Valve or shaft must not bind in any position

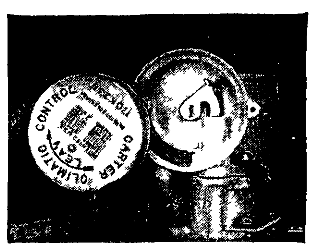


Fig. 254 Install piston h using strain r and th rm static c il and h using. Install h using with indicat r marks n b t- t m. Rev lv h using c unter- cl ckwis and s t index mark as stated in th *Automatic Choke* chapt r, then tight n attaching screws

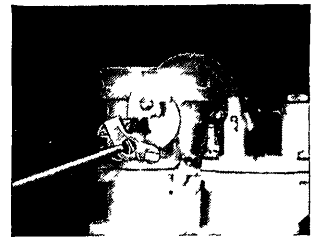


Fig. 255 Install fast idl cam, washer and ch k trip lev r on choke shaft. Th n install fast idle arm, pin and scr w, and fast idle spring

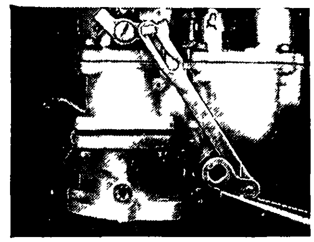


Fig. 256 Install fast idl c n- nector link, throttle shaft arm and pin, washer and spring

Fig. 257 Adjust fast idle as described in text

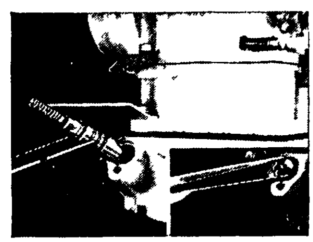


Fig. 258 If equipped with starter switch, install strainer and retainer ring. Th n switch ball, plunger, guid block, contact spring and r turn spring

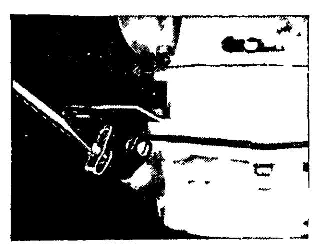


Fig. 259 Install terminal cap, hold down clip and cap attaching screw

METERING ROD GAUGING

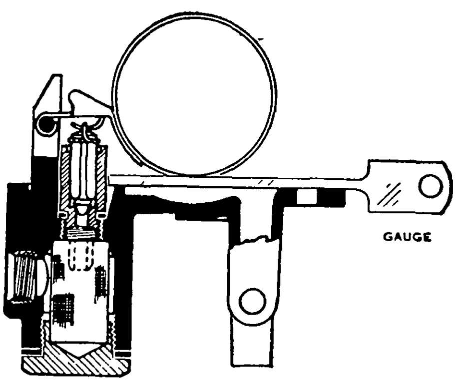


Fig. 260 Carter WDO. Gauging float level

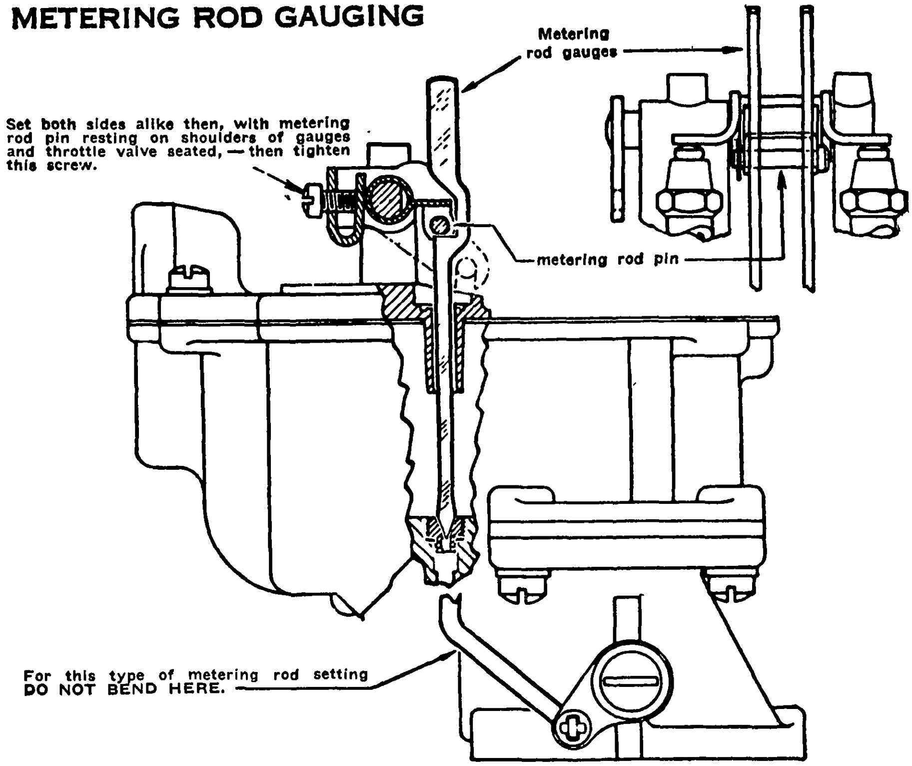
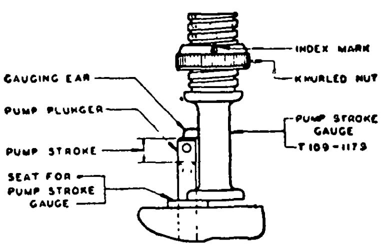


Fig. 262 CARTER WDO. Metering rod gauging on 1937 and later units with mechanically operated metering rods

USE OF UNIVERSAL PUMP TRAVEL GAUGE



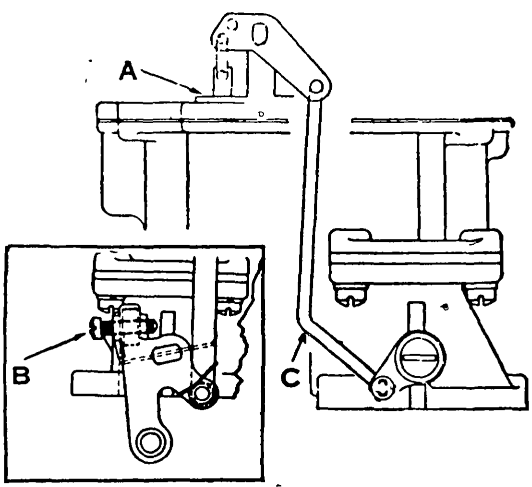


Fig. 261 CARTER WDO. Gauging pump travel

WDO ADJUSTMENTS—In making the following adjustments, consult the *Carter Specification* table for the settings.

FLOAT LEVEL—Fig. 260. Remove the bowl cover and gasket. Turn the bowl cover upside down. Take the proper gauge and lay it on the flat portion of the bowl cover. Always gauge the float at both ends, making sure the needle is seated.

If the float level is too high, place a finger under float to raise it from contact with the needle. Then press down on the float lever lip with a screw driver. Do not use pliers to bend this lip. Bend only a small amount at a time.

PUMP GAUGING—Fig. 261. With pump connector link in proper hole in pump arm, throttle adjustment screw (B)

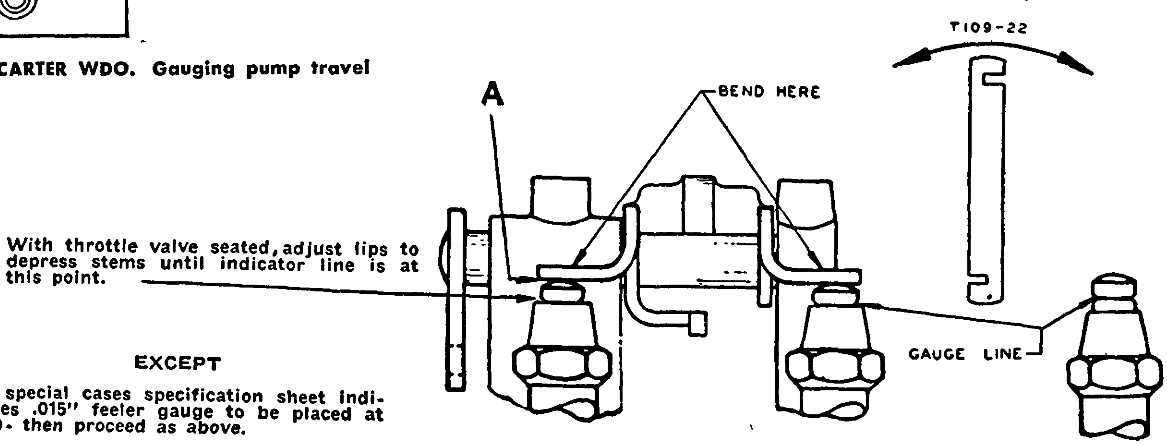


Fig. 264 CARTER WDO. Anti-percolator setting. See Carter table and text for details

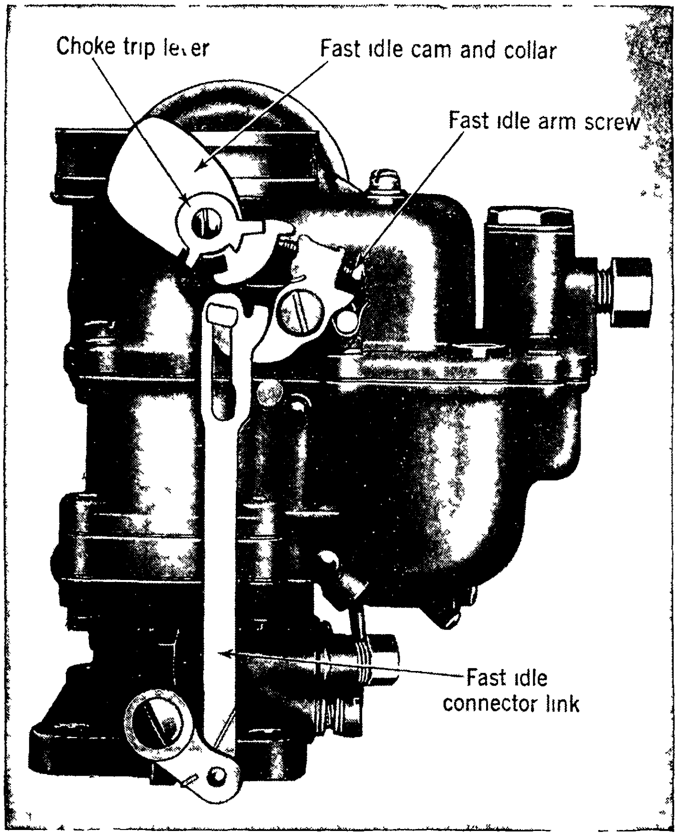


Fig. 265 CARTER WDO. Fast idle setting

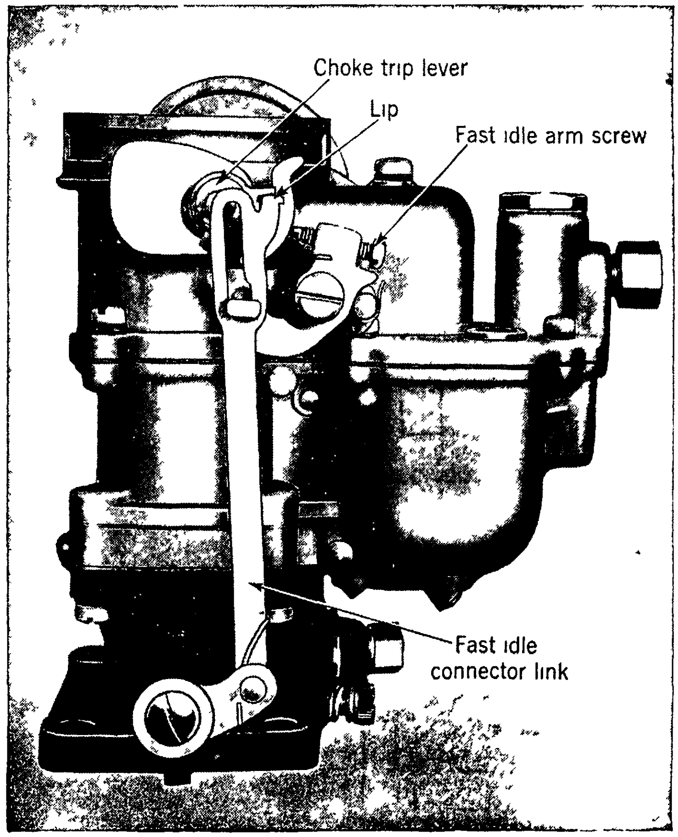


Fig. 266 CARTER WDO. Unloader s tting

backed out and throttle held in closed position, set the gauge on the seat (A) and adjust gauging ear to top of pump shaft Read gauge Open throttle wide and again set gauging ear on same spot as before Read gauge again Deduct second reading from first reading (gauge reads in 64th of an inch). To adjust pump stroke, bent at (C).

METERING ROD SETTING—On 1937 and later models, pump setting must be made before adjusting metering rods

On 1935-39 models having mechanically operated metering rods, adjust as follows Insert the proper metering rod gauges in place of the metering rods, seating them in the metering rod jets Replace the metering rod pin in the arm The pin should now rest at the bottom of the notches in both gauges, Fig 262 If not, bend the metering arm until the pin rests easily in both gauges With gauges in place and metering rod pin resting lightly on shoulder of both gauges (throttle seated) tighten lock screw on metering rod pin carrier

On 1935-1936 models, metering rod adjustment is made by bending the throttle connector rod at the lower angle On 1937 and later models, Fig 262, tighten the anti-percolator arm screw Remove the gauges and assemble the metering rods and related parts, using graphite grease to lubricate in the pump arm so the shaft operates freely

On models with vacuum operated metering rods, adjustment is made as follows Fig 263 Back out throttle lever adjusting screw so that throttle valves seat Insert metering pin in vacuum pis-

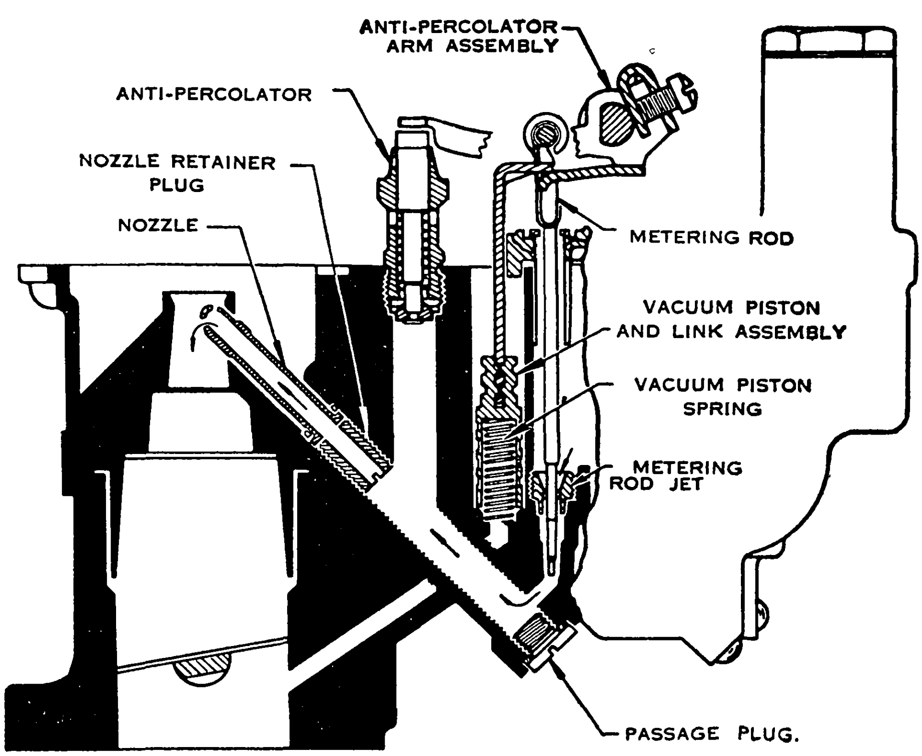


Fig. 263 CARTER WDO

High sp d system on units having vacuum p r-at d metering r ds and anti-p rc lat r valves

ton shaft and then insert one metering rod gauge in place of metering rod, being sure it seats in metering rod jet Depress vacuum piston shaft lightly until contact is made with tongue on anti-percolator arm Bend tongue on anti-percoator arm until there is less than 005 inch clearance between metering rod pin and shoulder of notch in gauge, Fig. 249 Remove gauge and install metering rods, discs and metering rod spring

ANTI-PERCOLATOR SETTING — See Fig 264 and be guided by the instructions given in the *Carter Specification* table

FAST IDLE SETTING—Fig 265. Hold the choke valve tightly closed and adjust the fast idle arm screw to give the proper clearance between the edge of the throttle valve and the carburetor bore—side opposite idle port

UNLOADER SETTING—Fig 266 With throttle wide open, the distance between the edge of the choke valve and the inner wall of the carburetor should be as given in the *Carter Specification* table Make the adjustment by bending the lip on the fast idle connector link

CHOKE LOCKOUT — Since the choke trip lever is notched out for the unloader setting, the lockout adjustment is automatically correct if the unloader is properly set

The unloader is adjusted properly if the choke valve locks when both the choke and throttle valves are wide open Closing the throttle will release the choke valve

CARTER WCD SERIES

The WCD series carburetor is quite similar to the WDO type except that the float chamber is provided with two floats The anti-percolator valves are not used A special series of vent passages in the high speed circuit act as the anti-percolator without the need for mechanical valves

Follow the step-by-step service procedure shown in Figs 267 to 315 and consult the *Carter Specification* table for proper settings when making the f llowing adjustments

SERVICE PROCEDURE

CARTER WCD DUAL CLIMATIC CONTROL CARBURETOR

With Vacuum Operated Metering Rod and Carter Starting Switch

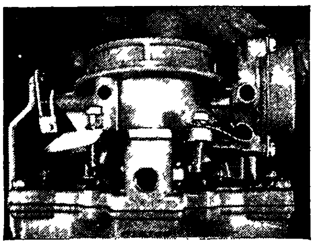


Fig. 267 R m ve air horn and climatic c ntrol

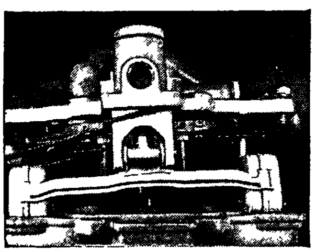


Fig. 268 Rem ve bowl cover with all parts attached

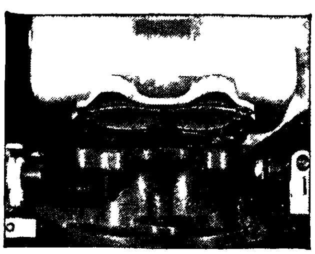


Fig. 269 Rem v b dy flange and gask t

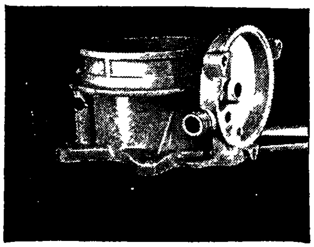


Fig. 270 Remove all parts from air horn and choke

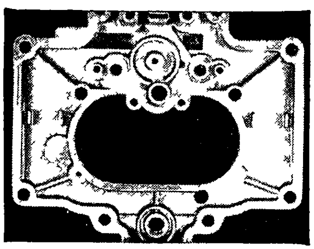


Fig. 271 Remove all parts from bowl cover

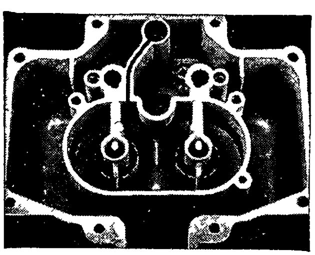


Fig. 272 Rem ve all parts from c a r b u r t r xc pt n zzles

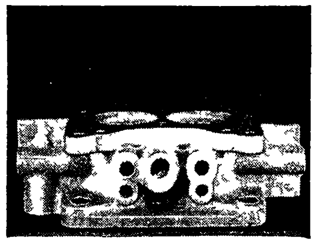


Fig. 273 Remove all parts from body flange. Check throttle shaft for wear, loose lever and throttle rod holes in lever for wear. Wash all parts in clean gasoline *except coil and housing assembly, cork pieces and switch parts*

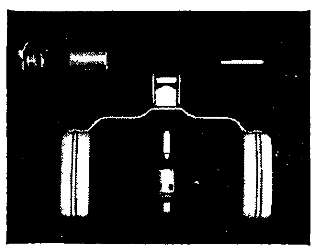


Fig. 274 Group all parts of float circuit

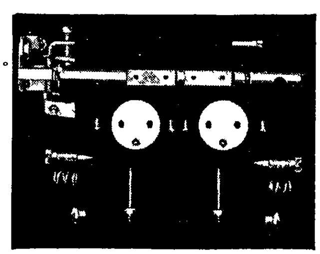


Fig. 275 Gr up all parts f l w spe d circuit

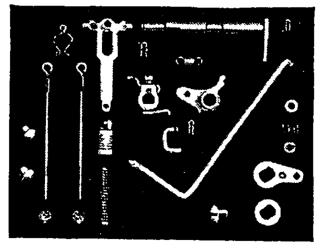


Fig. 276 Group all parts f high sp ed circuit

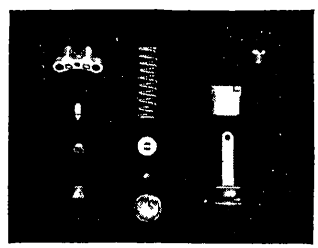


Fig. 277 Gr up all parts of pump circuit

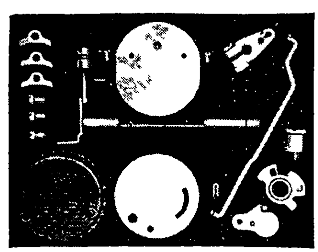


Fig. 278 Gr up all parts f ch k circuit

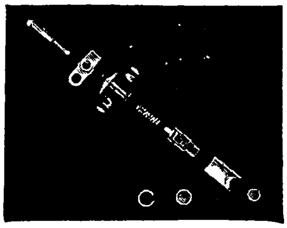


Fig. 279 Gr up all parts controlling switch peration

Fig. 280 Idl circuit. Install throttl shaft and lever and thr ttl centering screw. Back ut thr ttl l ver adjusting screw

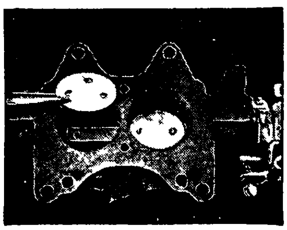


Fig. 281 Install throttle valve. Small "c" in circle or part number should b toward idle p rt when vi wing casting from manif ld side. Center throttl valves by tapping lightly and h ld in place with fing rs b f r tightening scr ws

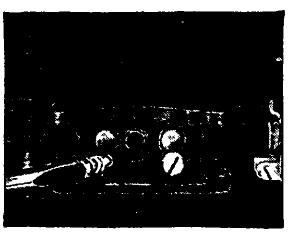


Fig. 282 Install idle port rivet plugs, then idl adjustment scr ws and springs. Set idle scr ws t specifications

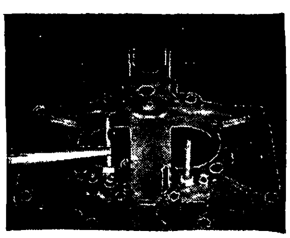


Fig. 283 Install l w sp ed j ts. N gask ts ar us d

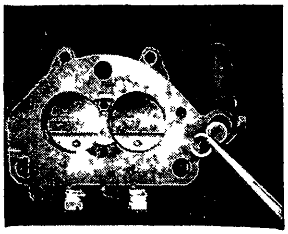


Fig. 284 Starter switch. Install switch strainer and retainer

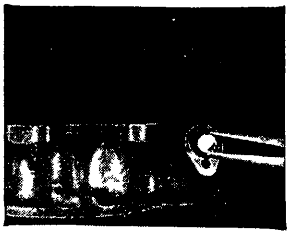


Fig. 285 Install switch ball

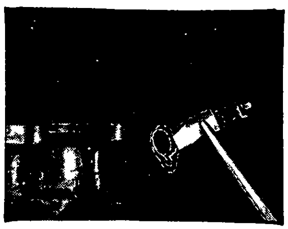


Fig. 286 Install switch plunger, guide block and W-shaped switch contact spring. Do not forget to reinstall shims under contact spring

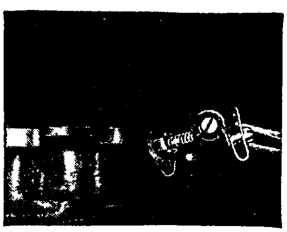


Fig. 287 Install switch return spring, terminal cap, hold down clip and attaching screw

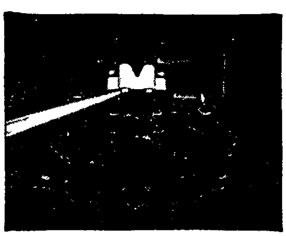


Fig. 288 Pump circuit. Install air horn gask t, then pump j t and h using. Use new gasket

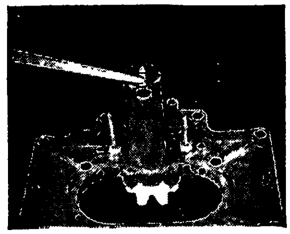


Fig. 289 Install pump check needle — blunt end first

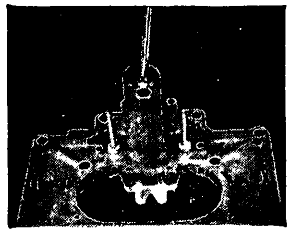


Fig. 290 Install discharge check first, then pump discharge passage plug

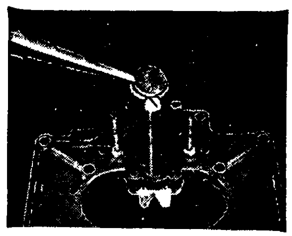


Fig. 291 Install pump strainer

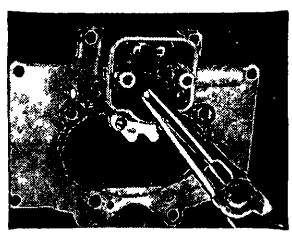


Fig. 292 Install intake check

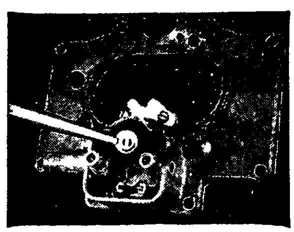


Fig. 293 Install check strainer

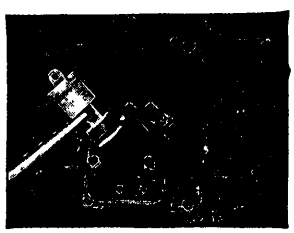


Fig. 294 Install pump spring, plung r and plunger guid

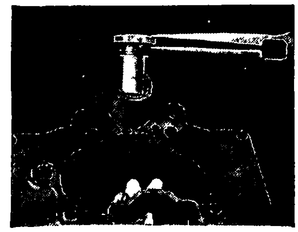


Fig. 295 Float circuit. Install bowl strainer, nut and gasket

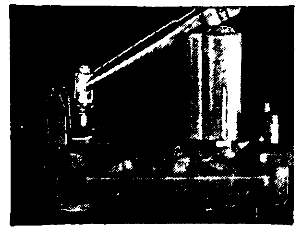


Fig. 296 Install needle and seat. Us n w gasket

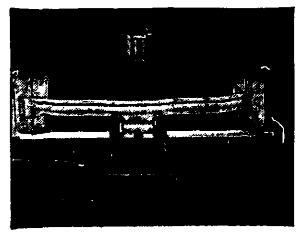


Fig. 297 Install fl at and lever. After gauging float level (see text), remove fl at, install bowl c ver gasket, then replac fl at

Fig. 298 High speed circuit. Assemble flange t b dy

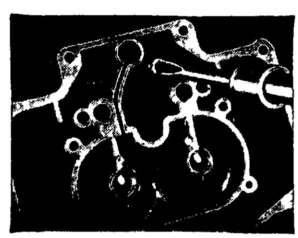


Fig. 299 Install metering r d j ts and new gask ts. Install jets snugly but n t so tight as to cause dist rti n

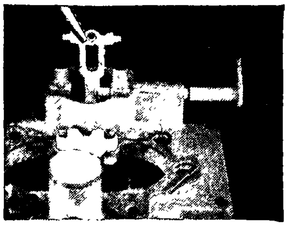


Fig. 300 Install vacumeter pist n link and metering rod spring. Start pump counter-shaft assembly

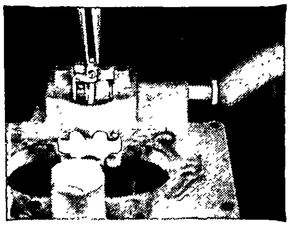


Fig. 301 Install pump arm and c llar, m tering rod arm and scr w, and pump arm spring

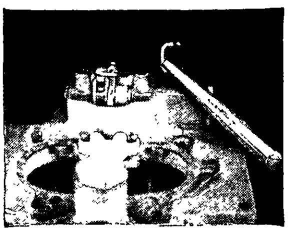


Fig. 302 Install pump arm link n pump arm and collar and plung r shaft

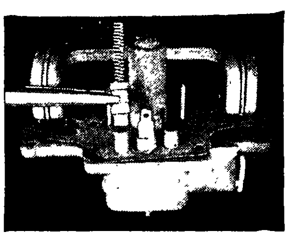


Fig. 303 Install vacuum piston and pin, and vacuum piston spring n piston link

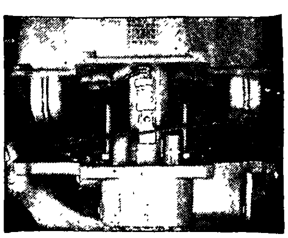


Fig. 304 Install bowl c v r assembly n b dy. Use n w gask t

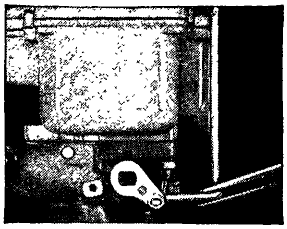


Fig. 305 Install throttle shaft lever and throttle connector rod. Don't forget throttle shaft washer

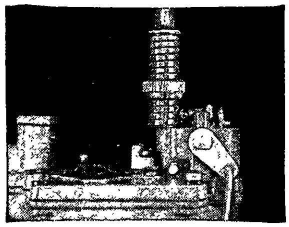


Fig. 306 Make pump adjustment (see text)

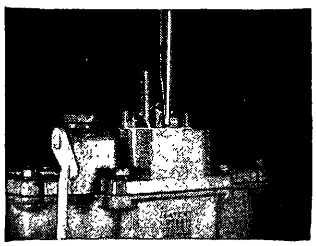


Fig. 307 Adjust metering rods (see text)

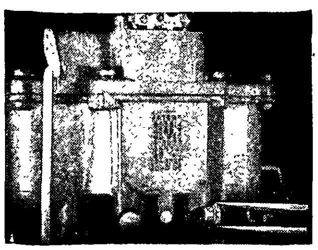


Fig. 308 Install nozzle passage rivet plugs

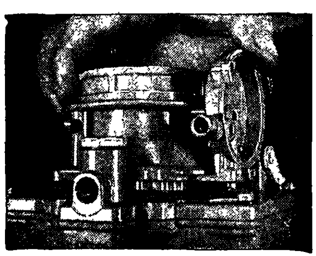


Fig. 309 Ch ke circuit. Install air h rn casting

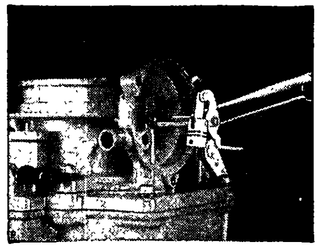


Fig. 310 Install choke piston lever, link and shaft, and piston

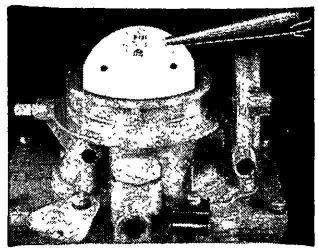


Fig. 311 Install choke valve. Seat valve by tapping lightly; hold in place with fingers before tightening screws. Valve or shaft must not bind in any position

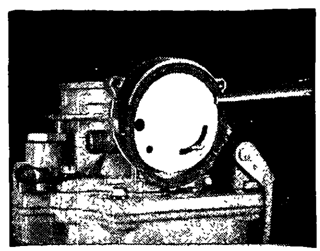


Fig. 312 Install coil housing baffle plate and coil housing gasket

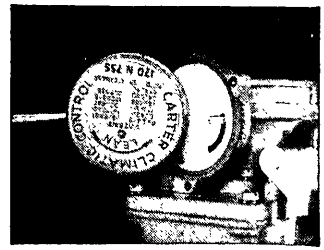


Fig. 313 Install th rm static coil and housing. Install h using with indicat r marks at bottom. R v lv h using clockwise and s t index mark as stated in th *Automatic Choke* chapter, then tighten attaching screws

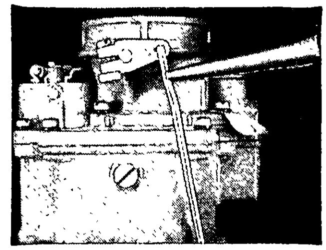


Fig. 314 Install chok lever and screw, and fast idl connect r r d

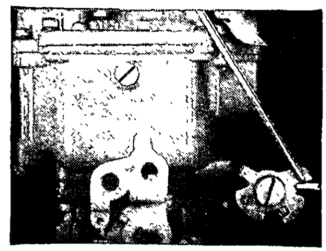


Fig. 315 Install fast idl cam. Make unl ader and fast idl adjustments (see text), and starter switch adjustm nt as given in th *Start r Switch* chapter

FLOAT LEVEL—Fig. 316. Two separate float adjustments must be made: lateral and vertical.

Lateral Adjustment: With bowl cover inverted, bowl cover gasket removed and float bracket resting on seated needle, place the proper float gauge in position as shown in Fig. 316. Sides of float should barely touch the vertical uprights of the gauge at (A). Adjust by bending arm of float.

Vertical Adjustment: With float gauge in position shown, floats should just clear horizontal portion of gauge at (B). Vertical distance between top of float and machined surface of casting should be as specified in the *Carter Specification* table. Adjust by bending arm of float. Carefully remove float, install bowl cover gasket and then reinstall float.

PUMP ADJUSTMENT—Fig. 317. The pump has been designed to produce a uniform pump action. The total distance

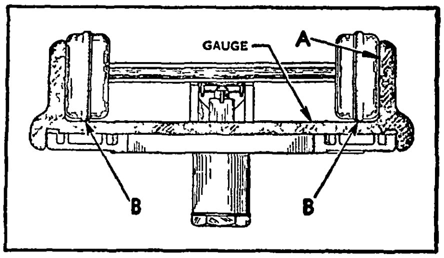


Fig. 316 CARTER WCD
Float adjustment

the plunger (not shaft) moves from closed to wide open throttle controls the amount of fuel discharged.

Before taking pump gauge readings, it is advisable to practice opening throttle several times to find position at which increased throttle resistance indicates plunger bottoming in cylinder.

With pump connector link in place, back out throttle lever set screw and fast idle adjustment screw to allow throttle valves to seat in bores of carburetor. Support the carburetor so throttle can be closed with levers dragging on bench top (wooden block will suffice). With air horn assembly removed, place pump travel gauge (E) inverted on edge of dust cover boss of bowl cover. Turn knurled nut of gauge until finger just touches upper end of plunger shaft. Read figure on gauge at notch in knurled nut.

Open throttle slowly until plunger bottoms in pump cylinder (at approximately half throttle). This can be determined by the additional force necessary to continue to move throttle lever. Relocate the pump travel gauge and turn knurled nut until finger again touches top of plunger shaft. Observe number indicated on gauge. Hold gauge vertical to insure correct pump stroke readings. The difference in the two readings obtained should be as specified in the *Carter Specification* table.

Adjust by bending throttle connector rod at lower angle (F).

PUMP JET ADJUSTMENT—On 1946-47 Buick carburetors 608S and 609S, each of the two pump jet streams must be

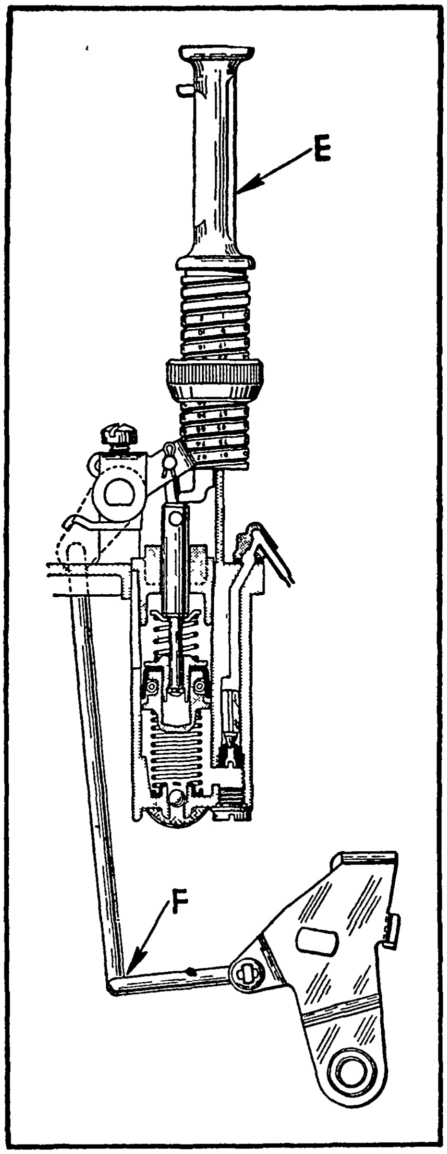


Fig. 317 CARTER WCD
Pump adjustment

directed to its proper section of the venturi system, and in order to obtain maximum efficiency each stream must strike a specified target point on the primary venturi.

Late production 608S and 609S carburetors have these target points marked, but it will be necessary to measure and mark these points on early production units. Figs. 317A and 317B show these target points. Mark these points with a pencil; do not scratch venturi with a sharp tool.

Fill the float bowl with gasoline through the float bowl inlet. Operate the accelerating pump with a short, quick movement of the throttle shaft lever and note whether the stream from each jet strikes the specified target point. Carefully bend the jets, if necessary, to aim the streams.

Use care to avoid distorting the jets.

METERING ROD ADJUSTMENT—Fig. 318. Back out throttle lever adjustment screw until throttle valves are fully seated. Insert one metering rod gauge in place of either metering rod. Press down lightly on vacuum piston link (A) until lug of piston link (D) contacts lip of metering rod arm (C). There should be less than .005 inch clearance between metering rod bearing (B) and shoulder of notch in metering rod gauge with throttle valves seated.

Adjustment should be made by bending lip of metering rod arm (C).

UNLOADER ADJUSTMENT—Fig. 319. Two adjustments are necessary to get correct unloader setting. First loosen choke lever and screw assembly on choke shaft (G). Insert .010 inch feeler gauge between lip on fast idle cam and boss on flange casting (H). Hold choke valve tightly closed and take all slack out of linkage by pressing choke lever toward closed position. Then tighten clamp screw.

Second, adjust unloader lip (K) on throttle shaft lever until there is the specified clearance between upper edge of choke valve and inner wall of air horn (J) with throttle in wide open position.

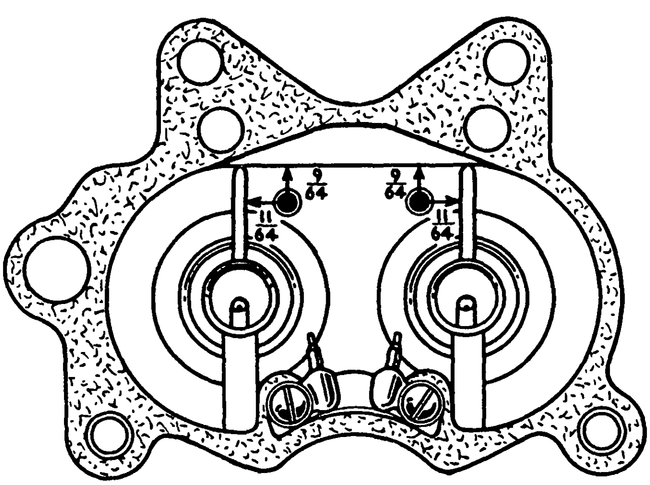


Fig. 317A CARTER WCD 608S. Pump jet targets

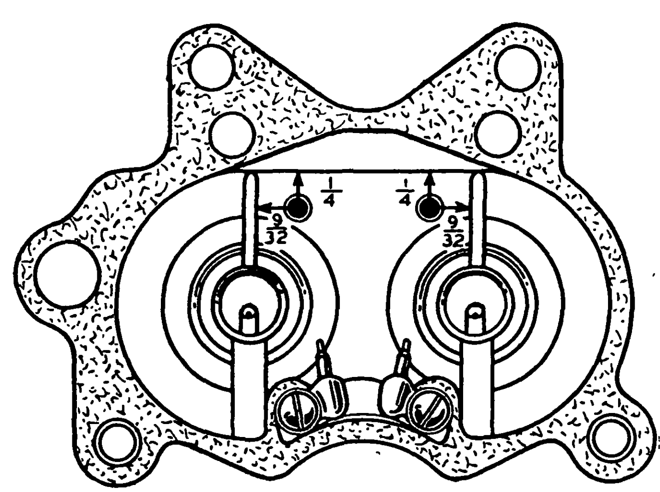


Fig. 317B CARTER WCD 609S. Pump jet targets

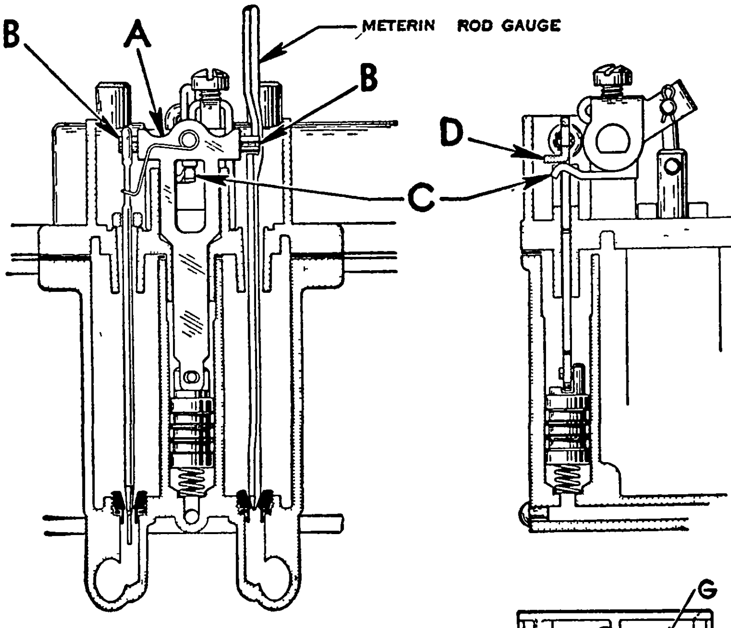


Fig. 318 CARTER WCD
M tering rod adjustment

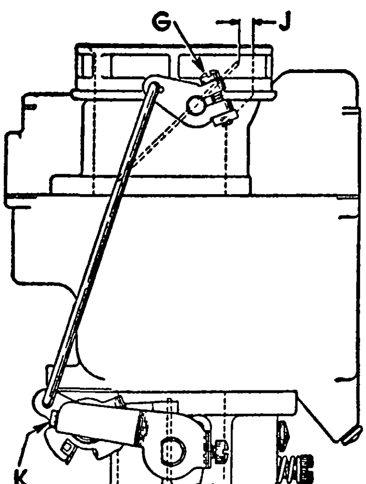


Fig. 319 CARTER WCD
Unl ader adjustment

FAST IDLE ADJUSTMENT—Fig. 320. With choke valve tightly closed, tighten fast idle set screw (L) until there is the specified opening (M) between throttle valve and bore of carburetor (side opposite port). Be sure fast idle adjusting screw is on high step of cam (N) when making this adjustment.

CARTER WGD SERIES

This model retains the desirable features of the WCD model, the chief difference between the two is that the WGD has a single float.

Follow the step-by-step service procedure when necessary to overhaul the

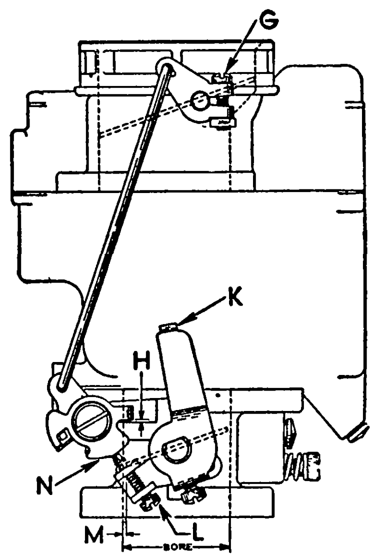


Fig. 320 CARTER WCD
Fast idle adjustment

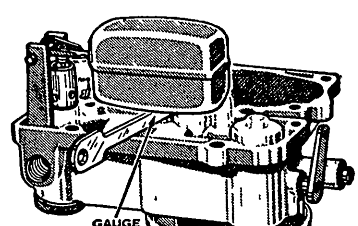


Fig. 320A CARTER WGD
Float adjustment

carburetor and consult the *Carter Specifications* table for proper settings when making the following adjustments.

FLOAT ADJUSTMENT — Fig. 320A. With bowl cover removed, bowl cover inverted and needle seated, there should be the specified distance between the top of the float and the bowl cover. Adjust

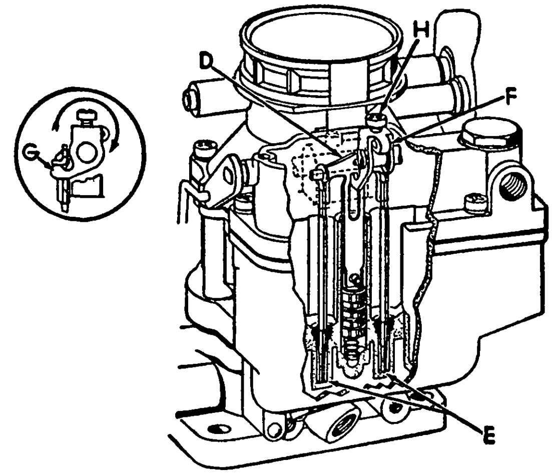


Fig. 320C CARTER WGD. Metering r d adjustm nt

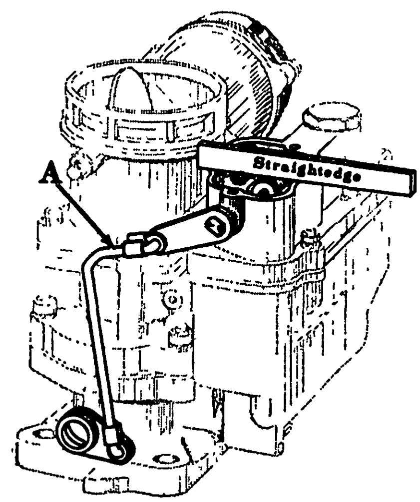


Fig. 320B CARTER WGD
Pump adjustment

by bending the lip of the float, not the float arm.

PUMP ADJUSTMENT—Fig. 320B. Install the pump connector link in the outer hole (long stroke) of the pump arm with ends extending toward the countershaft arm. Back out the throttle lever set screw until the throttle valves seat in bores of carburetor. Hold straight edge across top of dust cover boss at pump arm. The flat on top of pump arm should be parallel to straight edge. Adjust by bending pump arm at upper angle (A, Fig. 320B).

METERING ROD ADJUSTMENT—Fig. 320C. This adjustment must be made after the pump adjustment or when leaner than standard rods are installed. No metering rod gauges are necessary; the procedure is as follows:

With the throttle lever set screw backed out and throttle valves seated in bores of carburetor, press down on vacumeter link (D) until metering rods bottom in casting at (E). With rods held in this position, revolve metering rod arm (F) until link contacts vacumeter link at (G). Hold in place and care-

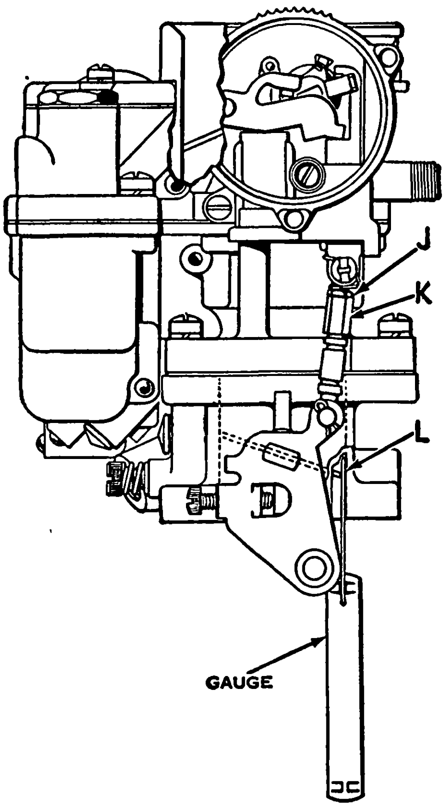


Fig. 320D CARTER WGD
Fast idl adjustment

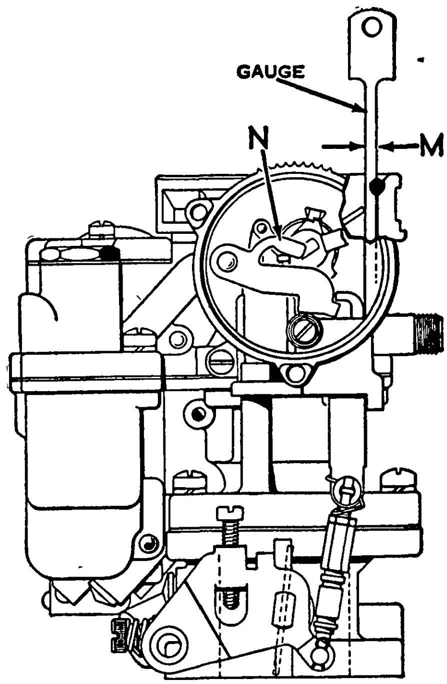


Fig. 320E CARTER WGD
Unloader adjustment

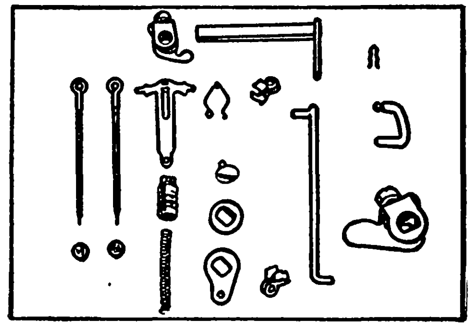


Fig. 320H CARTER WGD
High speed system parts

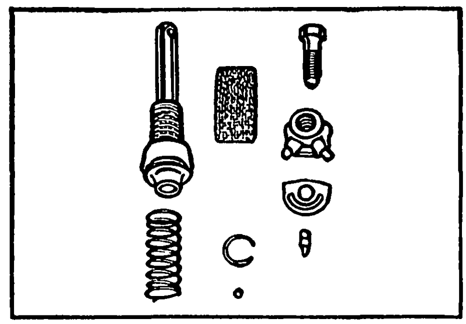


Fig. 320J CARTER WGD
Pump system parts

fully tighten metering rod arm set screw (H).

FAST IDLE ADJUSTMENT—Fig. 320D. Remove the thermostatic coil housing, gasket and baffle plate. Open throttle valve and hold choke valve fully closed, then close throttle. This will allow fast idle cam to revolve to fast idle position. With choke valve held tightly closed and slight tension on throttle lever, loosen lock nut (J) on choke connector rod assembly and turn sleeve (K) until there is the specified clearance (L) between throttle valve and bore of carburetor (side opposite idle port). Hold sleeve (K) in position and secure lock nut.

UNLOADER ADJUSTMENT — Fig. 320E. This adjustment must be made after the fast idle adjustment. Hold the throttle valve wide open and close choke valve as far as possible without forcing. There should now be the specified clearance between the upper edge of the choke valve and the inner wall of the air horn (M). Adjust by bending arm on choke trip lever (N).

WGD SERVICE PROCEDURE

1. Remove dust cover screws, cover and gasket.
2. Remove clevis clips, throttle connector rod and choke connector rod.
3. Remove bowl cover with all parts attached.
4. Remove body flange screws, flange assembly and gasket.
5. Remove all parts from bowl cover.

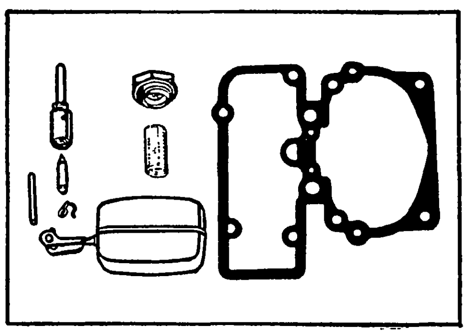


Fig. 320F CARTER WGD
Float system parts

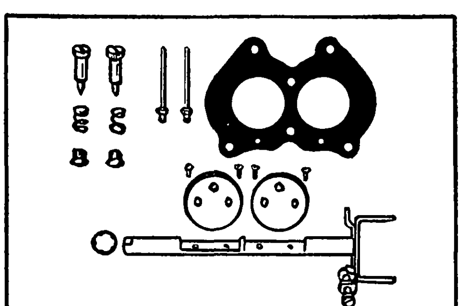


Fig. 320G CARTER WGD
Idle system parts

6. Remove all parts from carburetor body except nozzles and other pressed in parts.
7. Remove all parts from body flange assembly.

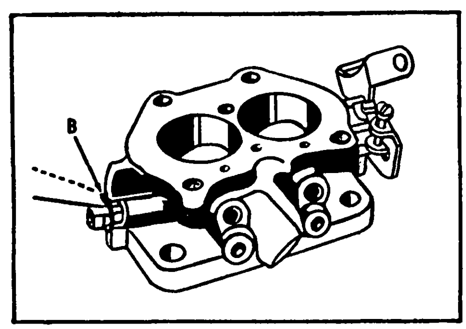


Fig. 320L CARTER WGD
Throttle centering wash r (B)

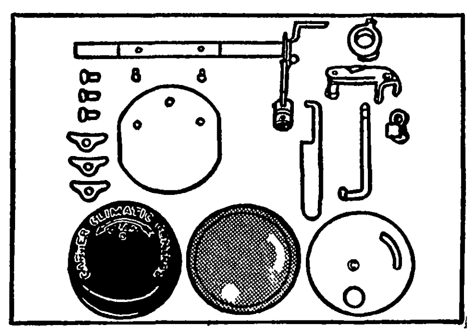


Fig. 320K CARTER WGD
Ch ke syst m parts

NOTE—Wash all parts in carburetor cleaning solution except thermostatic coil and housing assembly, starter switch parts (if equipped) and pump plunger. Do not soak bowl cover assembly for

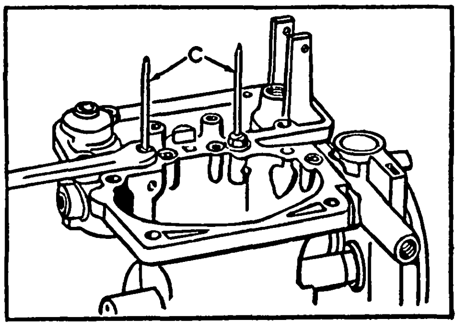


Fig. 320M CARTER WGD
Low speed jets (C)

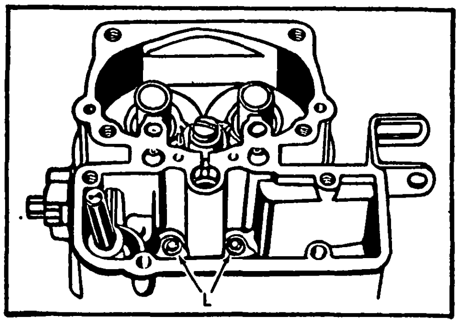


Fig. 320Q CARTER WGD
Metering rod jets (L)

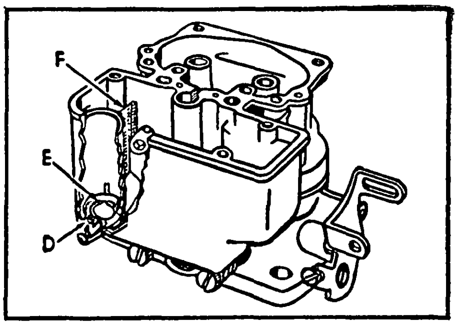


Fig. 320N CARTER WGD
Intake ball check (D),
r tainer ring (E') and strainer (F)

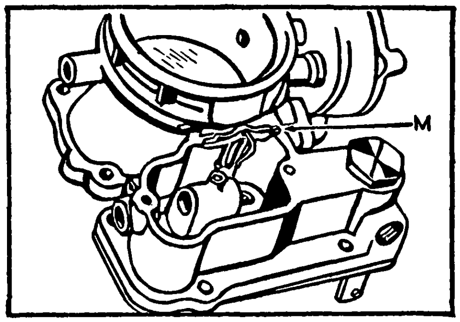


Fig. 320R CARTER WGD
Vacumeter piston link and
metering rod spring (M)

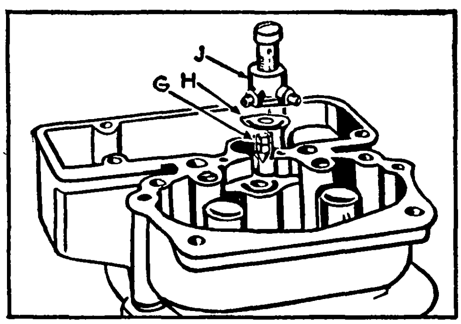


Fig. 320P CARTER WGD
Discharg check needle (G),
pump jet cluster gasket (H)
and pump jet cluster and screw (J)

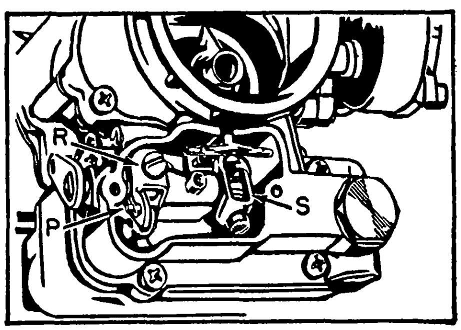


Fig. 320S CARTER WGD
Pump connector link (P), pump arm (R),
metering rod arm (S)

more than one-half hour. Note carefully slots in choke piston cylinder. If they are carbonized, remove Welch plug by piercing center with small pointed instrument and prying outward. Be careful not to damage casting. Blow out all passages with compressed air and scrape carbon from bore of flange. Use carburetor repair kit when reassembling, the procedure for which is as follows:

1. Group all parts of the various systems as shown in Figs. 320F to 320K.
2. Install throttle shaft and lever assembly. Back out throttle lever adjusting screw.
3. Install throttle valves. Small "c" in circle should be toward idle port when viewing casting from manifold side. Center throttle valves by tapping lightly and holding in place with fingers before tightening screws. Always use new screws.
4. With throttle closed, press throttle shaft from lever side and install throttle centering washer with prongs extending outward. Press washer tight against casting, Fig. 320L.
5. Install idle port rivet plugs, idle adjustment screws and springs.
6. Install low speed jet assemblies, Fig. 320M. No gaskets are used.
7. Install body casting to flange. Use new gasket.
8. In the pump circuit, Fig. 320N, install ball check, retainer ring and strainer. Use tool T109-122U.
9. Install discharge check needle, Fig. 320P, with point downward, pump jet cluster gasket and pump jet cluster and screw. Use new gasket.
10. Install lower pump spring and plunger assembly.
11. In the float circuit, install bowl strainer gauze, nut and gasket assembly.
12. Install float needle seat and gasket.
13. Attach intake needle and pull clip (if used) to float lip. Install float and lever, and float lever pin. Set float to specifications. Then install new bowl cover gasket.
14. Install metering rod jets, Fig. 320Q. No gaskets are used.
15. Install vacumeter piston link and metering rod spring, Fig. 320R. Lip on link should extend toward air horn.
16. Install vacumeter piston on link with pin extending away from float. Install a new bowl cover gasket.
17. Install vacumeter spring in cylinder and assemble bowl cover on body. Install bowl cover screws, tightening center screws first.
18. Install pump connector link, Fig. 320S, in proper hole of pump arm. Install pin spring. Insert lower end of connector link in hole in plunger shaft. Hold pump arm in place and press shaft through arm. Hold metering rod arm with lip extending through slot in vacumeter piston link and press shaft in place. Tighten pump arm screw.
19. Install throttle shaft lever, washer and screw. Install throttle connector rod and clevis clips.
20. Set pump adjustment according to specifications.
21. Install metering rods. Catch metering rod spring loop with lower end of metering rod as rods are inserted. Adjust metering rods as outlined previously.
22. Install the fast idle cam and spring in choke housing.
23. Install choke piston, lever, link and shaft.
24. Connect fast idle cam spring to choke piston lever.
25. Install choke valve with circle "c" visible from top of carburetor with valve in closed position. Seat choke valve by tapping lightly. Hold it in place with fingers before tightening screws. Valve or shaft must not bind in any position.
26. Install fast idle link, choke connector rod and clevis clip.
27. Install choke trip lever assembly.
28. Adjust fast idle as outlined previously.
29. Make unloader adjustment as outlined previously.
30. Install choke baffle plate and gasket.
31. Install choke thermostatic coil and housing, retainers and screws.
32. If equipped with starter switch, install switch strainer. Then install switch ball, plunger (notch up), guide block and W-shaped contact spring. Reinstall original shims under contact spring. Install switch return spring, terminal cap, hold-down clip and attaching screw. (Operation of switch is covered in *Starter Switch* chapter.)

CARTER BALL & BALL (BB) SERIES

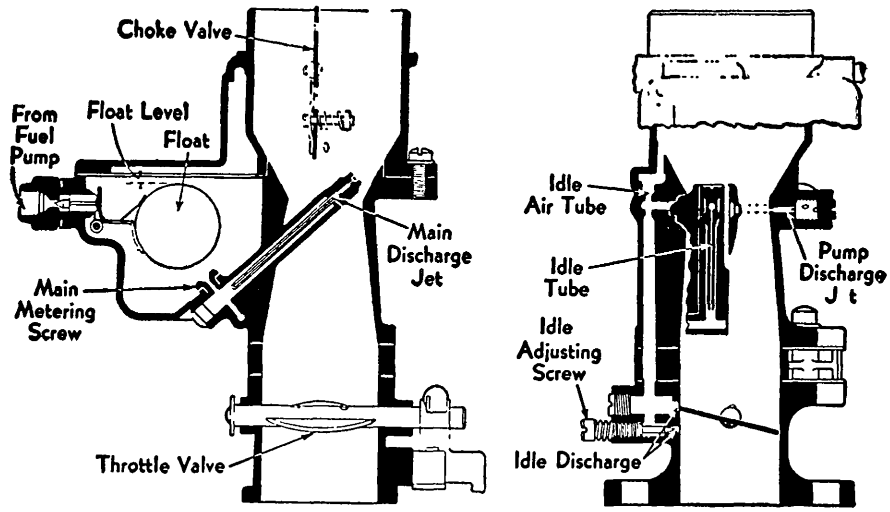


Fig. 321 CARTER BALL & BALL

Showing proper method for checking float level

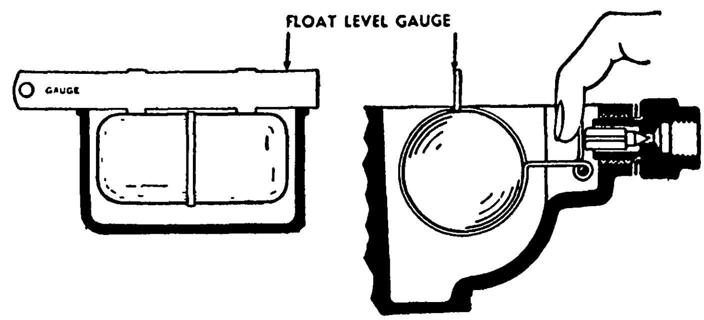


Fig. 322 CARTER B. & B. Float adjustment

This carburetor, Fig. 321, is of the plain tube, down-draft type with fixed jets which cover all speed ranges except the idle range, which is controlled by an adjusting needle. The unit is equipped with an adjustable accelerating pump and a fast idle device for the prevention of stalling with a cold engine. The idle needle valve controls the fuel mixture for idle. Turning the adjustment screw clockwise gives a leaner mixture and counter-clockwise, a richer mixture. When adjusting the carburetor, a vacuum gauge may be used and the adjustment should be set at the highest reading of the gauge.

In order to provide the additional fuel required for rapid acceleration, the carburetor is equipped with a pump which supplies an extra charge of fuel momentarily, as the throttle is opened.

Three positions are provided on the accelerator pump lever in order to give a greater or lesser discharge of fuel, depending upon climatic conditions.

For extremely warm weather or for high altitudes above 3,000 feet, the pump link should be in the hole in the accelerating pump lever which is nearest to the throttle shaft. This position gives the shortest stroke of the pump.

For cold weather operation, the pump link should be in the pump lever hole which is farthest from the throttle shaft. For normal summer temperatures, the pump link should be in the center hole.

For high altitudes, leaner main jets are available, which can be installed by removing the air horn and float. Then, with a special socket wrench which is made for the purpose, unscrew and remove the jet. If leaner main jets are used in lower altitudes, the maximum speed and power developed by the engine will be materially reduced, but slightly greater fuel economy may be obtained. However, it is recommended that the standard jet as furnished with the carburetor be used for best results.

Follow the step-by-step procedure pictured in servicing these carburetors. A new flange gasket should be used when installing carburetor on manifold.

NOTE—On cars without a governor, gasket with four slots should be used; on cars with governor, gasket with four small holes should be used between carburetor and governor, the original gasket with four slots to remain on manifold beneath governor.

In checking float level on these carburetors, measure the distance between the top of the float to the top of the float chamber, Fig. 322. This dimension should be as specified in the *Carter Specification* table and can be reset by bending the lip on the float lever away from the needle to raise the float, and toward the needle to lower the float. Bend only the vertical lip of the float.

ANTI-STALL DEVICE—On Chrysler-built cars equipped with semi-automatic transmission, the carburetor has a dash-pot device which permits slow closing of the throttle. Its purpose is to prevent the engine from stalling when the accelerator pedal is suddenly released. By retarding the closing of the throttle, the engine has time to clear out the heavy charge of fuel in the manifold before coming back to the normal idle position.

NOTE—The first type dash-pot was changed in later production to a solenoid controlled assembly. Operation of both types are covered in the following service instructions.

SERVICE PROCEDURE

CARTER BALL & BALL (BB) CARBURETOR

1935 through 1938 models

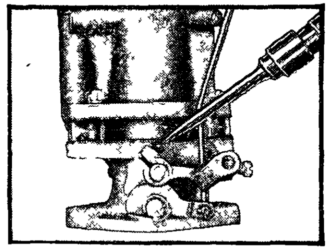


Fig. 323 Remov thr ttl l ver

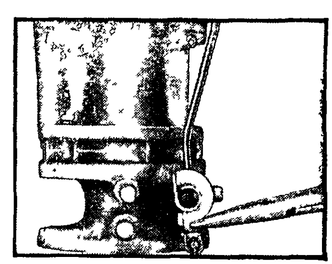


Fig. 324 R move thr ttl shaft d g and ch ke c nnect r rod. Disc nn ct r d at upp r end

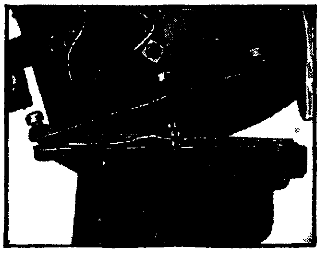


Fig. 325 R move air horn and b dy gasket

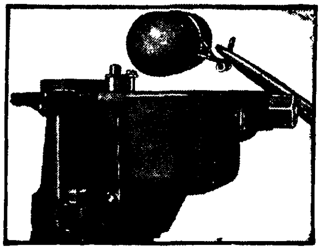


Fig. 326 Remove float lever pin retainer, fl at and lever, and pin. R m ve needle and seat. If ne dle shows wear, r plac both

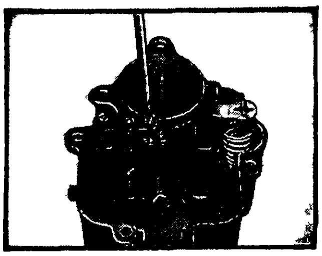


Fig. 327 R m ve idle orifice tub and plug and attached parts. Rem v pin spring to detach fr m step-up piston and plate. Remove step-up pist n spring and gasket from cylinder

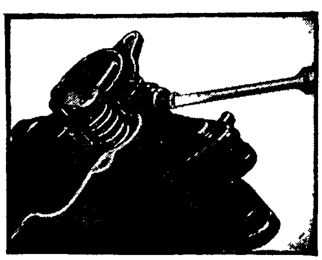
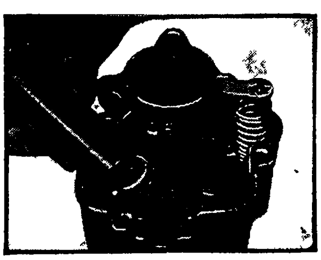


Fig. 328 Rem ve pump jet



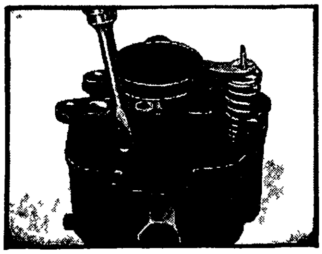


Fig. 330. Remove step-up jet and gasket

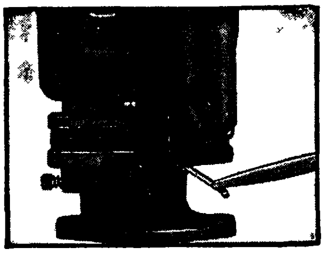


Fig. 331 Disconnect pump connector link at both ends. Check throttle shaft lever and pump connector link for wear

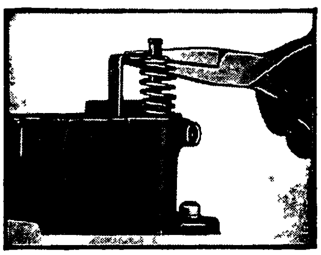


Fig. 332 Remove entire pump. Disconnect pump operating link and spring from plunger. Examine leather for wear or indication of leakage

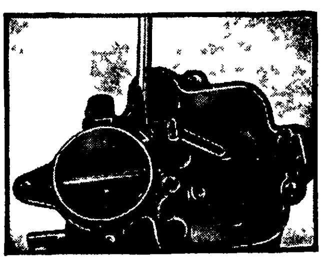


Fig. 333 Remove pump check needle plug and needle. Disregard this operation in 1936 and prior models

Fig. 329 R m ve main m t ring j t and gasket. Early 1935 and pri r m dels used main metering screw beneath float b wl

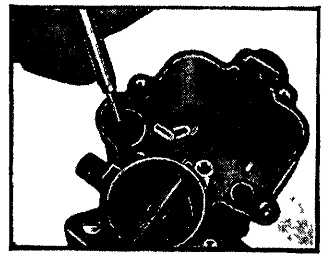


Fig. 334 Remove pump retainer ring and ball at bottom of pump cylinder

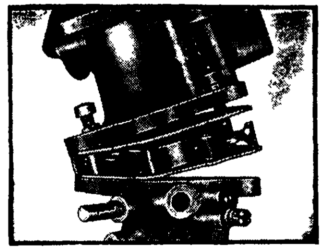


Fig. 335 Remove body flange and insulator from body. In 1936 and prior models, vent tube in diffuser bar in venturi should be removed with screw driver and cleaned with air. In 1937-38 models, vent tube can be serviced by removing rivet plug under bowl directly below main metering jet. Never reuse old vent tube or plug

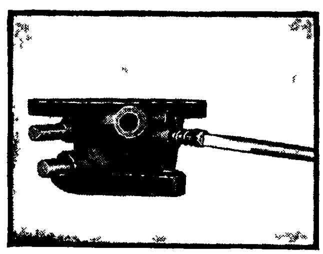


Fig. 336 Remove idle adjustment screw and spring and idle port plug

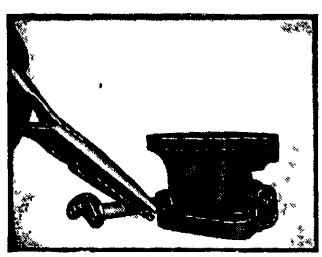


Fig. 337 Rem v thr ttl valv and shaft and arm. Check f r lo s arm and w ar n shaft

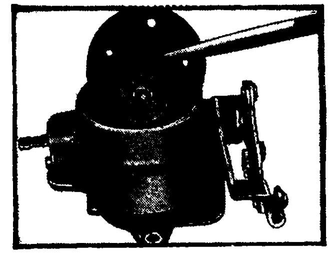


Fig. 338 Rem v ch ke valv

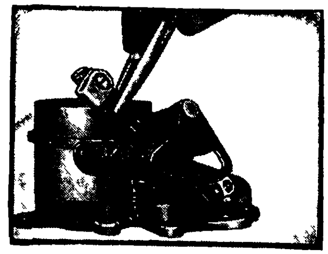


Fig. 339 Rem ve ch ke tub bracket. Dis ngage spring before removing t av id injury t spring

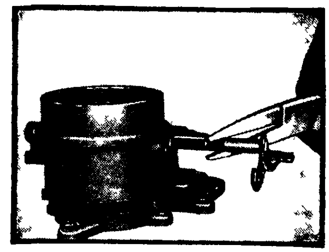


Fig. 340 R m v ch k c ntrol l v r and shaft

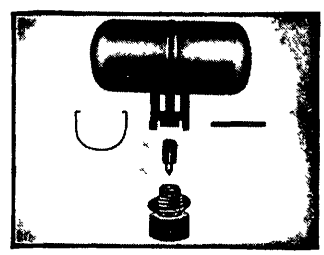


Fig. 341 Gr up parts f float circuit

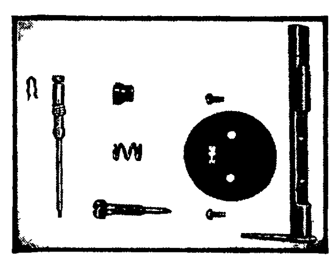


Fig. 342 roup parts of idl circuit

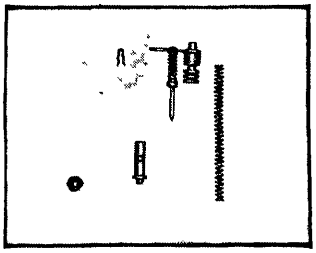


Fig. 343 Group parts of high sp ed circuit

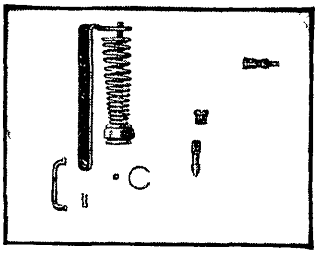


Fig. 344 Group parts of pump circuit

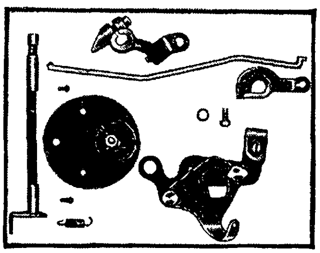


Fig. 345 Group parts of choke circuit. Examine each part in all gr ups and replace any part that sh ws wear. Use Carter R pair Kit

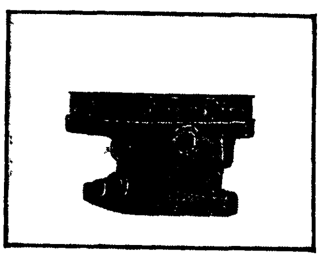


Fig. 346 Place insulator and new flange gaskets on body flang casting. Be sure holes in casting, insulat r and gaskets lin up

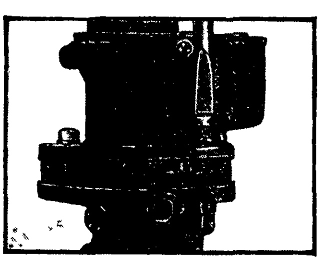


Fig. 347 S t b dy in place, then tighten scr ws securely. Don't f rget l ck washers

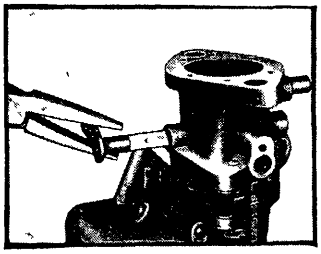


Fig. 348 Install throttle shaft and arm

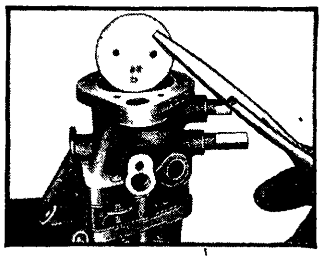


Fig. 349 Install throttle valve. Small "c" in circle or part number should be toward idle port when viewing casting from manifold side. Center throttle valve by tapping lightly and hold in place with fingers before tightening screws

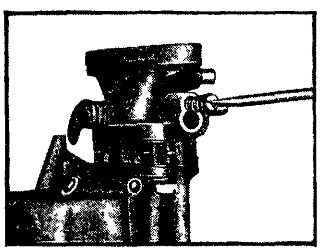


Fig. 350 Install idle adjustment screw and spring. Back out from seated position to specifications

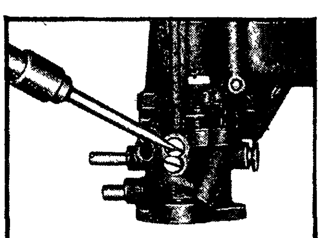


Fig. 351 Install idle p rt plug. Lat m dels have rivet which must be install d b f re idle adjustment screw and spring

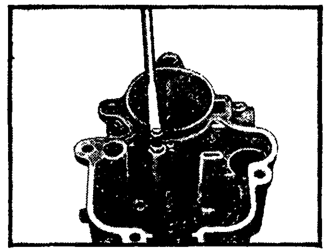


Fig. 352 Install idle orifice tube and plug. Assembly must seat well in casting

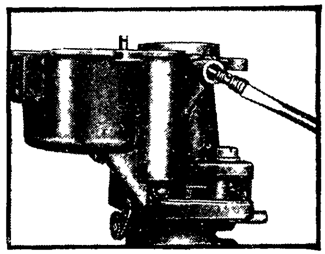


Fig. 353 Install pump jet. Models prior to 1937 used separate pump jet and pump jet plug. Be sure jet is clear of all restrictions and seats properly

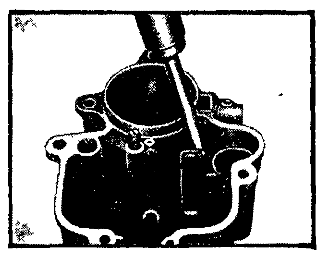


Fig. 354 Install pump check needle and plug. Disregard this operation on models prior to 1937 as they do not have the needle and plug. 1938 models use ball and spring instead of needle

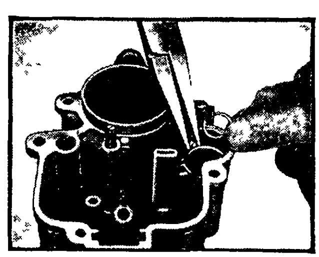


Fig. 355 Install ball and pump r tainer ring in pump cylinder. 1935 and pri r mod ls used pump check n edle and retainer seat instead f retainer ring

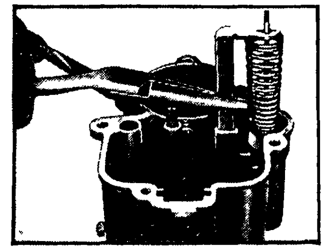


Fig. 356 Install c mplete pump plunger assembly as shown. 1936 and pri r m dels us d double piston pump arrang ment which sh uld be installed with casting invert d. Inner piston sh uld perat fr ly

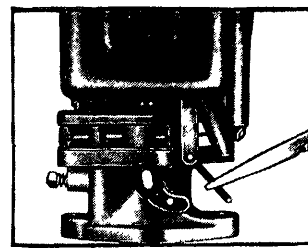


Fig. 357 Install pump c nnector link. Inner h l f r sh rt stroke; outer h le f r l ng str ke

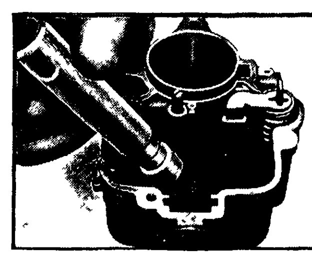


Fig. 358 Install main metering jet and gasket. Early 1935 and prior models used main metering screw beneath float b wl

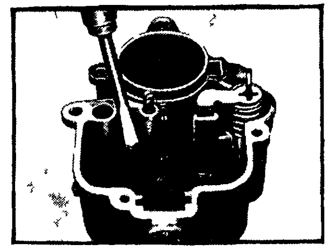


Fig. 359 Install step-up j t and gask t. Early 1935 and pri r m d ls us d st p-up valve

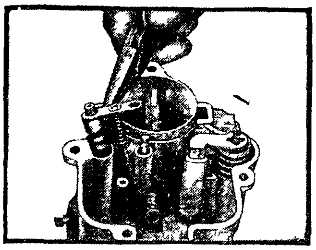


Fig. 360 Install step-up piston, gask t, spring, and step-up pist n plat and rod. Early 1935 and prior models used step-up pist n in air horn (b wl cov r) casting

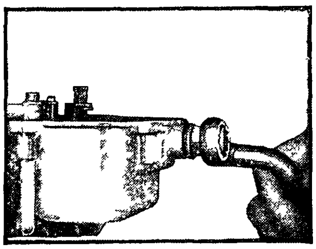


Fig. 361 Install needle seat and gasket

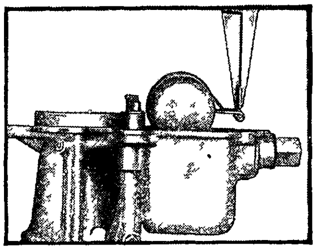


Fig. 362 Install needle, float pin, float and lever, and retainer. Set float level to specifications by bending lip—not float

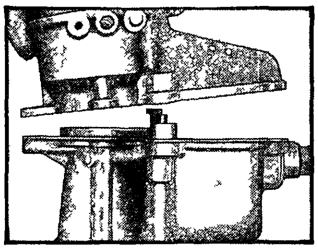


Fig. 363 Install air horn casting. Use new body gasket

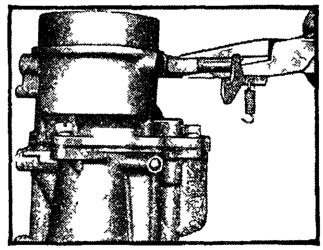


Fig. 364 Install choke lever and shaft. Check for loose lever on shaft

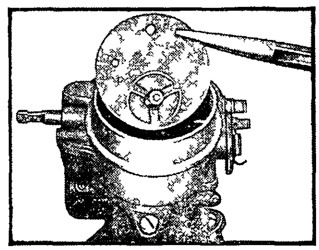


Fig. 365 Install choke valve. Use new screws

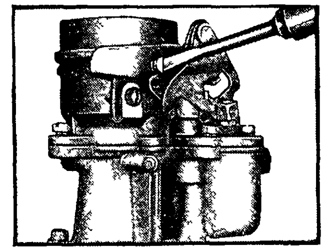


Fig. 366 Install ch ke tub bracket, and spring

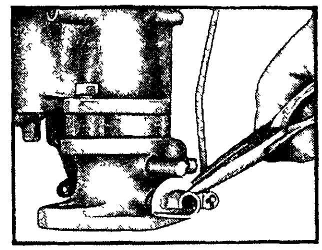


Fig. 367 Install ch k connector rod and thr ttl shaft d g

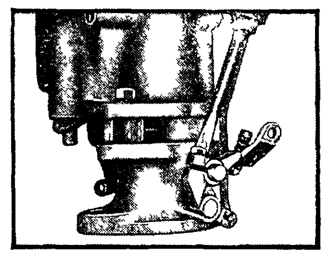


Fig. 368 Install thr ttl lever. Tighten screws secur ly

SERVICE PROCEDURE

CARTER BALL & BALL (BB) CARBURETOR

1939 and Later Models

Courtesy Carter Carburetor Corp.

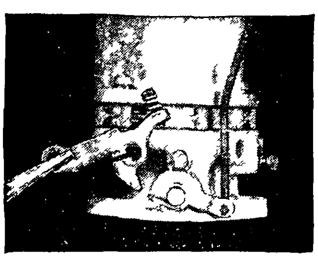


Fig. 369 Rem ve throttle lever

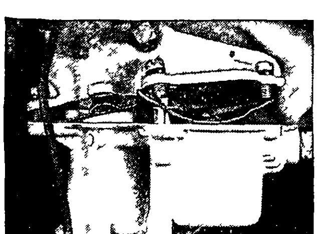


Fig. 370 Rem ve air h rn

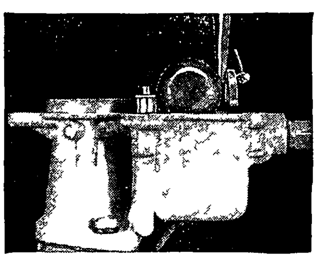


Fig. 371 Remove float and lever, float pin and retainer

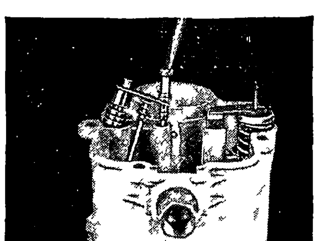


Fig. 372 R m ve idl rifice tube and plug, step-up pist n plate and r d

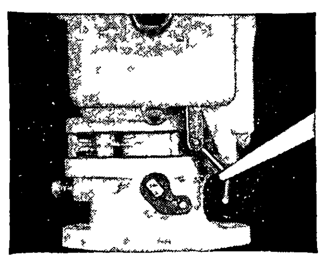


Fig. 373 Remove pump link

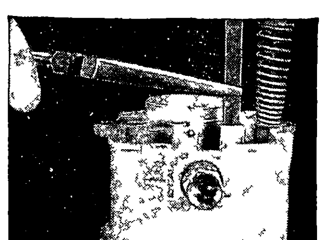


Fig. 374 Remove pump plunger and r d, pump spring and pump perating link

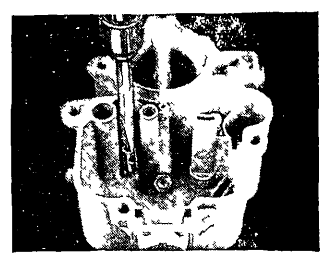


Fig. 375 Rem v st p-up jet

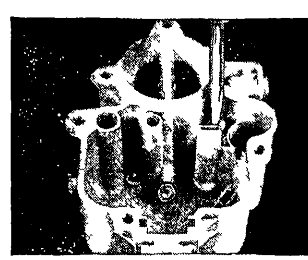


Fig. 376 Rem v pump check plug and discharge check ball

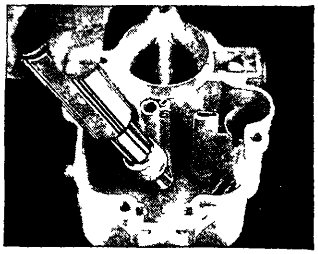


Fig. 377 R mov m tering jet

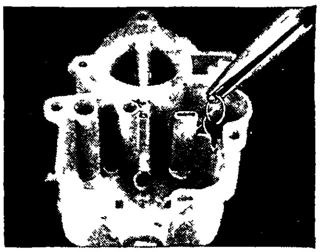


Fig. 378 R m v pump retain r ring and intake check

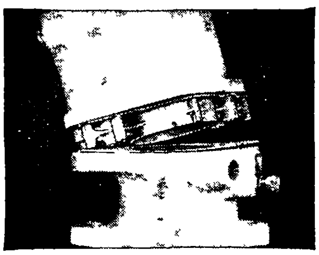


Fig. 379 Rem ve b dy flange and insulat r fr m body

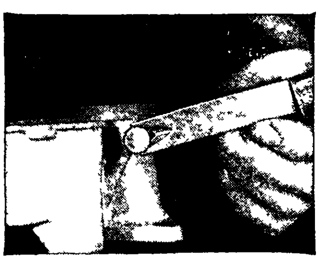


Fig. 380 Rem v pump jet riv t plug and pump jet

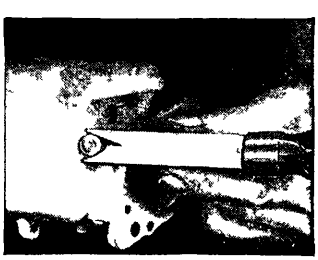


Fig. 381 Rem v main vent tub riv t plug

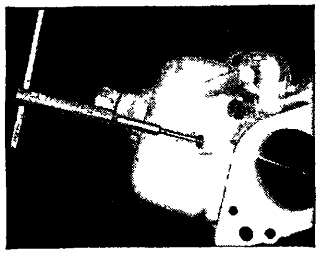


Fig. 382 Remove main vent tube (use tool T109-70)

Fig. 383 Remove needle seat

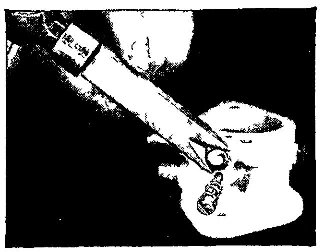


Fig. 384 Remove idle adjustment screw and spring, then idle port rivet plug

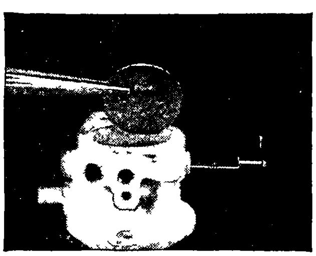


Fig. 385 Remove throttle valve, shaft and arm

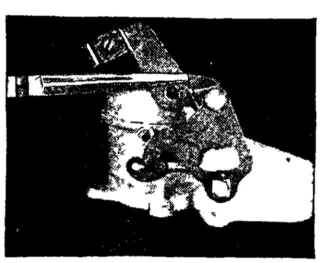


Fig. 386 Remove ch k tub brack t

Fig. 387 Remove choke valve screws, and choke shaft and lever. Check for loose arm on shaft and for wear

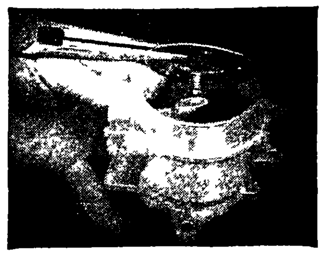


Fig. 388 Remove choke valve

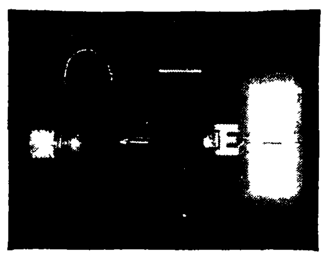


Fig. 389 Group parts of float circuit

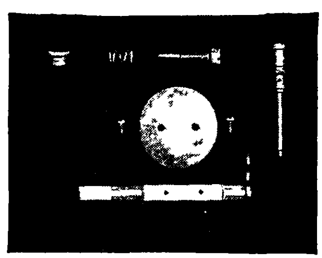


Fig. 390 Group parts of idle circuit

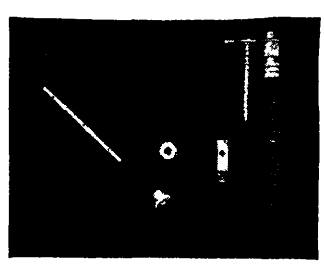


Fig. 391 r up parts of high sp d circuit

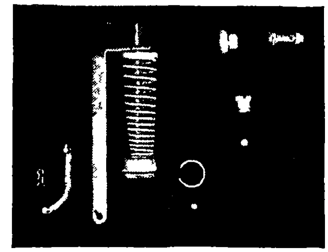


Fig. 392 Group parts f pump circuit

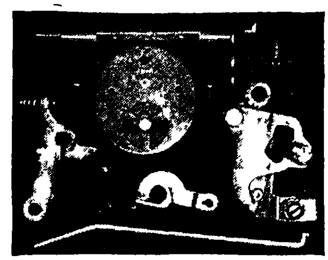


Fig. 393 Group parts f chok circuit. Examin parts in all groups and replac any that shows wear. Us Carter Repair Kit

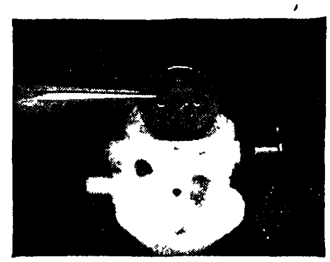


Fig. 394 With manifold sid of flange down, install thr ttle shaft and arm, then throttle valve. Small "c" in circle should be toward idl port, and facing down. Cent r valv by tapping lightly and h ld with the fingers b f re tightening screws

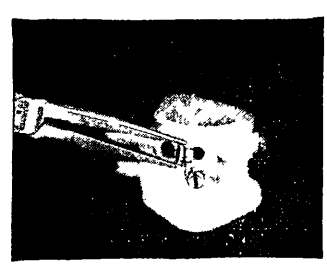


Fig. 395 Install idle p rt plug first, then idl adjustm nt scr w and spring. Back scr w out from s ated p siti n to specificati ns

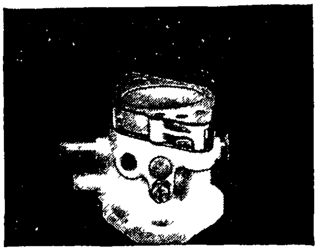


Fig. 396 Install insulator and gask ts. B sure holes in casting, insulat r and gaskets lin up pr perly

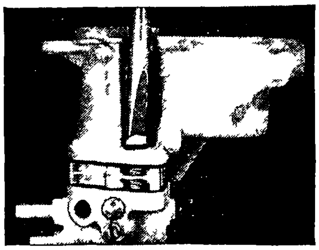


Fig. 397 Install body castings and tighten scr ws securely. Don't f rget l ck washers

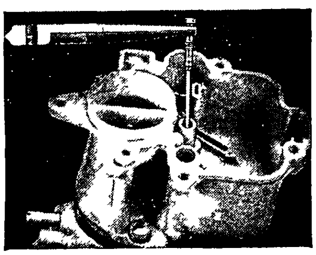


Fig. 398 Install idle orifice tube. D n't tighten—leave it l s

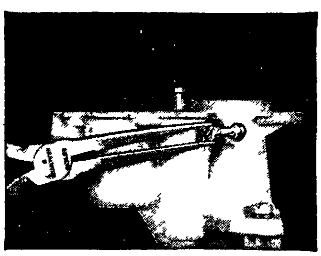


Fig. 399 Install pump jet and pump jet riv t plug. Be sure j t is clear f all restrictions and seats properly

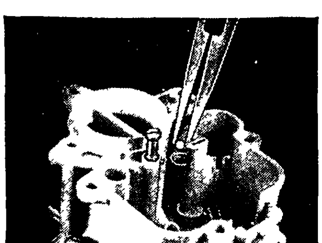


Fig. 400 Install pump discharge check ball and plug. Discharge ball is large on . B sur t put check balls in c rrect passag s

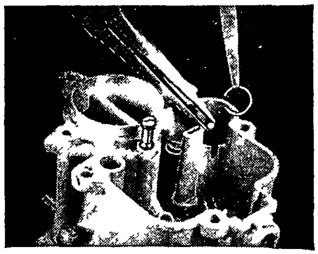


Fig. 401 Install pump intake check ball and pump strainer

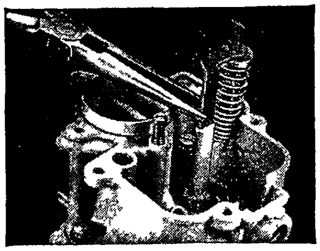


Fig. 402 Install pump plunger and rod, pump spring and pump operating link

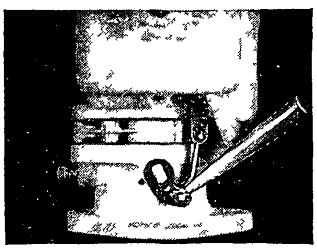


Fig. 403 Install pump connector link and pin spring. Connect in center hole

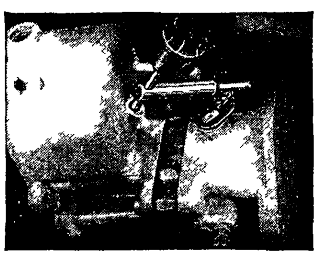


Fig. 404 Install main vent tube rivet plug. Tools T-109-70 or T109-151 *must be used* to install new tube. Never reuse an old vent tube or plug

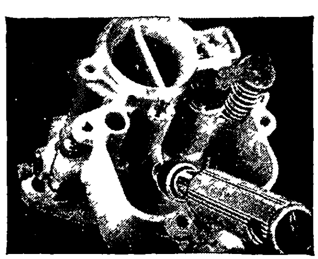


Fig. 405 Install main metering jet and gasket

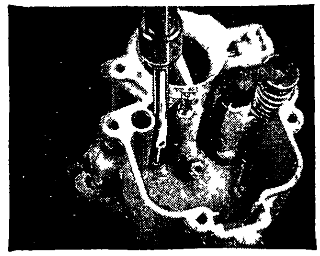


Fig. 406 Install step-up jet and gasket

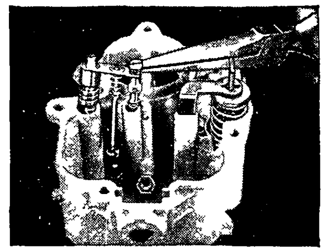


Fig. 407 Install step-up piston ring, gasket and step-up piston, plate and rod. Securely tighten idle orifice tube. Check springs for damage

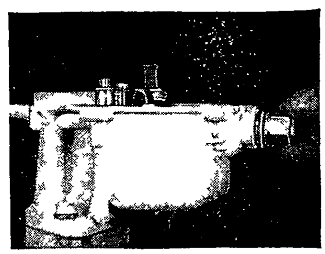


Fig. 408 Install needle seat and gasket, then install needle. If needle or seat shows wear, replace both

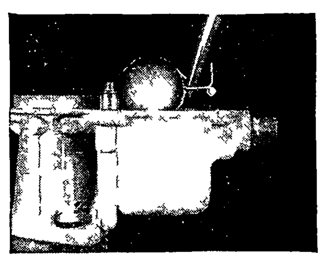


Fig. 409 Install float and lever, float pin and float lever pin retainer. Check float for dents and for wear on float lip or float pin

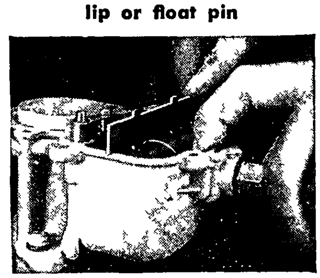


Fig. 410 Set fl at level t sp cificati ns. Bend lip, n t fl at. Also see Fig. 322

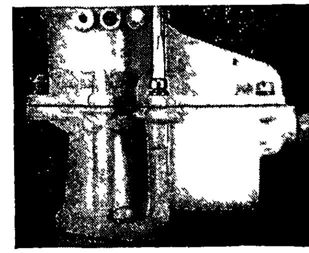


Fig. 411 Install air h rn. Use new gasket

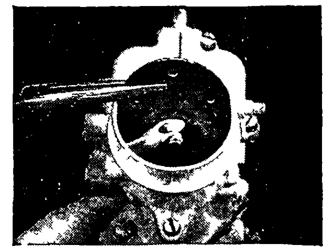


Fig. 412 Install choke valve. Center valve by tapping lightly bef r tightening screws

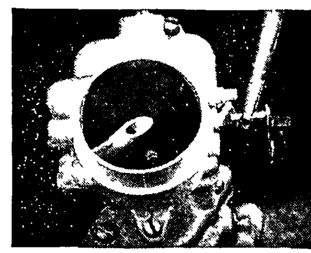


Fig. 413 Install ch k shaft and lever with spring attached. Check f r l os lever n shaft

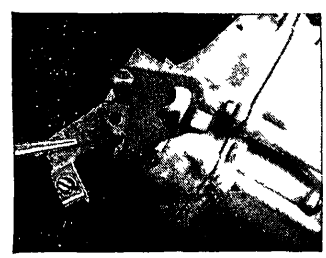


Fig. 414 Install ch k bracket. Attach spring

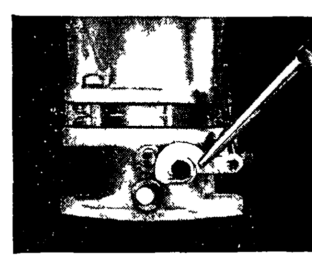


Fig. 415 Install choke c nnect r r d and throttl shaft d g. Place d g n cast iron shaft. Check r d and d g for w ar

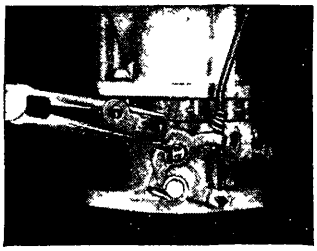


Fig. 416 Install throttle lever. Tight n screws securely

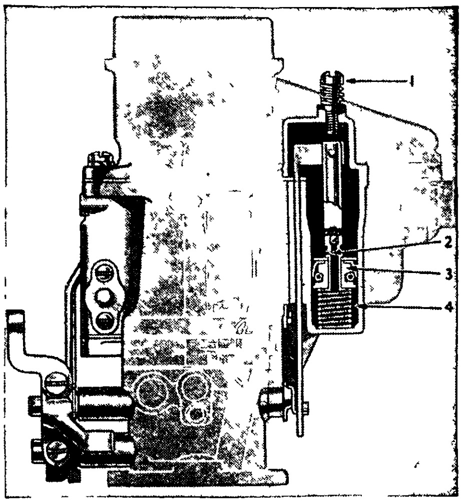


Fig. 417 CARTER BB Dash-pot (1st type)

1. **Dash-p t adjusting screw**
2. **R stricted fuel opening**
3. **Dash-pot piston**
4. **Fu l chamber**

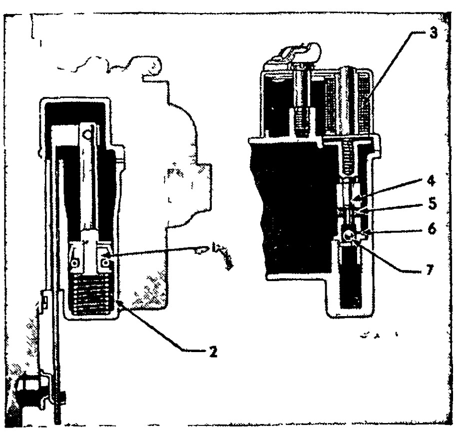


Fig. 418 CARTER BB Dash-pot (2nd type)

1. **Pist n**
2. **R strict d fu l p ning**
3. **Solen id**
4. **S len id c r**
5. **and 6. Fuel passag**
7. **Ball ch ck**

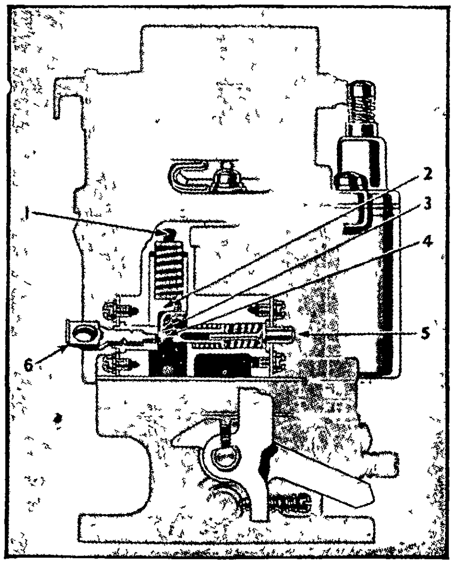


Fig. 419 CARTER BB. Kick Down Switch

1. **Air passage**
2. **Piston**
3. **Contact arm**
4. **Contact**
5. **Plunger**

FIRST TYPE—Fig. 417. When the engine is under load the piston (3) is in the upward position and the chamber (4) is full of fuel. When the throttle is released and the linkage returns to the idle setting, the piston tends to return to the lower position. To do so, however, the fuel must be discharged through the restricted opening (2).

This restriction retards the closing of the throttle and avoids too rapid a return to idle position which could stall the engine. The only adjustment is the slotted screw (1). Normally, the screw should be set approximately five full turns out. Further adjustment outward will increase the action of the dash-pot and lengthen its retarding effect. Too much retard will effect automatic gear change on the upshift. The transmission has to synchronize before shifting is accomplished, and if the engine speed falls off too slowly when the accelerator is released, gear change will be retarded.

The leather seal on piston (3) controls the retarding action. Should this seal become worn, cracked or dry, the action will be upset.

SECOND TYPE—Fig. 418. The solenoid controlled dash-pot functions as follows: When car speed is below 8 mph in first or second gear, and 15 mph in third or fourth gear, the transmission governor points close thus energizing the dash-pot solenoid. This raises the solenoid core and ball check, allowing fuel to enter under the dash-pot piston. As the piston tends to return to a lower position, the fuel is discharged through a restricted opening, retarding the closing of the carburetor throttle. When the car speed is greater than the afore-mentioned speeds, the solenoid is not energized, the ball is down, allowing fuel to be by-passed through openings so that the dash-pot does not function.

SERVICE NOTE—In replacing a carburetor having the first type dash-pot with one having the second type, the electrical connections should be made as follows: Connect either one of the solenoid terminals with the terminal on the kick down switch on the carburetor. Connect the other solenoid terminal to the point marked "SF" on the relay, situated at the right of the voltage regulator. The relay terminal marked "SF" already carries two wires and will then have three wires connected.

KICK DOWN SWITCH—Fig. 419. Carburetors on Chrysler-built cars with semi-automatic transmission are equipped with a transmission kick down limit switch as illustrated. The purpose of this switch is to bring the car from fourth to third speed when the car is going at a speed where acceleration in third speed is faster than in fourth. To operate the switch, it is only necessary to depress the accelerator pedal to the floor board. The switch will then make contact provided the pull of the vacuum on the piston is less than the strength of the spring.

In operation, the plunger (5) is moved inward when the accelerator is depressed. When the pedal is fully depressed, the plunger makes contact with arm (3) and moves it against contact (4) which energizes the solenoid circuit, permitting the transmission to function (see transmission section in Chrysler chapter). Contact (4) is attached to piston (2) and which moves up and down, dependent upon the velocity of air at the carburetor venturi. Consequently its position varies according to engine speed.

SERVICE NOTE — Underneath the spring in the piston, there may be anywhere from one to four washers, which are placed there at the factory and should not be changed in service. If it ever becomes necessary to change *both* the piston and spring, *do not use any washers*. If only the spring is to be replaced, *do not add or remove* any washers from the piston.

To determine if the switch is working, insert a six-volt timing light between a hot terminal on the voltage regulator and the terminal on the carburetor. To determine if the switch is functioning at the proper speed, drive the car in second gear and accelerate rapidly from a speed of about 20 mph. The kick down should occur at approximately 22 to 25 mph.

CARTER YF SERIES

Carter YF units differ from other Carter carburetors chiefly in that it has a diaphragm type accelerating pump. The carburetor is a balanced bowl vent type, maintaining the correct air-fuel ratio at all times regardless of the amount of restriction in the air cleaner due to dirt, etc.

FLOAT CIRCUIT—the float circuit is of the conventional Carter design which controls the fuel level in the carburetor bowl. A supply of fuel is maintained for the low speed, high speed, pump and choke circuits.

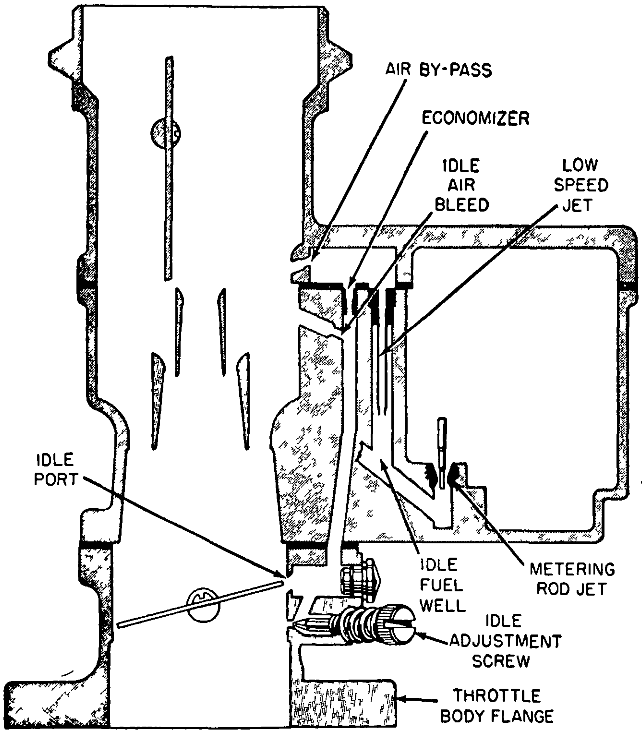


Fig. 419B Low speed circuit. Carter YF
Courtesy Carter Carburetor Corp

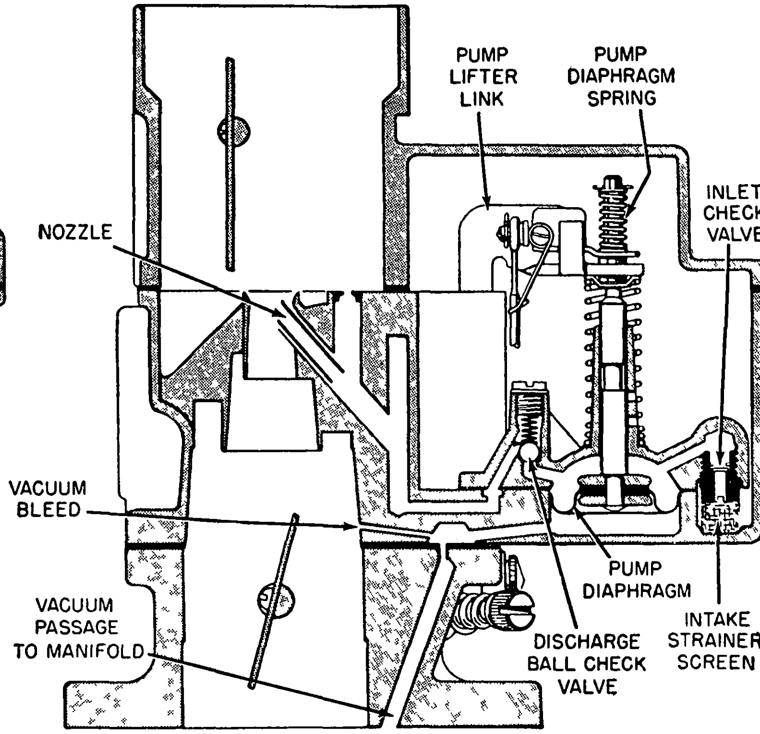


Fig. 419D Accelerating pump circuit of Carter YF carburetor used on Nash 1951 Statesman and Rambler
Courtesy Carter Carburetor Corp

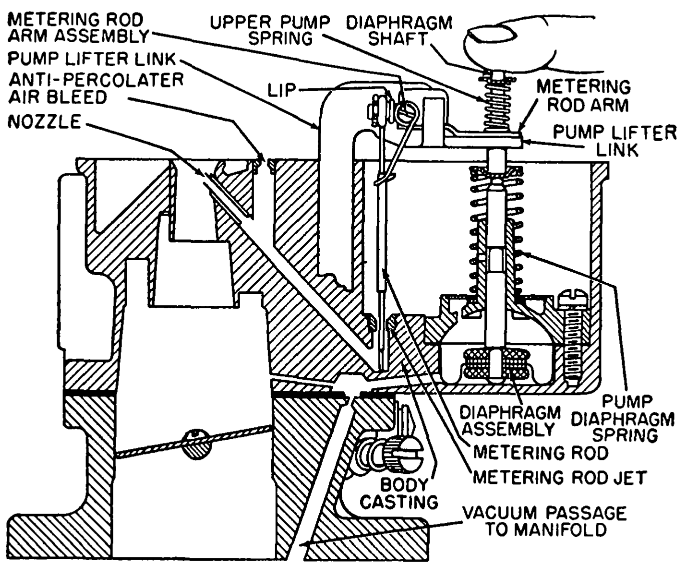


Fig. 419C High speed circuit. Carter YF
Courtesy Carter Carburetor Corp

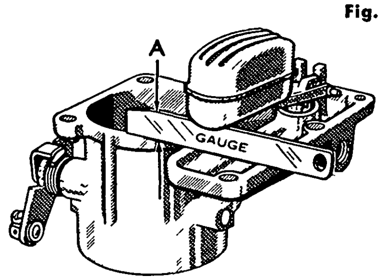


Fig. 419A Float adjustment. Carter YF
Courtesy Carter Carburetor Corp.

The float circuit consists of a float, float pin, air horn gasket, and needle and seat assembly Worn needle and seats must be replaced in matched sets only

To adjust float level, invert the bowl cover and remove bowl gasket With the float resting on pin in seated needle, the distance from the bowl cover to the top of the float should be as given in the *Carter Adjustments* chart Use the proper gauge as shown in Fig 419A to check the position of the float Adjust the level by bending the lip of the float, not the float arm

LOW SPEED CIRCUIT — Fig 419B. Fuel for idle and early part throttle operation is metered through the low speed circuit Liquid fuel enters the idle well through the metering rod jet The low speed jet measures the amount of fuel for idle and early part throttle operation The air by-pass, economizer and idle air bleed are calibrated orifices which serve to break up the liquid fuel and mix it with air as it moves through the passage through the idle port and idle adjustment screw port

Turning the idle adjustment screw in toward its seat reduces the quantity of fuel mixture supplied by the idle circuit.

The air by-pass, economizer, idle port, idle adjustment screw port and the bore of the throttle body flange must be clean and free of carbon Obstructions at any of the above points will cause poor low speed engine operation

Worn or damaged idle adjustment screw or low speed jet must be replaced

HIGH SPEED CIRCUIT — Fig 419C Fuel for part and full throttle operation is supplied through the high speed circuit The metering rod and metering rod jet control the amount of fuel admitted to the nozzle The metering rod is both mechanically and vacuum controlled, and is attached to the metering rod arm

During part throttle operation, the vacuum in the accelerating pump chamber pulls the diaphragm down holding the metering rod against the pump lifter link Movement of the metering rod will

be controlled by the pump lifter link, which is attached to the throttle shaft of the carburetor. This is true at all times that vacuum in the diaphragm chamber is strong enough to overcome the tension of the pump diaphragm spring. The upper pump spring serves as a bumper upon deceleration and as a delayed action spring on acceleration.

Under any operating conditions, when the pump diphragm spring overcomes the vacuum in the diaphragm chamber, the metering rod will move toward the wide open throttle or power position.

The nozzle and anti-percolator air bleed are pressed in place and should not be removed.

METERING ROD ADJUSTMENT—Due to the fact that two types of pump lifter links have been used, one with and one without a supporting lug for the metering rod arm, it is necessary to have two metering rod adjustments for YF carburetors.

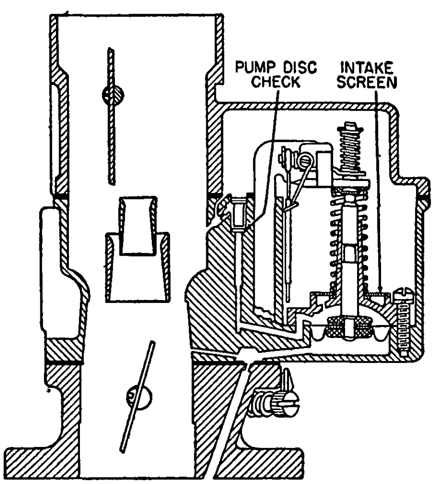


Fig. 419E Accelerating pump circuit f Carter YF carburetor us d n Willys and Henry J
Courtesy Carter Carburetor Corp.

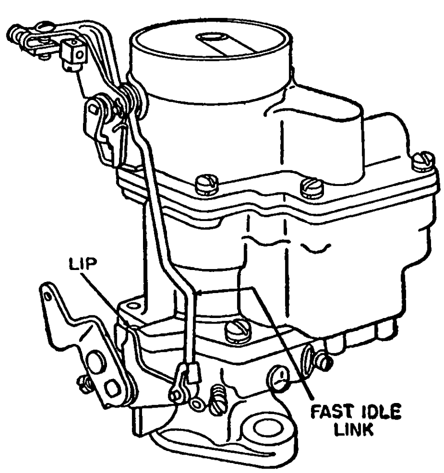


Fig. 419F Fast idl adjustment on Carter YF with ut Climatic C ntr l
Courtesy Carter Carburetor Corp.

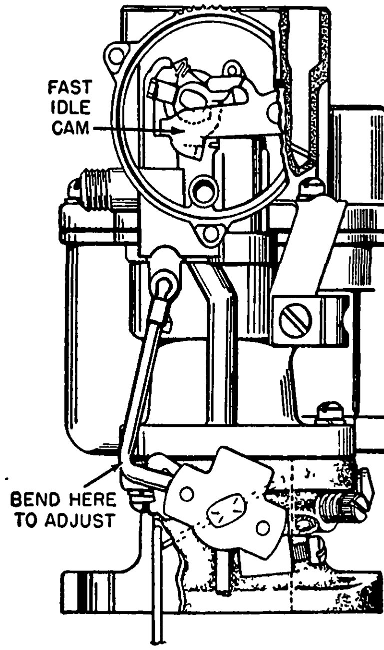


Fig. 420 Fast idle adjustment on Carter YF with Climatic Control
Courtesy Carter Carburetor Corp.

The following is to be used when pump lifter link *with* supporting lug is used:

This adjustment is important and should be checked each time the carburetor is reassembled or when leaner than standard rods are installed. With throttle valve seated in bore of carburetor, press down on upper end of diaphragm shaft until diaphragm bottoms in vacuum chamber. Metering rod arm should contact lifter link flat surface between springs and at supporting lug, and at the same time metering rod must contact bottom of metering rod well. Adjust by bending lip of metering rod arm to which metering rod is attached, up or down.

The following is to be used when the pump lifter link *without* supporting lug is used:

This adjustment is important and should be checked each time the carburetor is reassembled. With throttle valve seated in carburetor bore, press down on upper end of diaphragm shaft, Fig. 419C, until diaphragm bottoms in vacuum chamber. Metering rod arm should contact lifter link at the same time metering rod bottoms in metering rod well.

Before making adjustment, be sure flat on metering rod arm is parallel with flat of pump link arm. Adjust by bending lip up or down.

ACCELERATING PUMP CIRCUIT—Figs. 419D and 419E show the construction of two applications of this circuit. The chief difference between the two designs is that in Fig. 419D a discharge ball check is used to smooth out the fuel delivery more nearly in accord with engine demand.

In both designs, the accelerating pump gets its fuel supply from the bowl through the inlet check valve. From this valve it fills the diaphragm chamber. When the throttle valve is opened, the pump lifter link tends to pull the diaphragm upward. The first shock of movement is absorbed by the small bumper spring located above the pump lifter link. As vacuum decreases, the pump diaphragm spring, plus the mechanical lift on the lifter link, forces fuel through the discharge passage into the main nozzle passage to enrichen the main circuit fuel for acceleration. (On Nash carburetors, this fuel is first forced through the discharge check valve.)

If acceleration is not satisfactory, remove the pump diaphragm assembly and check the diaphragm for wear or damage. Be sure the intake screen is not clogged with lint or other foreign matter. Be sure pump disc check is seated as a leak at this point will result in poor acceleration.

There is no pump adjustment.

FAST IDLE ADJUSTMENT (UNITS WITHOUT CLIMATIC CONTROL) — Fig. 419F. With choke held in wide open position, lip on fast idle arm should contact boss on body casting. Adjust by bending at offset on fast idle link.

FAST IDLE ADJUSTMENT (UNITS WITH CLIMATIC CONTROL) — Fig. 420. Remove thermostatic coil housing, gasket and baffle plate. Crack throttle valve and hold choke valve firmly closed, then close the throttle valve. This will allow the fast idle cam to revolve to the fast idle position.

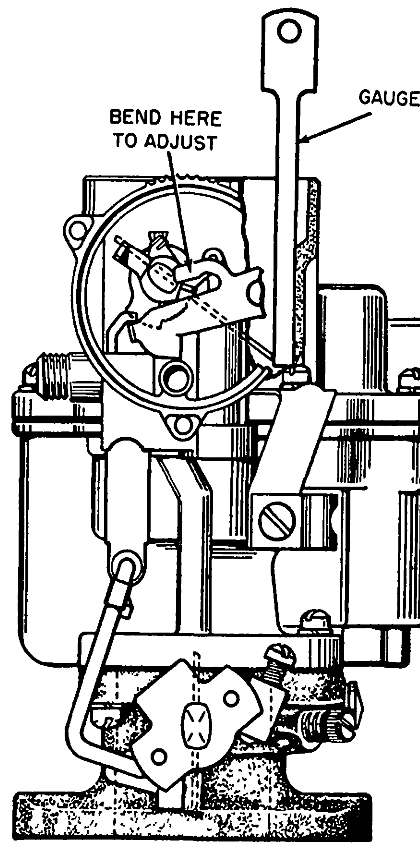


Fig. 421 Unl ader adjustm nt on Carter YF with Climatic C ntr l
Courtesy Carter Carburetor Corp.

With the choke valve held tightly closed and slight tension on the throttle lever, there should be the clearance specified in the *Carter Adjustments* chart between the throttle valve and bore of carburetor. Adjust by bending the connector link as required.

UNLOADER ADJUSTMENT (UNITS WITH CLIMATIC CONTROL) — Fig. 421. This adjustment must be made after the fast idle adjustment. Hold throttle valve wide open and close choke valve as far as possible without forcing.

There should be the specified clearance between the lower edge of the choke valve and inner wall of the air horn as given in the *Carter Adjustments* chart. Adjust by bending arm of choke trip lever.

FORD

DUAL CARBURETOR

Ford V8, Mercury & Lincoln Zephyr, 1938-48

The Ford dual carburetor (formerly marked "Chandler-Groves") was first used on 1938 Ford and Lincoln Zephyr cars. It is a plain tube dual downdraft type in which all the main channels are carried in a removable nozzle bar, Fig. 422, which carries the idle tube and an aspirating (breathing) nozzle. The central portion of the nozzle bar forms the discharge nozzle. In this construction, it is possible to locate the discharge nozzle in the center of the air stream without the need of attaching brackets or bosses which interfere with the flow of air into the venturi.

The discharge nozzle proper is located in the smallest part of the venturi, Fig. 423, is circular and is of such diameter as to create a high suction at the end of the nozzle. This suction, in addition to the atomizing holes in the nozzle, helps to vaporize the fuel.

This dual carburetor can be considered as being two carburetors built into one unit. There is a separate set of venturi, idle tubes, nozzle bars, main metering system, idle system and throttle plates, one for each side. There is one accelerating pump with the fuel being divided at the pump discharge nozzle, Fig. 424 (inset), one air chamber and one fuel chamber. There is one power valve which takes the fuel from the fuel chamber through one passage and divides the fuel evenly for each side. Fig. 425 is a sectional view of the power system.

SERVICE NOTES—If trouble is experienced at intermediate speeds, check the carburetor body and flange bolts for tightness and see that the gaskets are not leaking. Remove the main metering jets and blow out the metering jet channel and the main discharge nozzle. Check fuel level.

If high speed trouble is encountered, check the vacuum economizer valve and the economizer restrictions. Blow out channels with compressed air. Check fuel level and float travel. Check spark plug gaps, breaker points and engine compression.

In cases where the car is operated in high altitudes, it may be necessary to use leaner metering jets. Usually a 5% or 10% leaner jet will take care of any variation in altitude. Do not change the size of economizer passages or pump discharge holes as this will cause erratic performance.

FUEL & FLOAT LEVEL—The entire specification of the carburetor depends largely on the proper fuel level in the bowl. This should be measured accurately, and the fuel pump pressure should be checked with a pressure gauge.

Under 3 pounds pressure, the fuel in the bowl should measure $\frac{5}{8}$" below the top of the bowl surface for the Lincoln Zephyr, and $\frac{11}{16}$" for Ford and Mercury. The level can be corrected by bending the float arms; be sure float is level after bending the arms.

When using a glass tube as a level indicator, Fig. 426, care must be exercised because the reading in the tube will be approximately $\frac{1}{16}$" higher than in the carburetor bowl, due to capillary attraction. The float level can be set very close when the air horn is off, by measuring the distance between the bottom of the float (not the soldered seam) and the flange surface of the air horn. This distance should be between $1\frac{5}{16}$" and $1\frac{9}{32}$" for the Lincoln Zephyr, and between $1\frac{3}{8}$" and $1\frac{11}{32}$" for the Ford and Mercury. This measure-

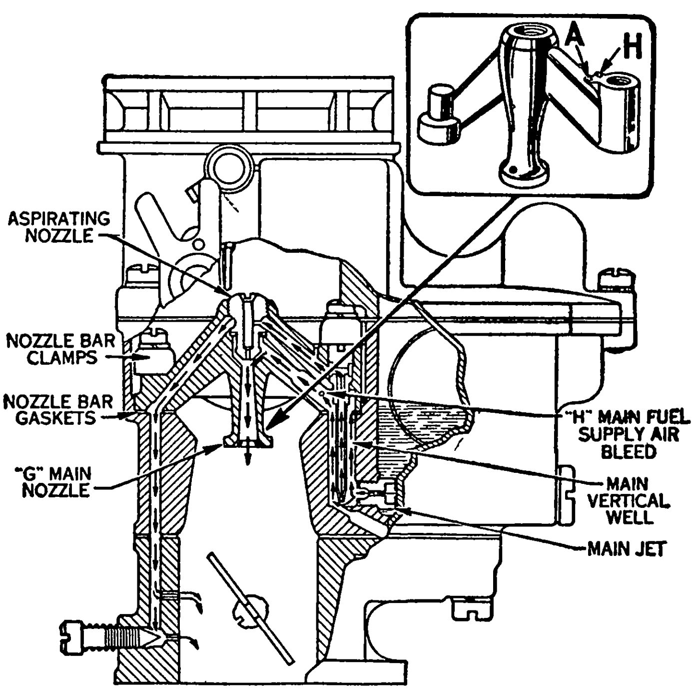


Fig. 422
FORD DUAL CARBURETOR, 1938-48
Main fuel system

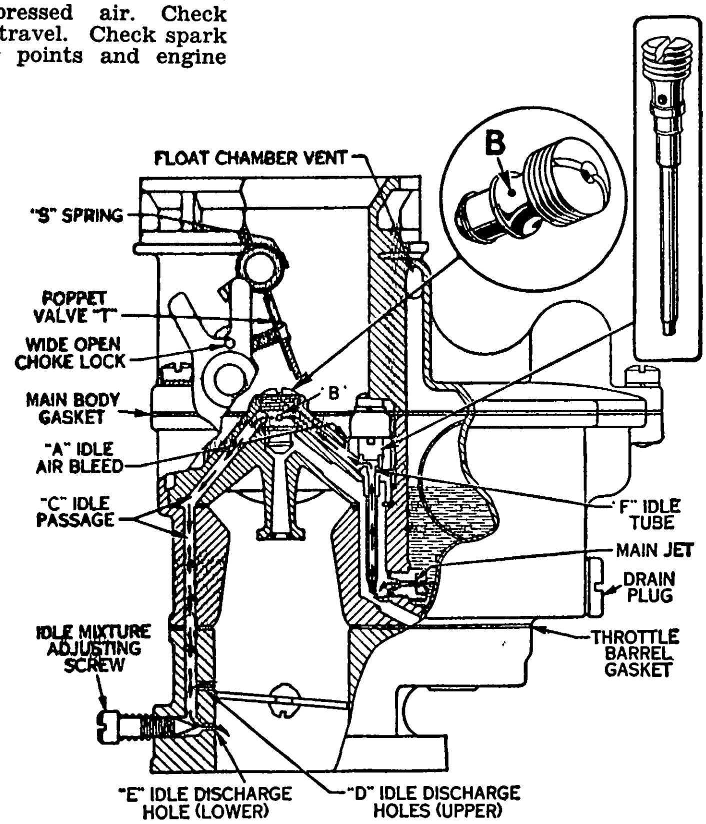


Fig. 423
FORD DUAL CARBURET R, 1938-48
Idle syst m

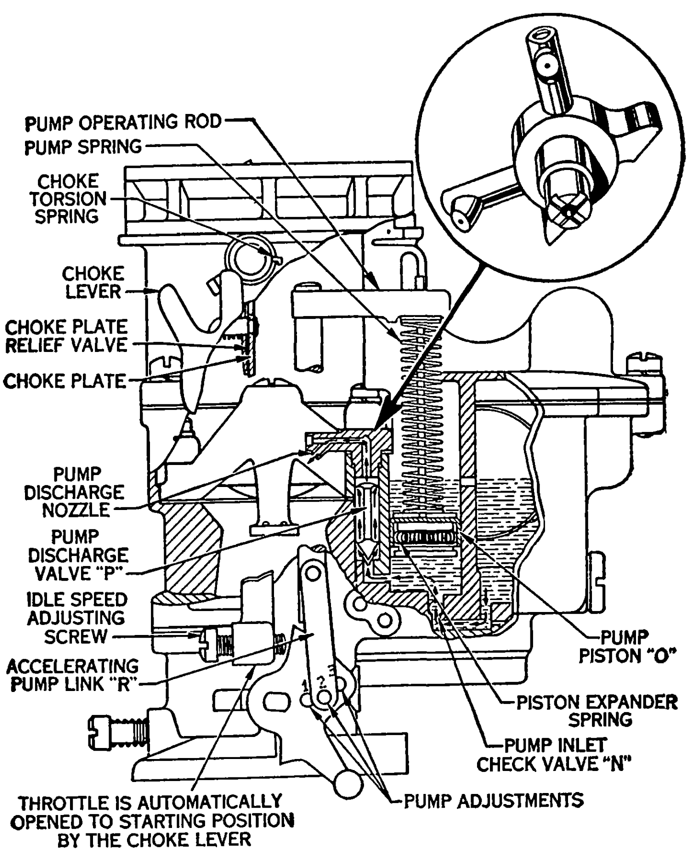


Fig. 424
FORD DUAL CARBURETOR, 1938-48
Acceleration system

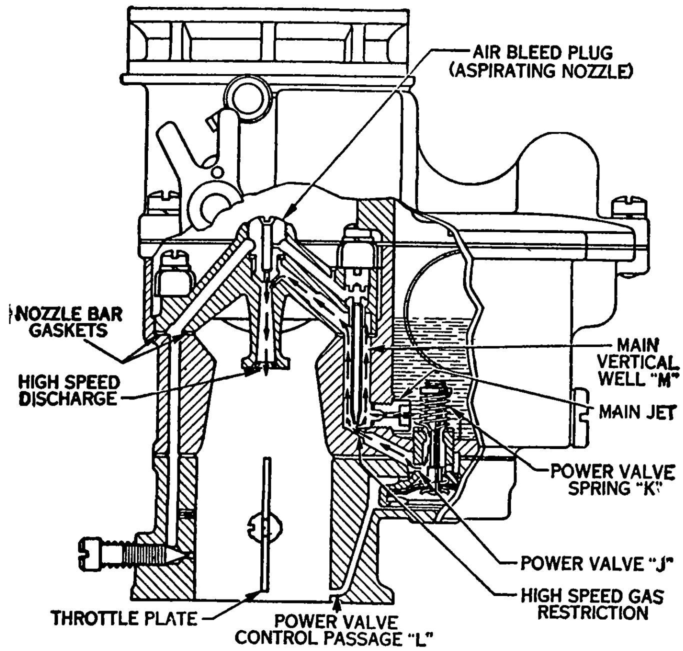


Fig. 425
FORD DUAL CARBURETOR, 1938-48
Power system

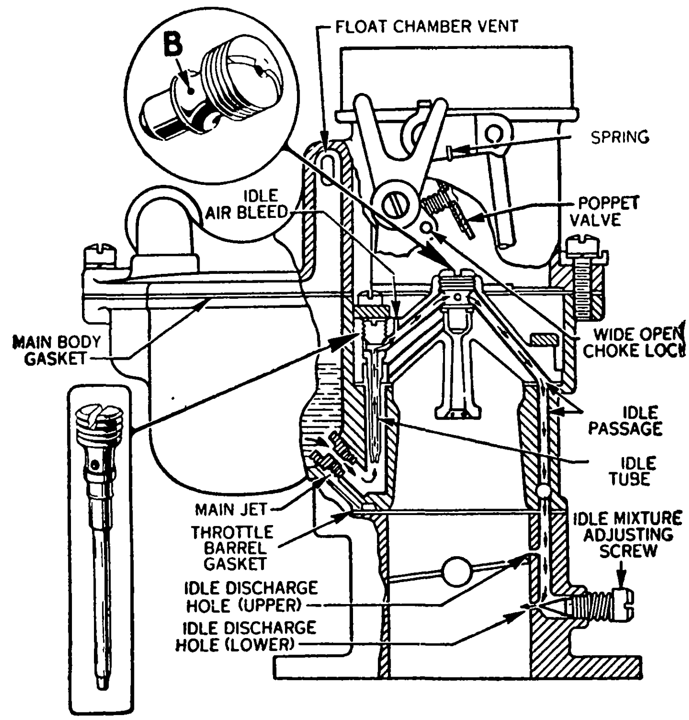


Fig. 427
FORD SINGLE BARREL CARBURETOR, 1941-48
Idle system

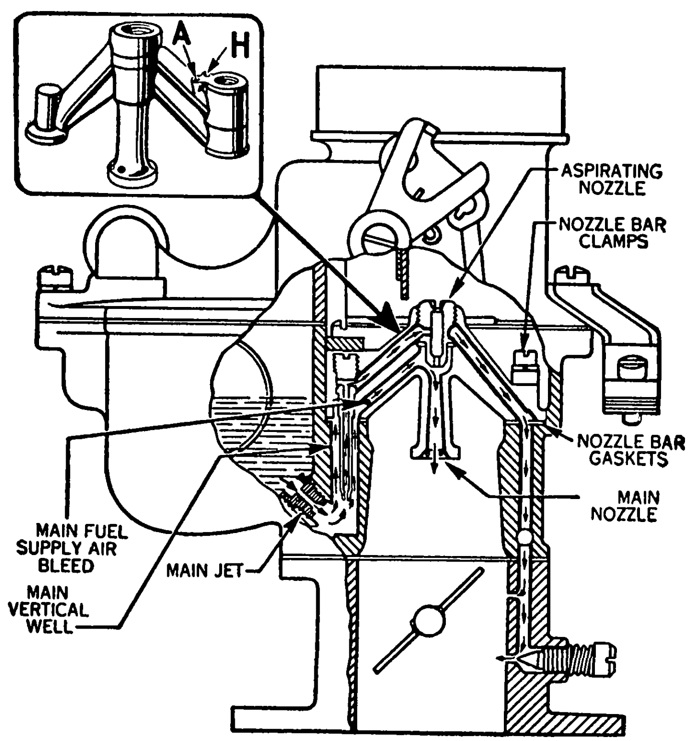


Fig. 428
F RD SINGLE BARREL CARBURETOR, 1941-48
Main fu l syst m

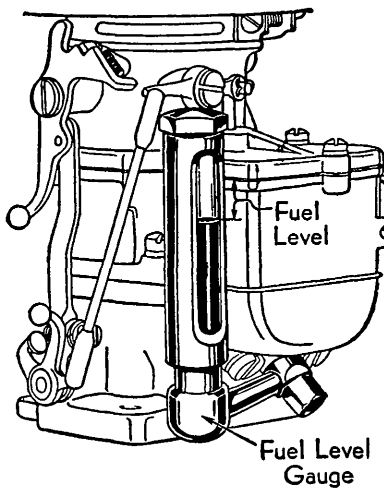


Fig. 426
FORD CARBURETORS
Checking fuel level

ment is taken with the air horn removed and held in an inverted position.

IDLE ADJUSTMENT — Set the idling speed with the throttle stop screw. The idle mixture is controlled by the idle adjusting needles. Turning the needles to the right, or in, makes the mixture leaner, and to the left, or out, makes the mixture richer.

1949-52 FORD

The dual carburetor used on all V8s and the single carburetor used on six-cylinder models prior to 1952 are essentially the same as the 1948 and prior models except for the two vacuum passages in the body to control the advance of the ignition distributor. The vacuum passages are located at the venturi and at a point just above the throttle plate. This innovation was incorporated because the new ignition distributor does not have any centrifugal advance mechanism. The vacuum, acting on the distributor diaphragm, at all times is a combination of that existing at both the venturi and throttle plate. The vacuum at these two points varies with throttle opening and road load. How this is accomplished is explained in the *Ignition* chapter.

1949-51 LINCOLN & MERCURY

These carburetors are dual concentric units of the plain tube downdraft type with a built-in automatic choke and a horizontal air horn. They can be considered as being two carburetors built into one unit. There is a separate set of venturi, idle tubes, throttle plates, main metering system and idle system for each side. There is one accelerating pump from which the fuel is divided at the pump discharge nozzle, one air chamber, and one fuel chamber. One power valve is used to take the fuel from the fuel chamber through the power valve chamber and the high speed restriction into the main well where the fuel is evenly divided for each side.

CARBURETOR SERVICE

These carburetors may be serviced with standard hand tools. After removing the carburetor from the engine, disassemble it as follows:

DISASSEMBLE—

1. Disconnect rod at fast idle link.
2. Unfasten and remove air horn from carburetor bowl.
3. Remove two gaskets and plate from carburetor bowl.
4. Inspect mating surfaces of bowl, particularly the center surface, for large burrs or scratches between drilled passages. If a correction is necessary, replace the bowl; do not file surface.
5. Invert carburetor with hand over bowl, pouring out fuel and removing the two main well tubes and pump discharge needle.
6. Remove float hinge pin and withdraw float and inlet needle.
7. Remove main jets, idling jets and power jet valve assembly.
8. Remove accelerator pump piston assembly.
9. Remove spring retainer and accelerator pump ball check, located under piston.
10. Clean all passages thoroughly and blow out with compressed air.

ASSEMBLE—

1. Install main jets.
2. Install idling jets.
3. Install accelerator pump ball check and spring retainer.

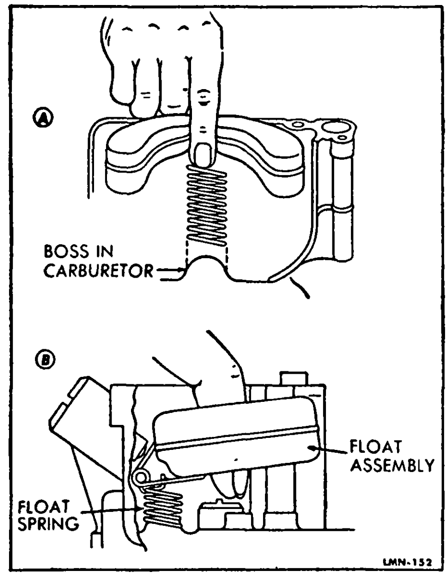


Fig. 426B Assembling fl at spring in 1949-51 Lincoln and Mercury carburet r

4. Install accelerator pump, being careful not to damage the piston leather.
5. Install accelerator pump discharge needle. The pump's operation must be checked at this time to be sure that there are no leaks in the pump system. To do this, refer to Fig. 426A and proceed as follows:
6. Fill carburetor bowl with clean fuel to normal level. Hold pump discharge needle firmly on its seat with a blunt tool and operate pump. With pressure maintained on pump piston, fuel should not pass at (1) pump

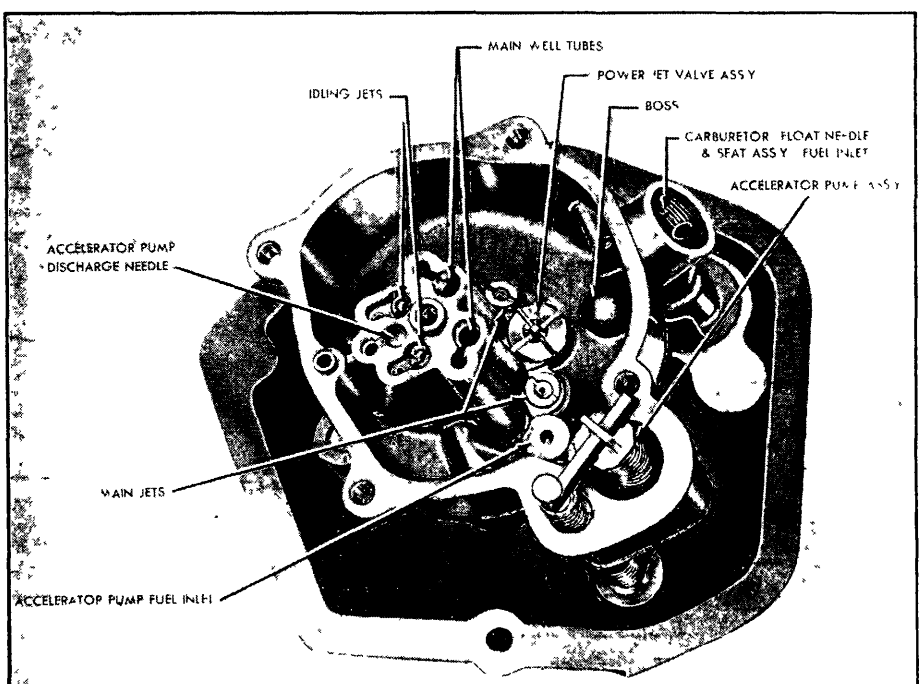


Fig. 426A T p view of 1949-51 Linc ln and M rcury carburet r

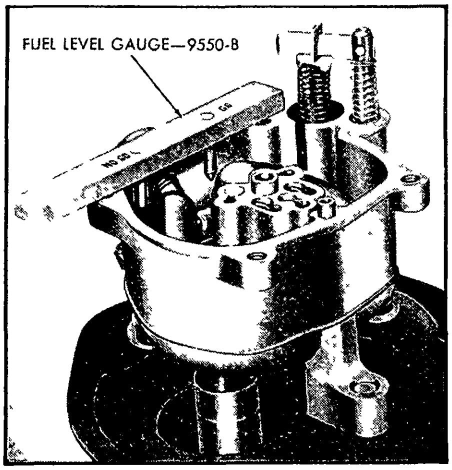


Fig. 426C Fuel level gauge applica-ti n n 1949-51 Lincoln and Mercury carburetor

discharge needle, (2) pump piston, (3) pump fuel inlet.

NOTE—Fuel bypassing the pump discharge needle would indicate the needle is not properly seated. To form a good seat, insert the end of a brass drift on a needle and tap lightly with a small mallet. If fuel bypasses the pump piston, it indicates a damaged or curled piston leather or loose rod at piston. Fuel returning to the carburetor bowl at the pump inlet indicates improper seating of the pumps ball check. This can be corrected by removing the pump piston and spring retainer and seating the ball check with a brass drift and small mallet. Do not use a steel drift on the ball check as it may cause a flat spot on the ball which will result in a leak.

7. Inspect, clean and insert the float needle and seat. Move needle to and fro to assure free movement.
8. Place carburetor at an angle so that needle remains on seat rather than dropping in float bowl.
9. Place straight end of float spring through small hole in arm of float and lever assembly as shown at "A" in Fig. 426B.
10. Hold spring in position with forefinger as shown at "B" in Fig. 426B.
11. Position float in main body so that free end of spring drops over boss in bottom of float bowl.
12. Install float hinge pin through main bowl and through hinge on float lever. Screw securely in place.
13. Place carburetor in upright position and check to insure spring has remained in its proper position. Also check to see that float and needle move freely.
14. Install main well tubes.
15. Install and secure carburetor to engine, and connect fuel pipe.
16. Crank engine to fill carburetor bowl with fuel.
17. Make certain that floats are of equal height. Then check fuel level with the gauge shown in Fig. 426C. If gauge is not available, the depth of fuel level from top of carburetor bowl is ½".
18. To adjust float, bend tab that contacts inlet needle UP to lower the float. To raise float, bend tab DOWN.
19. Reassemble carburetor by installing new cover plate gasket over bowl, cover plate, and new cover plate gasket over cover plate.

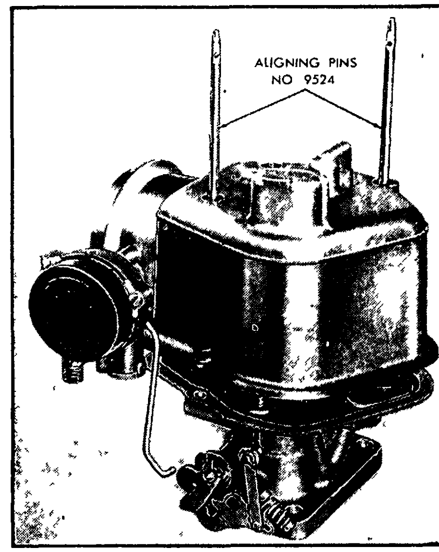


Fig. 426D Installing carburet r air horn with aligning pins. 1949-51 Lincoln and Mercury carbur tor

NOTE—Number on cover plate indicates size of air bleed holes in plate directly over main well (Lincoln .073", Mercury .067").

20. Before assembling the air horn, inspect the casting for cracks or breaks. Mating surface must be smooth and clean. Make sure idle air bleeds are open to size. Check for freedom of operation of economizer piston assembly by rotating piston to several different positions and compressing stem.

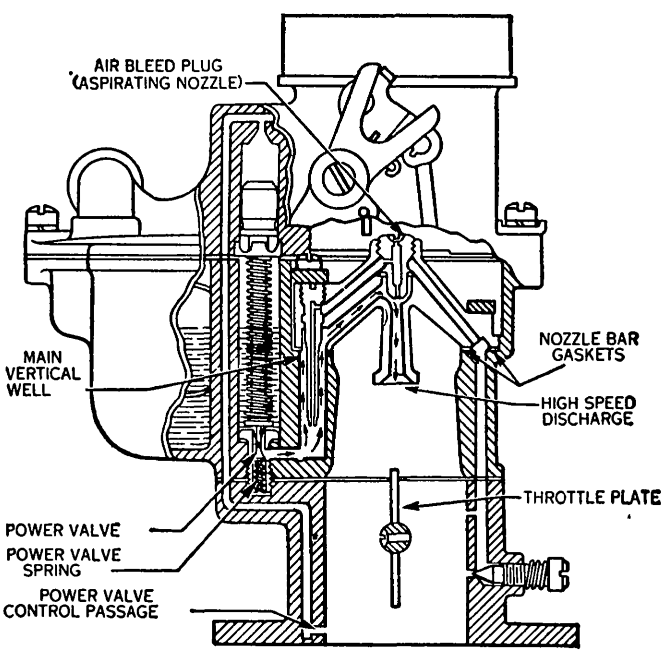


Fig. 429
FORD SINGLE BARREL CARBURETOR, 1941-48
P wer system

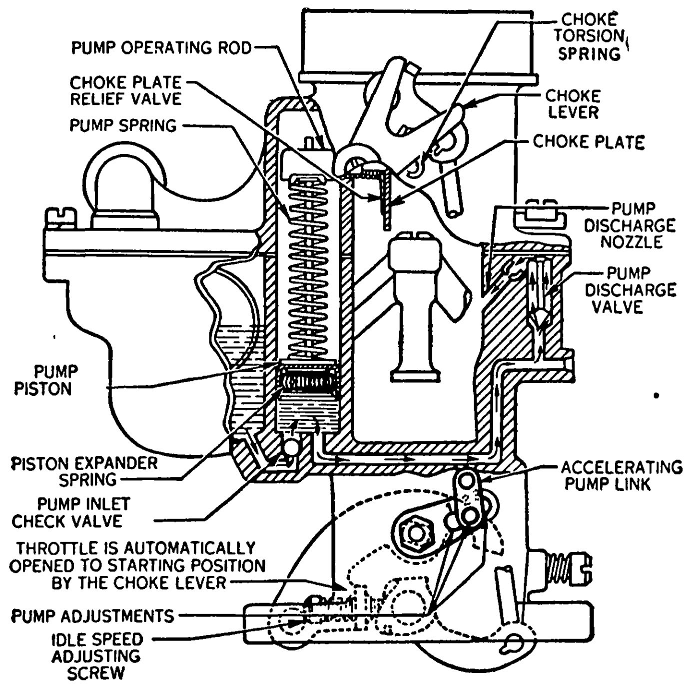


Fig. 430
FORD SINGLE BARREL CARBURETOR, 1941-48
Acceleration syst m

21. Use aligning pins, Fig. 426D, to install air horn, not forgetting new air horn gasket.
22. Attach fast idle rod at fast idle cam.
23. Complete the assembly by attaching vacuum line, automatic choke tube, air inlet tube to front of carburetor, and accelerator rod.

FORD SINGLE CARBURETOR

Ford Six Cylinder, 1941-48

As can be seen in Figs. 427 to 430, this carburetor is quite similar to Ford Dual carburetor, and it functions in exactly the same manner.

IDLE ADJUSTMENT—For best results, the idle adjustment should be set with a tachometer or for the highest and steadiest vacuum reading. Never turn the screw against its seat so hard that a groove is formed in the screw point. A grooved adjusting screw should be replaced in order to obtain a satisfactory idle adjustment.

For a richer mixture, turn the screw out, and for a leaner mixture, turn the screw in.

PUMP SETTING — The accelerating pump is provided with an adjustment for varying the quantity of the accelerating charge. A change can be made by changing the position of the pump link. The positions are marked 1, 2 and 3; number 2 being the average setting; number 1, the hot weather setting, and number 3, the extremely cold weather setting.

SERVICE NOTE—Failure of the accelerating pump can usually be attributed to dirt in the pump inlet check ball seat. To make a check, remove the air horn and operate the pump with a small amount of fuel in the bowl. If the check is leaking, air or fuel will bubble back into the fuel bowl from the inlet hole. When cleaning this seat, care should be used in re-installing the pump piston to be sure the leather is not damaged.

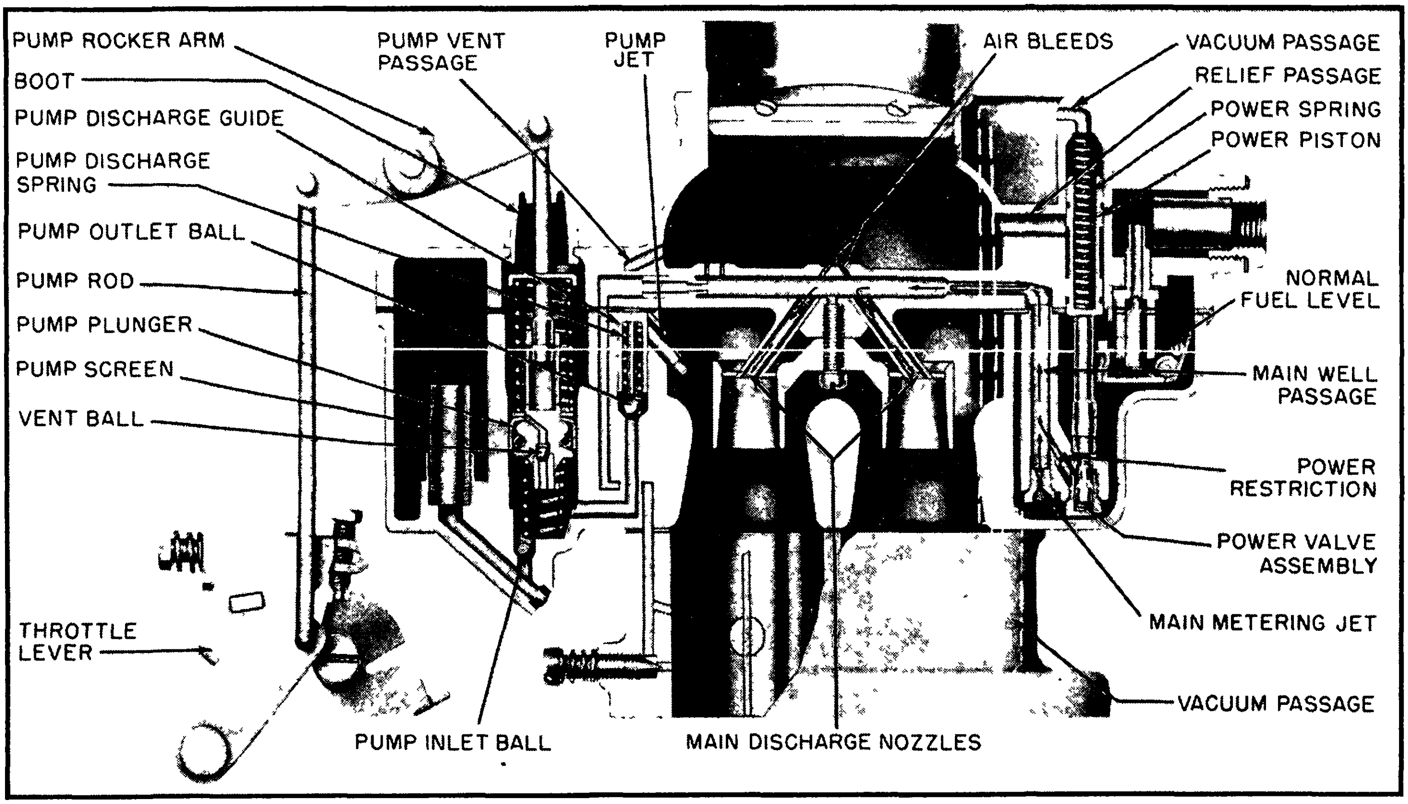


Fig. 430A Rochester BB carburetor

ROCHESTER CARBURETORS

Foremost among the features of these carburetors is the concentric float bowl, the design of which provides a twofold advantage. First, regardless of any shift of fuel level with the bowl due to road incline or sudden stoppage, the main metering jet at all times is immersed in fuel. This prevents the engine from stalling or malfunction due to momentary fuel starvation. The second advantage of the concentric float bowl is that it is closely aligned with the centrally located main discharge nozzle (or nozzles). The central location of the nozzle prevents any excess fuel to spill from the nozzle with a shift of fuel level.

The main well support assembly is attached to the cover and suspended in the float bowl. It contains the main metering jet and power valve. The importance of this feature is that it minimizes difficult hot weather starting complaints. When the engine is not operating, manifold heat may cause minor vapors in the float bowl. This is mitigated by the fact that the main metering jet, which is attached at the bottom of the main well support assembly, is surrounded by cooler solid fuel. This location of the jet in conjunction with the design of the carburetor passageways reduces to an absolute minimum any accumulation of vapors in the passages, which would otherwise contribute to hard starting due to vapor lock.

MODEL BB

OLDSMOBILE 1951-52

DISASSEMBLY—Fig. 430A.

1. Loosen ½″ brass fitting from choke housing.
2. Remove three attaching screws and retainers from choke cover, then remove choke cover and thermostatic coil assembly and gasket.
3. Remove baffle plate from choke housing.
4. Remove cotter pins from each end of choke rod and remove rod.
5. Remove retainer screw at end of choke shaft and carefully pry off trip lever, spacing washer and choke counterweight.

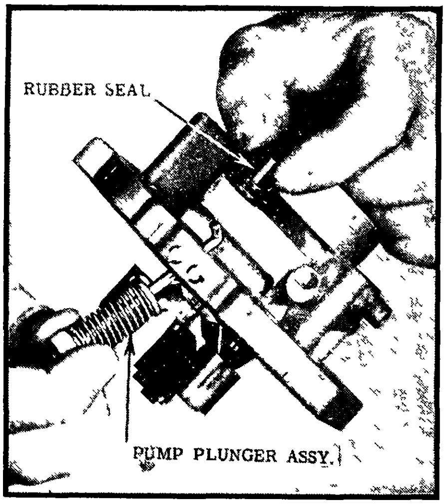


Fig. 430B Rochester BB
R m ving pump plunger

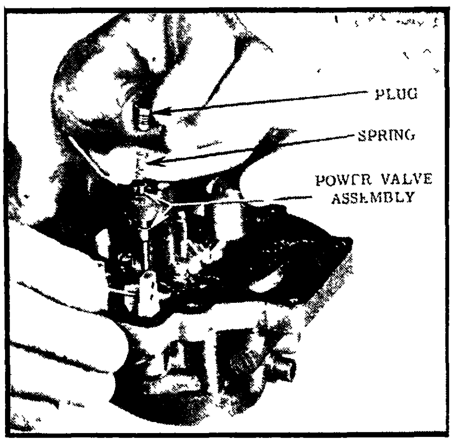


Fig. 430C Rochester BB
R m ving power valve plug

6. Remove two screws and take off choke valve.
7. Rotate choke shaft counterclockwise to free choke piston from housing and then remove piston and choke shaft from carburetor.
8. Remove choke piston pin and piston from choke shaft.
9. Remove two choke housing attaching screws, then remove choke housing and gasket from carburetor cover.

DISASSEMBLY OF COVER—

1. Remove fuel inlet fitting from cover.
2. Remove filter screen retainer nut and gasket with ¾" wrench and remove filter screen.
3. Remove clip on upper end of pump rod and the cotter pin from lower end of rod; then remove pump rod from rocker arm.
4. Remove cotter pin from center and pump shaft end of rocker arm; then remove washer and rocker arm.
5. Remove four cover screws.
6. Turn carburetor over (bottom side up) and remove cover screws (two each end) from bottom of carburetor.
7. Turn carburetor in an upright position and remove remaining four cover screws.
8. Carefully remove cover assembly from bowl. If necessary lightly tap sides of cover to break seal.
9. Place cover bottom side up and remove float assembly with needle attached.
10. Press rubber seal on pump plunger arm through cover and remove seal and pump plunger, Fig. 430B.
11. Separate plunger and seal.
12. Remove float needle seat and gasket, using a ½" screw driver.
13. Remove main metering jets from main support and then remove power valve plug, spring and valve from main well support, Fig. 430C.
14. Remove two screws and take out main well support; then remove cover gasket.
15. Lift power valve and actuating spring bowl cover, Fig. 430D.
16. Remove one secondary venturi attaching screw and take out secondary venturi cluster as shown in Fig. 403E. *Do not remove primary idle tube from cover casting.*

DISASSEMBLY OF BOWL & THROTTLE BODY—

1. Remove pump return spring and then hold the pump discharge guide into bowl while slowly tipping bowl over to allow intake check ball to roll into palm of hand as shown in Fig. 430F. *Do not lose ball.*
2. Carefully remove pump screen from bowl. *Do not remove choke heat suction tube from throttle body.*
3. Invert bowl and remove pump discharge guide, spring and pump discharge outlet ball, Fig. 430G.
4. Turn carburetor bowl over, being careful to allow the end of heat tube to hang over the end of a flat surface.
5. Remove four bowl-to-throttle body attaching screws, separate units and remove gasket.

CLEANING OF PARTS—

1. Remove idle adjusting needles and springs from throttle body for cleaning and inspection. *Do not remove throttle valves or choke suction tube from throttle body.*
2. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent. *Choke coil, housing and pump plunger should not be immersed in solvent. Clean plunger in clean gasoline only.*
3. Blow all passages in castings dry with compressed air. *Do not pass drills through jets or passages.*
4. Clean filter screens of dirt or lint. If they are distorted or plugged, replace.

INSPECTION OF PARTS—

1. Check floats for dents or wear at hinge pin holes.
2. Shake float to check for leaks.
3. Examine float needle and seat. If grooved, replace with a matched float needle, seat and gasket assembly.
4. Inspect idle adjusting needles for burrs or ridges.
5. Check choke shaft for wear in the air horn bores. If worn excessively, replace.
6. Due to the close tolerance fit of the

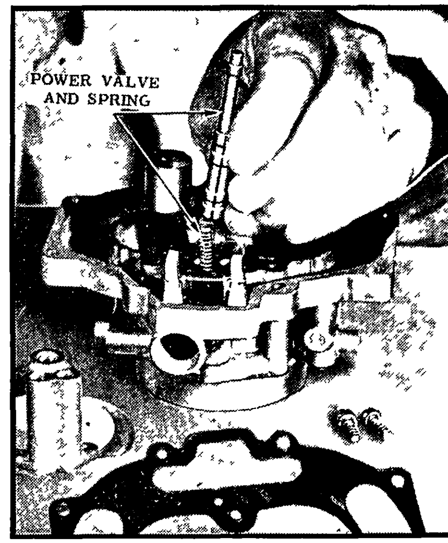


Fig. 430D Roch st r BB
Removing power valv

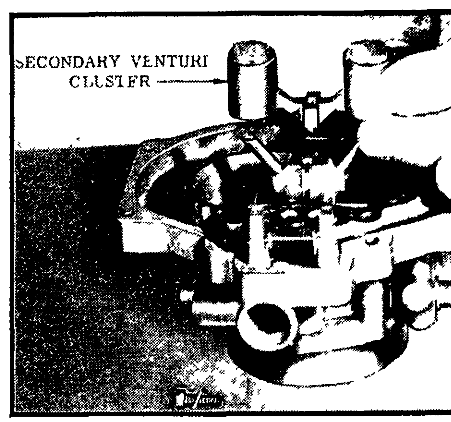


Fig. 430E Rochester BB
Removing secondary venturi

throttle valve and the fact the idle discharge holes are drilled in relation to a proper fitting valve, the throttle body and valve assembly should be replaced as a unit when wear is noted at the throttle valve, shaft, or throttle body bore.

7. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn to the extent of improper operation of carburetor, the worn parts should be replaced.
8. If excessive wear is noted on the fast idle cam, it should be replaced to assure proper engine operation during warm up and choking periods.
9. Inspect pump plunger leather. If leather is cracked or creased, replace the pump plunger as a unit.
10. Inspect gaskets for flexibility. If they appear hard and brittle, they should be replaced to assure proper seal.
11. Inspect lower end of choke suction tube in throttle body for tightness. If the seal is not tight, it should be tightened after carburetor is assembled. If the seal or tube is damaged, the parts should be assembled in

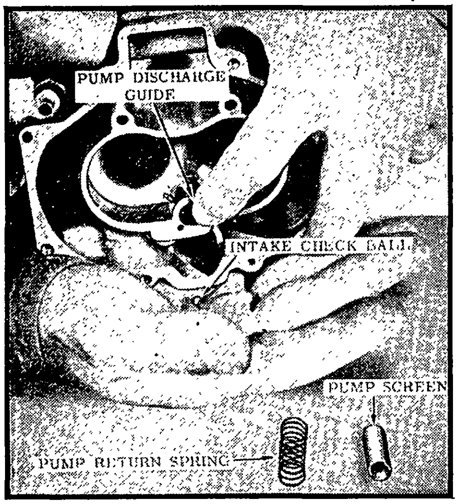


Fig. 430F Rochester BB
R m ving intake ball

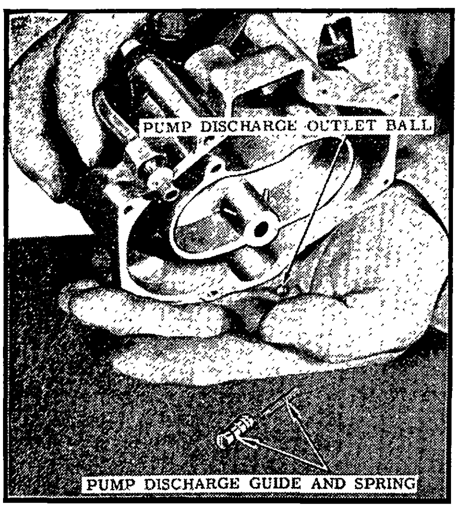


Fig. 430G Rochester BB
Rem ving outlet ball

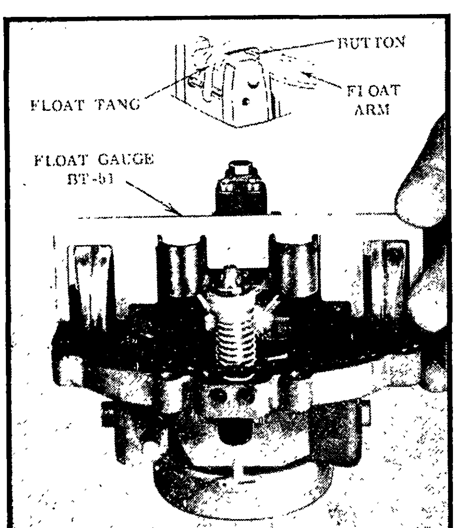


Fig. 430H Roch st r BB
Float setting

place before the carburetor is assembled and then tightened.

12. Inspect the suction tube nut packing at the upper end. If packing is tightly compressed or out of round, replace it.

ASSEMBLING MODEL BB CARBURETOR

THROTTLE BODY & BOWL—

1. Screw idle adjusting needles with springs in throttle body until they are finger tight. Back out both screws 1½ turns as a temporary adjustment. Final adjustment must be made with carburetor on engine.
2. Place throttle body gasket in position and attach throttle body. Tighten screws evenly and securely.
3. With bowl in upright position, drop *small* aluminum pump inlet ball into pump well hole and replace pump return spring. Press spring down with finger to center it in pump well.
4. Drop *large* steel ball in pump discharge cavity. Place spring and pump discharge guide over ball.
5. Press pump screen carefully into position.

COVER ASSEMBLY—

1. With cover bottom end up, install float needle seat and gasket, using screw driver with ½" bit.
2. Place power piston spring and piston into vacuum cavity. Piston should be free in cavity.
3. Place cover gasket on top of cover. Check to be sure all cover and gasket holes are aligned.
4. Place main well support over power piston and attach to cover with two screws. Tighten screws evenly and securely. *Main well guide sleeves must be aligned in cover.*
5. Install power valve, spring and plug in main well support. *Hold power piston down when installing small valve, spring and plug.*
6. Install main metering jets.
7. Assemble float and needle in place. Place float carefully in position with tang positioned on outside (back) of balance spring. (See inset, Fig. 430H.)
8. Install float hinge pin.
9. Place rubber seal on pump plunger shaft and pull seal through cover until it positions into groove on casting.
10. Install venturi cluster, being sure key is in groove in cover.
11. Float setting should be made at this time before assembling cover to bowl.

FLOAT SETTING — This adjustment must be made with the air horn gasket in position.

1. If required, carefully bend float arms vertically until floats appear level in relation to each other.
2. Place gauge BT-51 in position as shown in Fig. 430H, with locating tangs inserted into the secondary venturi to position gauge.
3. Bend float button, which contacts the float needle, until floats just touch top portion of gauge.
4. Now bend float arms horizontally until each float is centered between the gauge legs. Tilt assembly 90° each side and check that floats do not touch gauge legs.

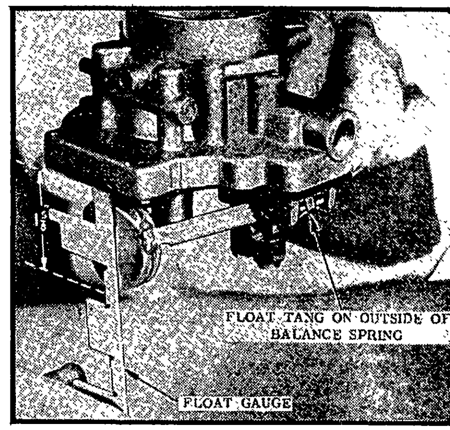


Fig. 430J Rochester BB
Adjusting float dr p r tensi n

Fig. 430K R ch ster BB
Installing counterweight

FLOAT TENSION ADJUSTMENT—

1. Bend float tang against balance spring and away from spring to increase the drop. The tension is correct when the distance from the bottom of the air horn gasket to the bottom of the floats is 1⅝" which is equivalent to the distance marked between arrows on float gauge BT-49 as shown in Fig. 430J.

ASSEMBLY OF BOWL TO COVER—

1. With bowl in upright position, place cover assembly on bowl so that screw holes line up. Guide pump plunger against pump return spring and be careful not to hit floats on side of bowl.
2. Start four cover screws through top and four cover screws through bottom of cover. Tighten screws evenly and securely.
3. Install gasoline inlet filter screen, nut and gasket assembly into cover.
4. Place pump rocker arm over shaft and slide pump plunger rod into rocker arm.
5. Install cotter pin in pump plunger rod; then place washer over shaft and install cotter pin in pump rocker arm shaft.
6. Place housing-to-air horn gasket in

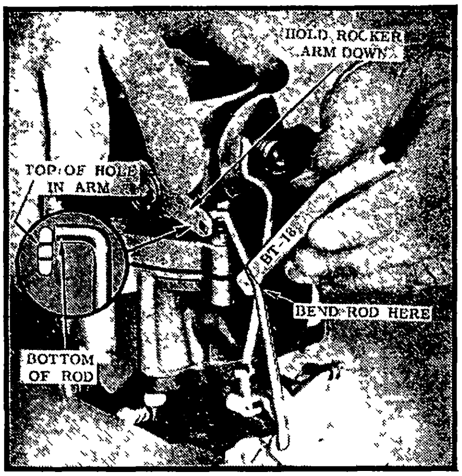


Fig. 430L Rochester BB Adjusting pump lever

place over bushing in air horn.

7. Place choke housing over suction tube, being sure packing is in place on tube. Then assemble housing over bushing into air horn.
8. Install two housing-to-air horn attaching screws.
9. Tighten choke suction tube nut to choke housing.
10. Assemble choke piston to shaft with pin. Then assemble shaft through housing, fitting piston into bore. Rotate choke shaft clockwise to see that piston operates freely in its bore.
11. With letters "R.P." on choke valve up, slide valve into position on choke shaft.
12. Center valve and tighten in place with two brass choke valve screws. Check to see that valve works free in air horn.
13. Place baffle in position. Then assembly choke coil cover with gasket in position. Index marks on cover and housing should be aligned on Hydra-Matic equipped cars, and two notches rich on syncromesh transmission equipped cars. Tighten cover in place with screws and retainers.
14. Place counterweight on end of choke shaft with letters "R.P." out.
15. Install spacing washer and then trip lever. Trip lever tang must be on top of counterweight tang, Fig. 430K.
16. Assemble choke rod with "offset" end into counterweight as shown in Fig. 430K. Then assemble the other end into fast idle cam.
17. Fasten rod at each end with cotter pins. Again check choke valve for free movement.
18. Install pump rod into rocker arm and fasten with clip; then install lower end of rod into throttle lever and fasten with cotter pin.

BB CARBURETOR ADJUSTMENTS

Whenever a Model BB carburetor is rebuilt there are eight important adjustments that must be made in the following order:

1. Float level.
2. Float tension.
3. Choke thermostat.
4. Pump lever.
5. Choke rod.
6. Unloader
7. Fast idle.
8. Slow idle.

The Float Level, Float Tension and Thermostat adjustments have been made in order during assembly of the carburetor. The remaining adjustments are made as follows:

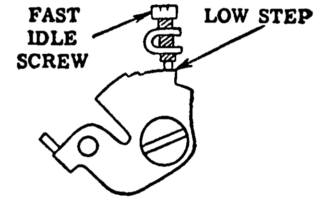


Fig. 430P Roch st r BB Fast idle adjustment n ngin

PUMP LEVER ADJUSTMENT—

Fig. 430L.

1. Disconnect choke rod from fast idle cam.
2. Back off idle stop screw so that the throttle valves fully close.
3. Remove cotter pin from pump rod at rocker arm.
4. Hold pump rod end of rocker arm down (pump plunger in extreme "UP" position).
5. Hold pump rod directly over hole in rocker arm.
6. Carefully bend pump rod with tool BT-62, Fig. 430L, until the *bottom* edge of rod is flush with *top* edge of hole in rocker arm.
7. Reassemble choke rod and pump rod.

CHOKE ROD ADJUSTMENT—

Fig. 430M.

1. With thermostat cover at index, turn fast idle screw to contact middle step on fast idle cam. Be sure choke trip lever contacts choke counterweight. Choke valve will be slightly open.

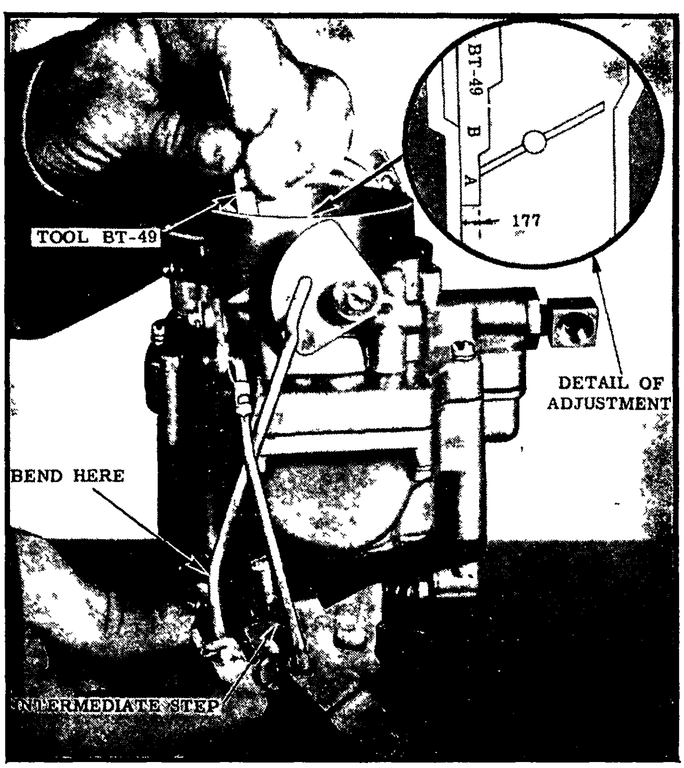


Fig. 430M R ch ster BB. Ch k adjustm nt

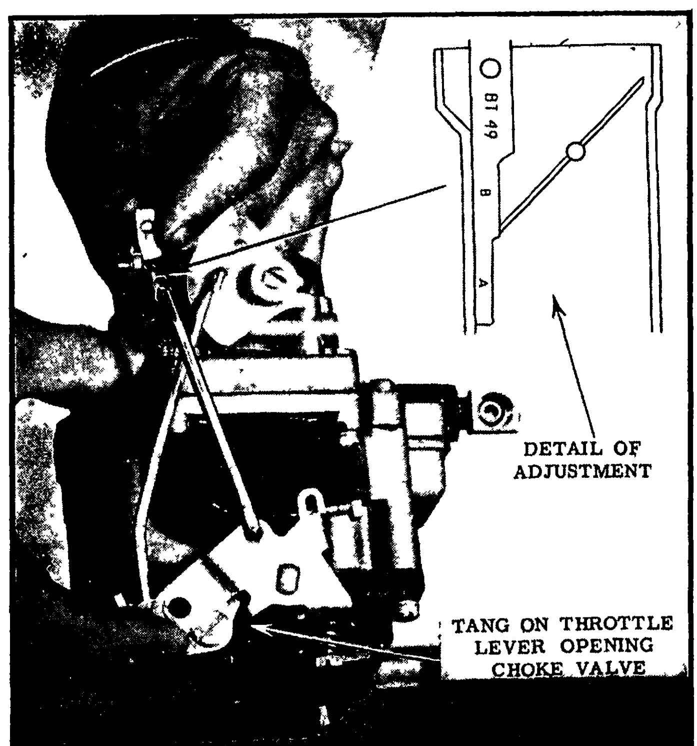


Fig. 430N R ch st r BB. Unl ad r adjustm nt

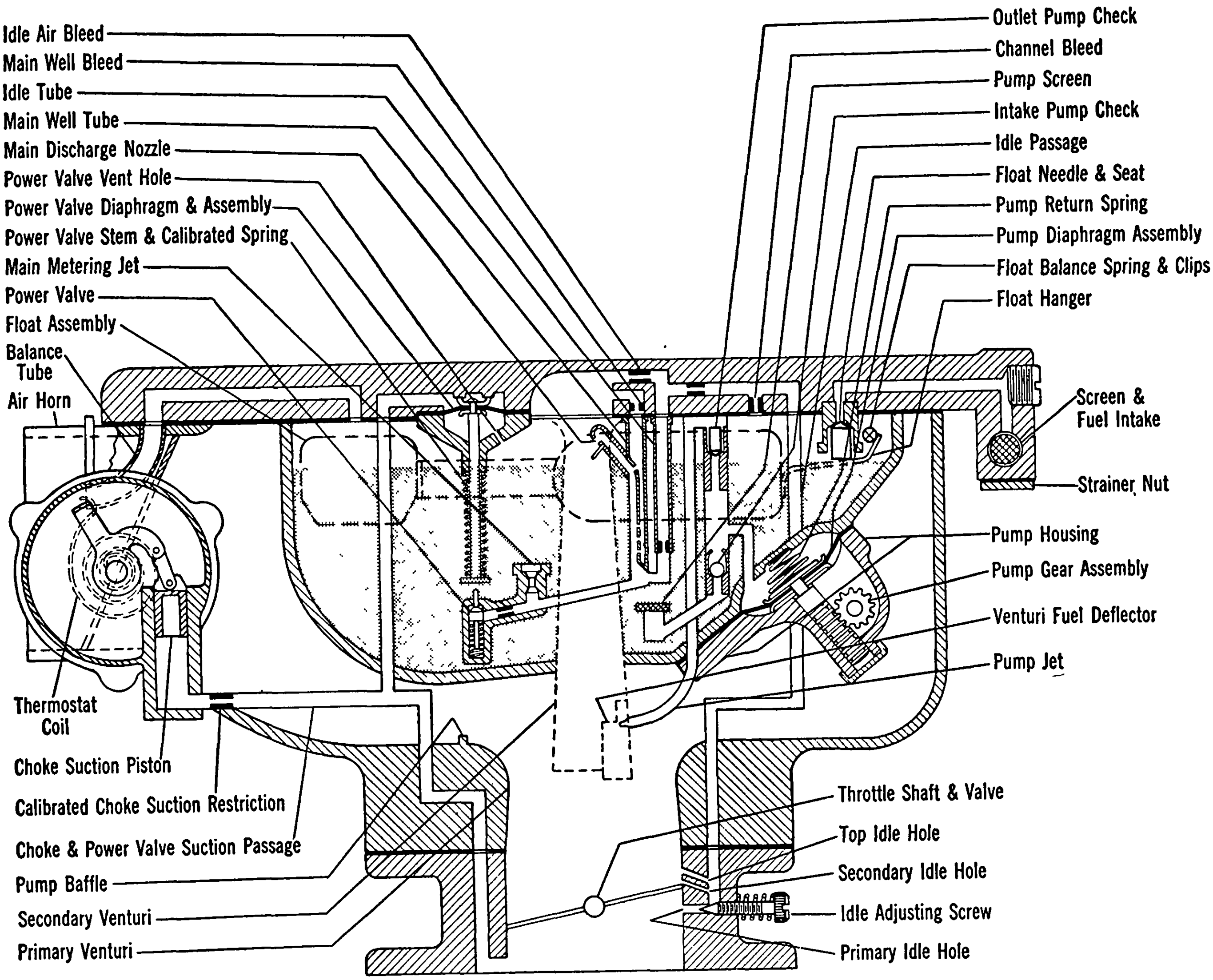


Fig. 431 Rochester Model AA carburetor used on 1949-50 Oldsmobile Rocket engines

2. Hold fast idle cam and screw in this position while bending the choke rod to obtain a clearance of .177" (section "A" of tool BT-49) between bottom edge of choke valve and inside diameter of air horn. Choke rod must not rub side of housing.

UNLOADER ADJUSTMENT—Fig. 430N.

1. Set thermostat at index.
2. Move throttle lever to full open position so tang on throttle lever opens choke valve.
3. Hold throttle lever in this position and check clearance between bottom edge of choke valve and inside diameter of air horn. Clearance should be .209" and can be checked with section "B" of tool BT-49 (see Fig. 430M).
4. Bend tang on throttle lever with tool BT-62.

FAST IDLE ADJUSTMENT—

1. Set thermostat at index.
2. Hold choke valve and throttle lever in fully closed position. Fast idle screw should be resting on *high* step of fast idle cam.
3. Adjust fast idle screw to obtain a clearance of .025" between throttle valves and bore of throttle body on side opposite idle screw.
4. With carburetor on the engine, fast idle adjustment is made as follows:
5. Rotate fast idle cam so fast idle screw rests on the lowest point of the low step on cam, Fig. 430P. With screw and cam in this position, adjust fast idle screw to give an engine speed of 500 rpm (transmission in neutral). This adjustment assures proper idle after starting the engine and should always be checked in the event stalling is experienced during warm-up period.

SLOW IDLE ADJUSTMENT—Set engine idle at 350 rpm with selector lever in DR range on Hydra-Matic cars. Set engine at 425 rpm on syncromesh transmission equipped cars.

MODEL AA

OLDSMOBILE 1949-50

The basic design of this carburetor, Fig. 431, is the same as the Model BB already described, the chief difference being that a diaphragm type accelerating pump is used.

To the service mechanic, an important feature of this design is the ease with which it can be serviced. By the simple removal of eight outside screws and the disconnection of the fuel line, the cover and bowl assembly may be removed from the outer housing for cleaning or inspection. It is only in rare instances that the air cleaner and entire carburetor need ever be removed from the engine.

The cover and bowl assembly, which is the heart of the carburetor, contains all the calibrated parts. This unit may also be obtained as a service replacement, thereby eliminating the need for a complete replacement carburetor.

Of importance also is the need for only

four minor external adjustments (1) Choke rod,)2) unloader, (3) fast idle, (4) accelerating pump discharge No special gauges or tools are needed

ADJUSTMENTS—Whenever the carburetor has been overhauled, the adjustments given below should be made in the order given The float adjustment is always made before the cover is attached to the carburetor bowl The remaining adjustments are made after the carburetor is completely assembled

FLOAT ADJUSTMENT — Fig 432. With cover gasket removed, check the float level as shown If an adjustment is required, bend the tang on the float Do not bend at the front of the float as it must appear in close parallel with cover face

The float tension adjustment, Fig. 432A, is made after the float level height is adjusted This adjustment is necessary to insure proper float level drop and consequent sufficient entry of fuel into the bowl under high speed operation.

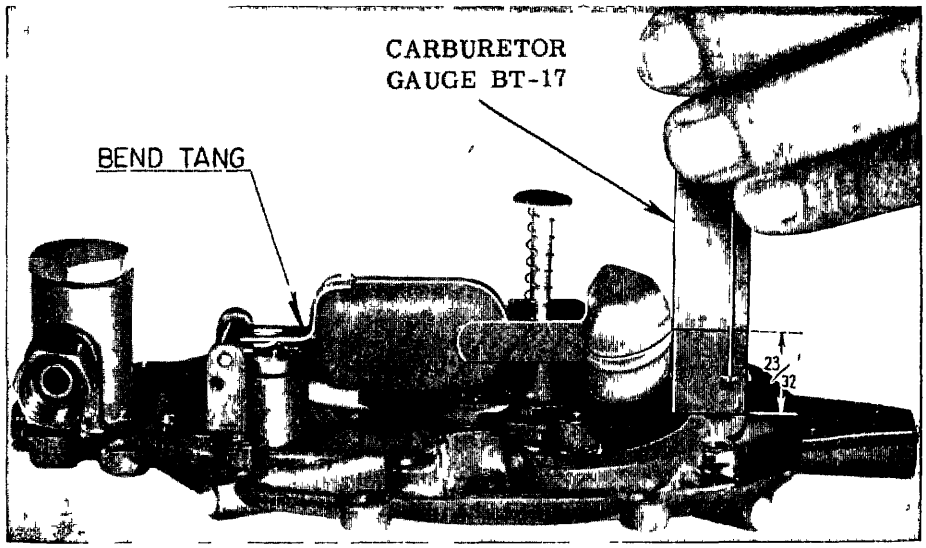


Fig. 432 Float adjustment on Rochester Oldsmobile 1949-50 carburetor

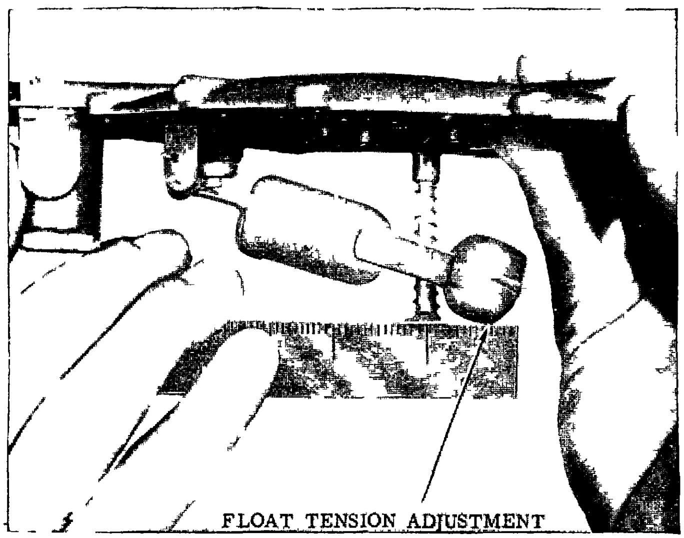


Fig. 432A Float tension adjustment on Rochester Oldsmobile 1949-50 carburetor

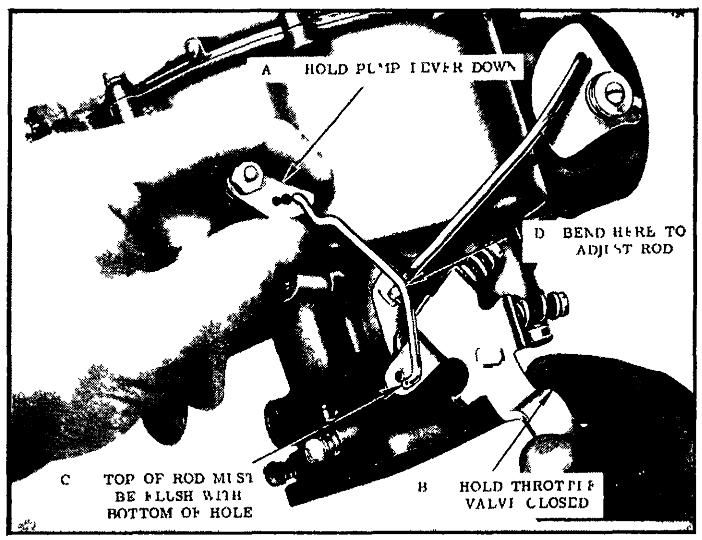


Fig. 432B Pump lever adjustment on Oldsmobile Rochester 1949-50 carburetor

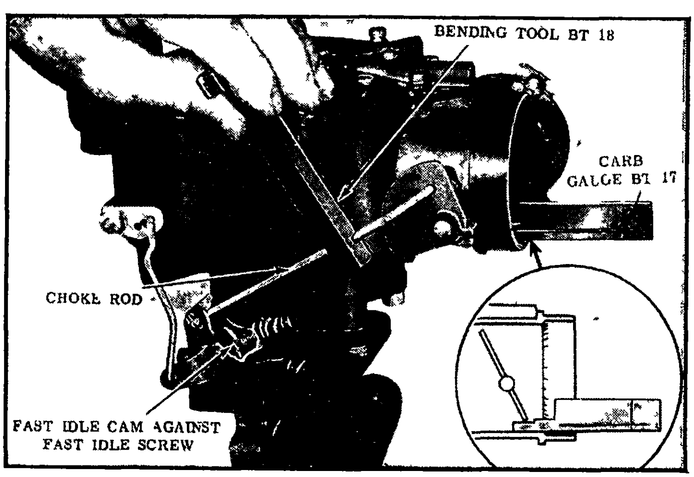


Fig. 432C Choke rod adjustment on Rochester Oldsmobile 1949-50 carburetor

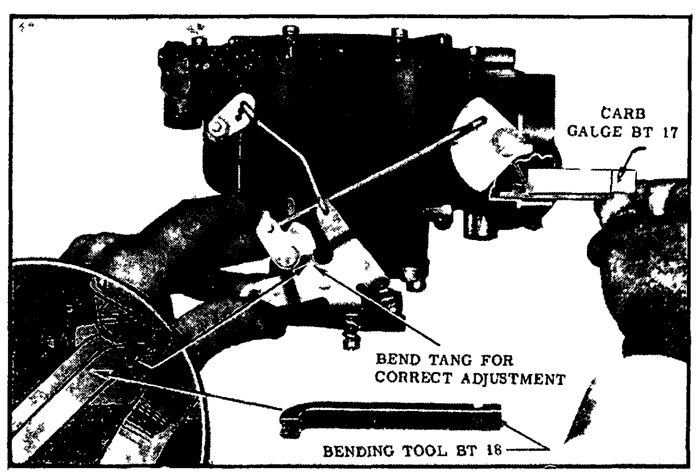


Fig. 432D Unloader adjustment on Rochester Oldsmobile 1949-50 carburetor

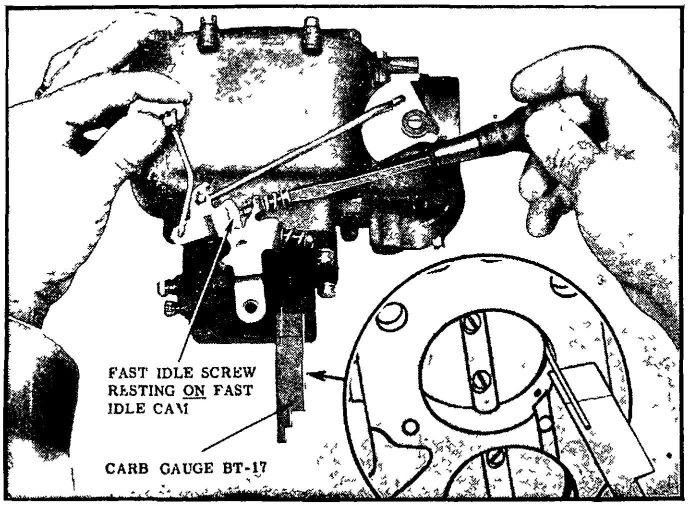


Fig. 432E Fast idle adjustment on Rochester Oldsmobile 1949-50 carburetor

To make the adjustment, bend float tang against spring to lessen drop and away from spring to increase drop. Tension is correct when float drop is such that outside edge of float (bottom) is level with power diaphragm stem when suspended freely from cover.

PUMP LEVER ADJUSTMENT—This adjustment is made according to the instructions given in Fig. 432B.

PUMP JET TARGETING—Good acceleration depends primarily on the gasoline discharge from the two pump jets (see Fig. 432). Each of the two streams of gasoline must be directed to its proper section of the dual venturi system. Although the actual point of the pump discharge striking the housing venturi cannot be seen, it can be checked.

With fuel in the carburetor, actuate the throttle lever slowly and note the pump discharge by looking into the air horn. The pump discharge will appear as a fan-shaped spray. Only a very slight bend is required to target the pump jets properly.

CHOKE ROD ADJUSTMENT — Fig. 432C. With thermostat cover set at the index mark (room temperature) choke valve should be closed. Turn fast idle screw toward fast idle cam until spring is slightly compressed. Hold the throttle in closed position and move fast idle cam so that the first step of the cam is resting against the fast idle screw. Be sure the choke trip lever is in contact with the choke counterweight. Choke valve will now be opened slightly.

With fast idle screw and fast idle cam held in this position, clearance between the bottom of the choke valve and bottom of air horn (small inside diameter) should be .147" and can be checked with the gauge shown in Fig. 432C. Bend the choke rod slightly to obtain the correct clearance. Be sure choke rod does not rub on housing at any choke valve position.

UNLOADER ADJUSTMENT — Fig. 432D. With thermostat cover at index mark, open the carburetor throttle lever fully, being sure choke trip lever is in contact with the choke counterweight tang. With throttle lever held in this position, check the clearance between the choke valve and air horn as shown in Fig. 432D. If this clearance is more or less than .238", bend throttle lever tang slightly to move fast idle cam so that choke valve opens to above dimension.

FAST IDLE ADJUSTMENT—Fig. 432E. With thermostat cover set at index mark, hold the choke valve closed by means of the choke rod. Hold the throttle in closed position so that fast idle screw rests on high step of fast idle cam. With throttle held in this position, adjust fast idle screw to obtain a clearance of .020" between throttle valves and air horns, as shown.

MODEL B

CHEVROLET 1949-52

Fig. 432AA—Except that it is a single barrel unit without an automatic choke, the Model B carburetor is essentially of the same design as the dual barrel Model BB carburetor already described.

To aid in faster, more efficient cold weather starting and to help prevent over-choking, the Model B carburetor incorporates a throttle kicker and fast idle assembly which is linked with the choke lever assembly and semi-automatic in operation. As the hand-operated choke valve is closed, a cam on the choke lever moves the top portion of the spring-loaded throttle kicker counterclockwise. This results in the bottom portion of the throttle kicker opening the throttle lever proportionately. Thus, the throttle valve exposes the idle ports to a greater degree, and this action, with the reduced amount of air due to choking action, provides the necessary richer mixture of fuel and air for easier cold weather starting.

To the service mechanic, the simplicity and ease of service of this carburetor is an outstanding feature. Aside from the conventional idle adjustment and float setting, there is no adjustment required. By the simple removal of four cover attaching screws, the entire unit is opened and ready for service and inspection.

CARBURETOR ADJUSTMENTS

IDLE MIXTURE—Screw the idle mixture screw, Fig. 432BB, all the way in and then back it off 1½ turns. Allow engine to idle. Turn the screw either way from this position until the best idle point is reached.

If it is necessary to turn the adjusting screw more than ½ turn in either direction to get a satisfactory idle, internal trouble is indicated.

IDLE SPEED — Make sure the hand throttle and hand choke buttons on the instrument panel are pushed in all the way and that the accelerator and throttle linkage is free so that the idle speed screw is against the stop, Fig. 432BB. Turn the screw in or out to obtain an idling speed of 450 to 500 R.P.M. Recheck the idle mixture adjustment as outlined above.

FLOAT LEVEL — A new bowl cover gasket has been designed for 1950 and later carburetors but may be used for previous models in service. This gasket incorporates the main well support gasket as an integral part. In conjunction with the gasket change, the float level setting was also changed from 1$\frac{3}{32}$ in. to 1$\frac{5}{16}$ in. to allow for checking the float level setting without removing the gasket and also to compensate for float assembly weight variation.

In checking setting, a special gauge which checks both float level and float width should be used. Use of this gauge will eliminate the possibility of twisted floats resulting from float level adjustments. The floats, if twisted, will result in float contact with the sides of the bowl and subsequent carburetor trouble. Adjustment procedure with this gauge is as follows:

1. With cover fully assembled and cover gasket in position, place assembly up-ended on a flat surface.
2. Place fuel float gauge, Fig. 432CC, into position with tang at center of gauge located in main discharge nozzle in cover.
3. Bend float arms vertically so that each float just touches top portion of gauge.
4. Carefully bend float arms horizontally so that each float is centered in gauge. Tilt assembly on each of its sides as shown in Fig. 432DD, and check to see that floats do not touch gauge. This insures that floats will not rub inner or outer sides of float bowl.
5. Recheck level adjustment.
6. To insure sufficient entry of fuel under high speed operation, it is necessary to check and adjust the float drop or tension. With the cover assembly held right-side up, Fig. 432EE, and floats suspended freely, carefully bend the float assembly so that the bottom of the float is 1¾" below the gasket surface.

SERVICING MODEL B CARBURETOR DISASSEMBLY—After removing carburetor from engine, disassemble as follows, referring to Fig. 432FF.

1. Remove cover attaching screws.
2. Lift cover straight up to prevent damage to floats. Hold throttle kicker lever while lifting cover.

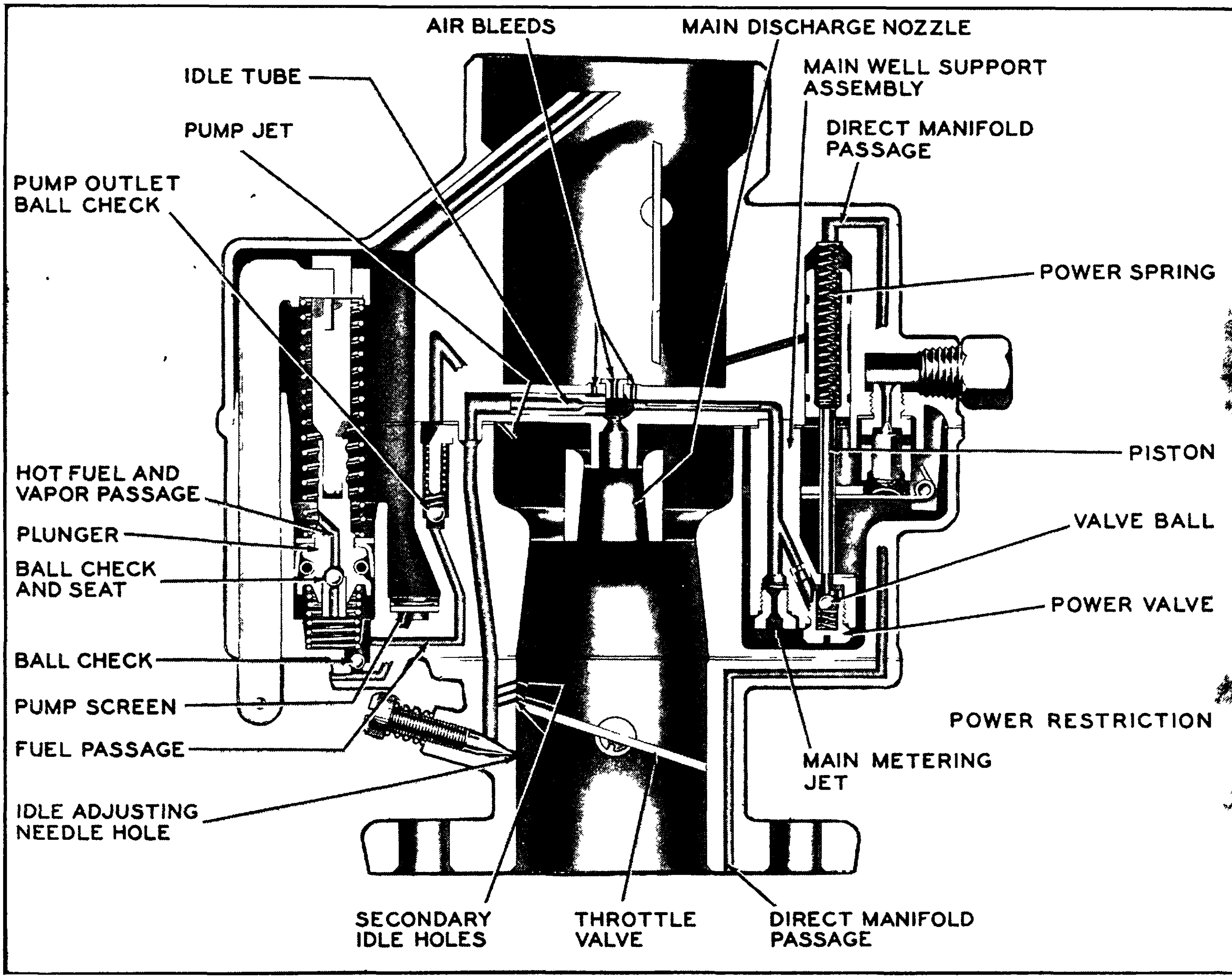


Fig. 432AA R chester Model B carburetor. Chevrolet 1949-52 without automatic choke

3. Place cover up-ended on flat surface and remove float hinge pin and floats.
4. Lift air horn gasket from cover and remove float needle. Use screw driver of proper width to remove float needle seat and fibre washer.
5. Remove main metering jet and power valve from main well support. Use care when removing the power valve not to lose the small spring and ball.
6. Remove attaching screw and take out main well support.
7. Remove main well support gasket and lift power piston and spring from cover.
8. Remove throttle kick lever and spring by removing retaining screw and washer.
9. Holding pump plunger all the way down, remove cotter pin or hairpin retainer from pump link and remove pump link from throttle lever and pump plunger. Pump plunger may now be lifted from bowl.
10. Lift pump spring from pump well and remove ball check from bottom of well.

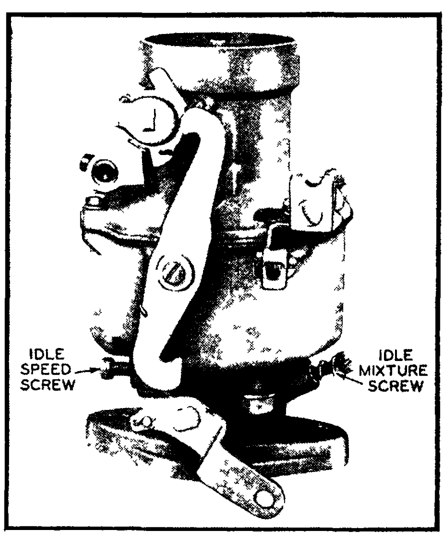


Fig. 432BB Idle and mixture adjustm nts n Roch ster M d l B carbur t r

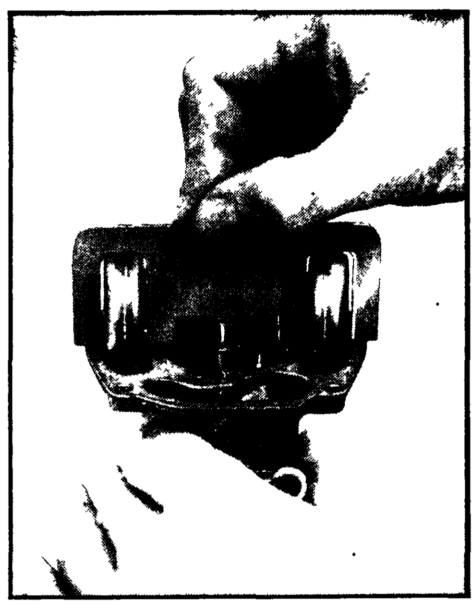


Fig. 432CC Checking fl at height with sp cial gauge. R chest r M d l B

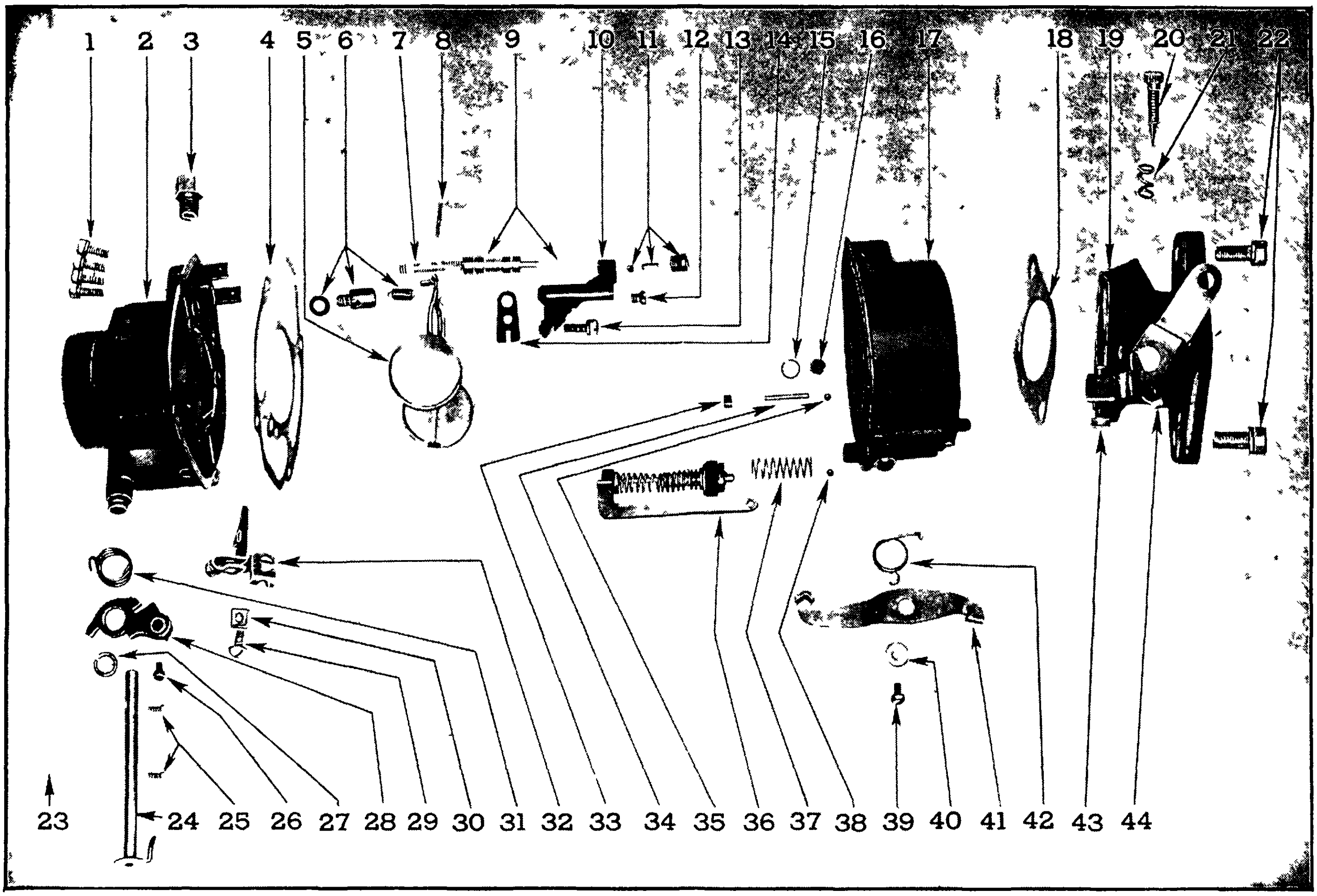


Fig. 432FF Rochester Model B carburetor. Chevrolet 1949-52 without automatic choke

1. C v r attaching screw
2. Air h rn
3. Fuel inlet fitting
4. Air h rn gasket
5. Float
6. Float n edle, seat, gasket
7. Power spring
8. Fl at hing pin
9. P w r pist n
10. Main well support
11. P wer valv
12. Main metering jet
13. Attaching screw
14. Gasket
15. Pump screen retainer
16. Pump screen
17. Float bowl
18. Throttle body gasket
19. Throttle body
20. Idle adjusting needle
21. Idle needle spring
22. Throttle body screw
23. Choke valve
24. Choke shaft
25. Choke valve screw
26. Choke lever screw
27. Choke lever retainer
28. Choke lever
29. Bracket screw
30. Bracket nut
31. Choke shaft spring
32. Choke bracket
33. Pump discharge guide
34. Pump discharge spring
35. Pump discharge ball
36. Pump plung r
37. Pump return spring
38. Pump check ball
39. Throttle kicker screw
40. Throttle kick r washer
41. Throttle kicker
42. Throttle kick r spring
43. Throttle valve screw
44. Throttle shaft

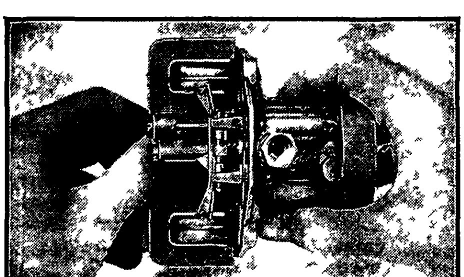


Fig. 432DD Ch cking side clearanc R chester M del B

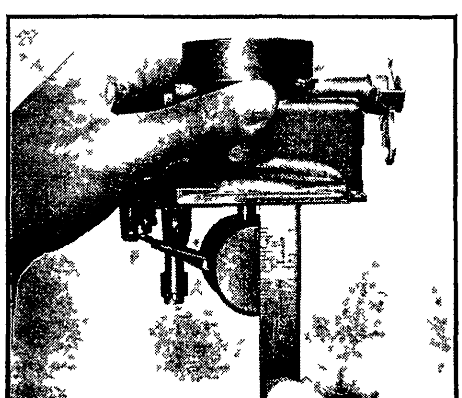


Fig. 432EE Ch cking fl at dr p. Rochest r Mod l B

11 With small screw driver, rotate pump discharge guide until it can be removed Pump discharge spring and ball check will fall from bowl when turned upside down
12. Remove pump screen retainer and screen from bowl
13. With bowl upside down, remove two throttle body attaching screws and remove throttle body assembly
14. Remove idle adjusting needle and spring from throttle body Due to the close tolerance of the throttle valve fit that is required, and the fact that the idle discharge holes are drilled in relation to a proper fitting valve, the throttle valve and shaft should not be removed

INSPECTION—Fig 432FF
1. Wash all parts thoroughly in car-

buretor solvent and dry with compressed air.
2. Check all ports and passages for carbon deposits.
3. Blow out all drilled passages with compressed air and check with flashlight to make sure they are clean. Do not use wire or drills to clean drilled passages or calibrated holes in carburetor.
4. Inspect pump plunger. If leather or its expanding spring are damaged in any way, the plunger assembly should be replaced.
5. Check float for dents and wear on lip and hinge pin. Also check cover for wear in hinge pin holes.
6. Check float needle. If wear is noted, install new float needle assembly consisting of matched needle and seat and fibre washer.
7. Check power piston for burrs or other damage. Piston must move freely in cover bore.
8. Be sure pump screen is clean.
9. Check throttle arm for looseness on shaft and for excessive wear at throttle rod connection.
10. Check throttle shaft for excessive looseness in throttle body. If damaged or excessively worn, replace throttle body assembly.
11. Make sure choke valve opens and closes freely. Hold lever in closed position and push valve open to see that choke spring has normal tension.

ASSEMBLING CARBURETOR—Fig. 432FF.

1. Install idle needle and spring finger tight in throttle body. As a temporary adjustment, turn needle out 1½ turns.
2. Using a new throttle body gasket, attach bowl to throttle body. Tighten screws evenly and securely.
3. Place clean pump screen in bottom of bowl and lock retainer in position.
4. Drop small aluminum ball in pump well, being sure it lifts freely from its seat.
5. Place pump return spring into pump well and center it by depressing with finger.
6. Install pump plunger and connect pump link to throttle lever and pump rod. If cotter pin is used to secure link, bend ends 180° to prevent binding. If hairpin type lock is used, make sure it is locked in position.
7. Drop large steel ball into pump discharge cavity of bowl and place bronze spring on top of ball. When installing steel ball check, tap lightly with a suitable hard fibre or brass rod. Then check to see that ball will lift readily from its seat by upending carburetor and allowing ball to drop into palm of hand.
8. Index end of pump discharge guide into bronze spring and press down until guide is flush with bowl surface.
9. Place throttle kick lever spring on bowl boss with smaller hooked end against bowl. Rotate clockwise until small end engages lower boss.
10. Attach throttle kick lever with screw and washer. Flat portion of lever must be against idle screw.
11. Install float needle seat, using new fibre washer, and install float needle.

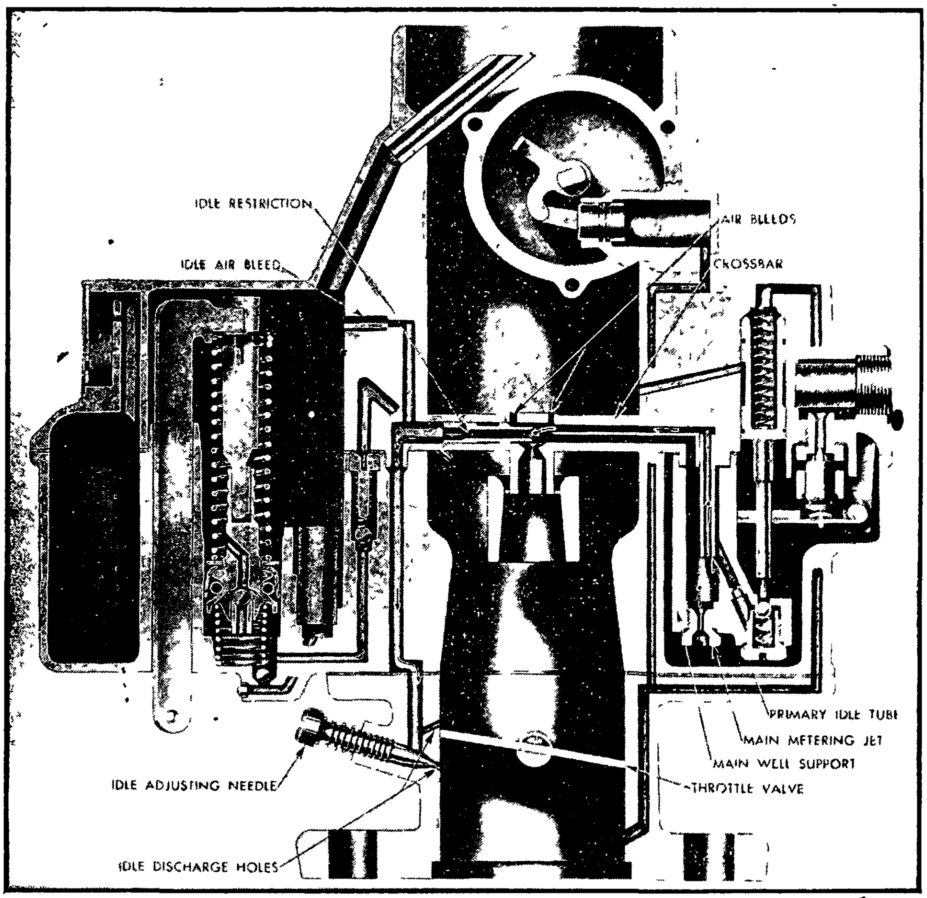


Fig. 432GG Rochester model BC, 1951-52 Pontiac Six and 1952 Chevrolet with Powerglide

12. Place power piston spring and piston in cover cavity.
13. Using new main well support gasket, attach main well support to cover.
14. Install main metering jet and tighten securely.
15. Hold power piston stem down and install power ball, spring and plug assembly, and tighten securely.
16. Place new cover gasket on cover.
17. Attach float with hinge pin, being sure float tang faces cover.
18. Adjust float as outlined previously.
19. Rotate throttle kick lever clockwise until extended hooked end engages lower half of lever. Turn lever to vertical position against tension of spring. Cam portion of lever will now be in position to engage cam portion of swivel.
20. Holding throttle kick lever, place cover assembly on bowl, Fig. 432EE. Install attaching screws and choke bracket and tighten screws securely.
21. Install the carburetor on engine and after connecting the choke and throttle wires, check their operation by pulling the buttons on the dash all the way out. Throttle valve should be fully open and choke valve fully closed. Push buttons all the way in. Throttle valve should be fully closed to stop screw and choke valve should be fully open.
22. Install air cleaner, start engine and after it has reached operating temperature, make idle mixture and idle speed adjustments as previously directed.

MODEL BC

PONTIAC SIX, 1951-52

Fig. 432GG—Except for the addition of the automatic choke, the Model BC carburetor is essentially the same as the Model B carburetor.

CARBURETOR ADJUSTMENTS

Idle Mixture—As a preliminary setting, turn idle mixture screw out 1½ turns. Then turn it as required to provide a smooth idle speed. Missing is a sign of too lean a mixture, while "rolling" or "loping" indicates too rich a mixture.

CHOKE ADJUSTMENT—Normal setting of the choke is such that the scribed mark on the choke housing cover is in line with the long cast mark on the air horn casting, Fig. 432HH. If it is believed that the indexing is wrong, it may be checked as follows:

1. Remove air cleaner. Allow car to remain in garage until engine and carburetor are at room temperature (about 75°).
2. Loosen screws holding choke cover. Then with throttle opened so idle speed screw will not contact fast idle cam, turn cover counterclockwise until choke valve opens.
3. Turn choke cover clockwise until choke valve just closes. Tighten cover screws. Index mark on cover

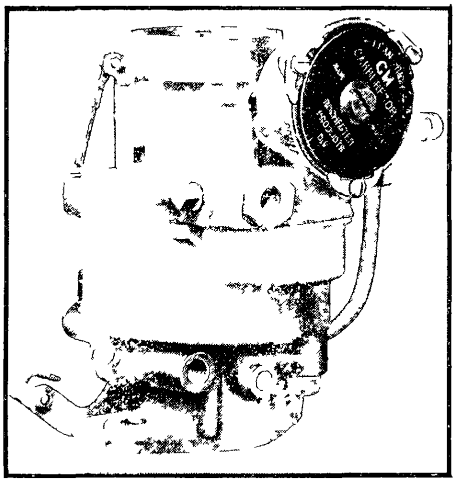


Fig. 432HH Exterior view of carburetor showing idle mixture adjusting screw and automatic choke. Rochester BC carburetor. 1951-52 Pontiac Six

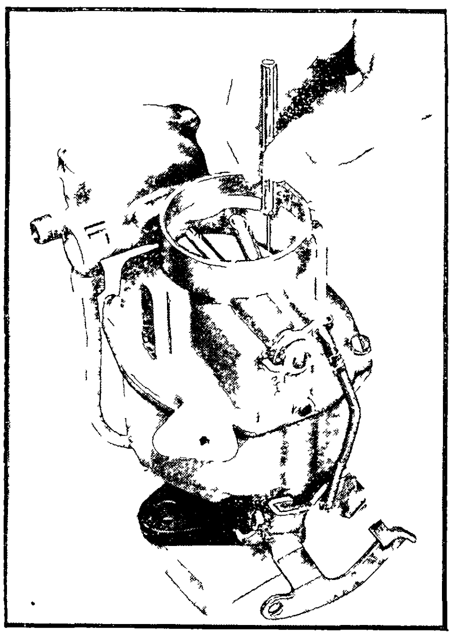


Fig. 432JJ Checking fast idle adjustment on Rochester BC carburetor. 1951-52 Pontiac Six

and mark on casting should now be in line.

FAST IDLE—No adjustment of fast idle is provided since the stops on the fast idle cam are correctly proportioned to give the correct speed stops above normal idle speed. It is necessary, however, to have the correct relationship between fast idle cam position and choke valve position To check and adjust this setting, proceed as follows

Place end of idle speed screw on the next to the highest step on the fast idle cam, Fig 432JJ. Using gauge J-4553 as shown, see if small end of gauge just slides easily between lower edge of choke valve and bore of carburetor. If necessary, bend choke rod until prescribed clearance is obtained.

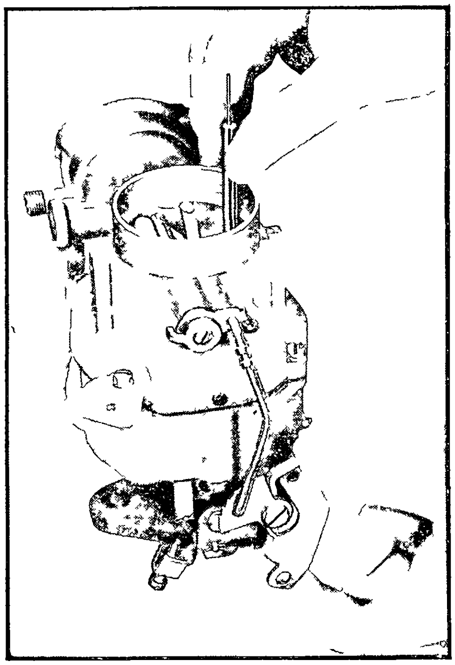


Fig. 432KK Checking unloader adjustment on Rochester BC carburetor. 1951-52 Pontiac Six

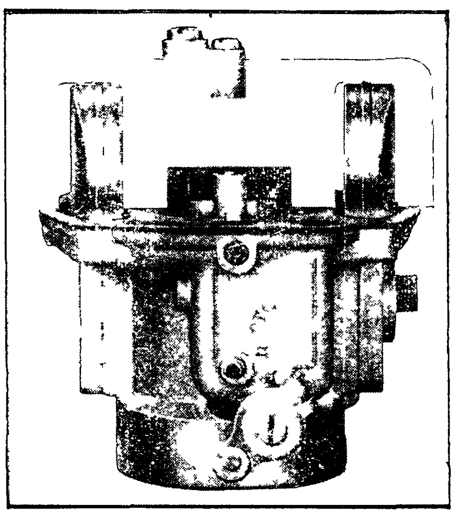


Fig. 432LL Checking float level on Rochester BC carburetor. 1951-52 Pontiac Six

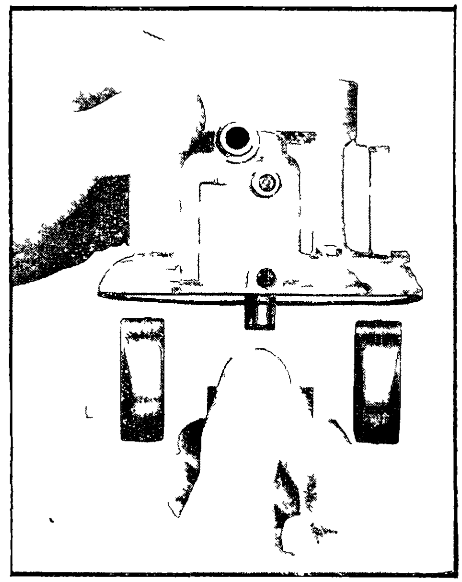


Fig. 432MM Checking float drop on Rochester BC carburetor. 1951-52 Pontiac Six

UNLOADER—Place throttle in wide open position Use the large end of gauge J-4553 between lower edge of choke valve and bore of carburetor, Fig 432KK, and if necessary bend the tang of the throttle lever to obtain the necessary clearance.

FLOAT SETTING—

1. Disconnect fuel line and manifold hot air tube from carburetor
2. Loosen hex nut fastening carburetor hot air tube to choke housing.
3. Remove choke rod from choke counterweight.
4. Remove bowl cover and air horn assembly from carburetor.
5. Position float gauge (J-4554) over cover gasket, Fig 432LL, and see if tops of floats just touch gauge If necessary, carefully bend float arms to get correct adjustment.
6. Using gauge as shown in Fig. 432MM, gauge float drop and sidewise positioning of floats If necessary, bend float tang at rear of float to get correct float drop or tension. Proper centering of floats between gauge legs can be attained by bending float arms.
7. Recheck float setting to be sure it has not changed

BC CARBURETOR SERVICE

Disassembly, inspection and assembly of this model carburetor is essentially the same as that described for the Model B except for the automatic choke.

STROMBERG CARBURETOR INDEX AND ADJUSTMENTS

NOTE—See text for details of these settings.

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H

(A) Stamped either on float chamber cover or metal tag attached to unit.
(B) Contains all parts ordinarily used in a carburetor overhaul.
(C) On AA series, check level through sight plug hole in side of carburetor. On all other models, measure with a standard depth gauge (or rule) with engine idling and air horn removed. Caution: Do not remove air horn until after engine is started and idling evenly to avoid personal injury due to fire as a result of backfires through the manifold.
(D) Pump piston to rest on bypass jet (less over-travel) with throttle valve open to dimension given.
(E) Insert drill which just fits into idle discharge hole and locate throttle by placing gauges of thickness shown between edge of throttle valve and drill.
(F) Insert drill which just fits into vacuum spark advance hole, and with throttle valve fully closed, locate edge of valve by placing gauges of thickness shown between edge of throttle valve and drill.
(G) Clearance between choke valve and air horn. Use drill size given in table for measuring and adjust as directed in text.
(H) Clearance between choke valve and air horn with wide-open throttle. Use drill size given in table and adjust as directed in text.

AUBURN (See Carter for additional applications)

1935-36 Six	EX-22	A-18052	17-3		5/8	3/8	.012	None	None	None
1935-36 Eight	EX-32	A-17753	17-9A		5/8	27/64	.012	None	None	None
1935-36 Eight	EE-1	A-17611	17-1		15/32	21/64	.030	None	None	None

BUICK (See Carter for additional applications)

1935, 40	EE-1	A-17671	7-1	RK-1	15/32	21/64	.030	.041	None	None
1935, 40	EE-1	A-17681	7-2	RK-9	15/32	21/64	.030	.041	None	None
1936, 40	EE-1	A-18181	7-5A	RK-2	15/32	21/64	.030	.041	④	None
1936, 40	EE-1	A-18191	7-7	RK-89	15/32	21/64	.030	.041	④	None
1936, 40	EE-1	A-18171	7-9	RK-90	15/32	21/64	.030	.041	④	None
1936, 60, 80, 90	EE-22	A-18182	7-6	RK-3	5/8	15/64	.030	.085	④	None
1936, 60, 80, 90	EE-22	A-18192	7-7	RK-91	5/8	15/64	.030	.085	④	None
1936, 60, 80, 90	EE-22	A-18302	7-10	RK-3	21/32	15/64	.030	.085	④	None
1936, 60, 80, 90	EE-22	A-18312	7-11	RK-91	21/32	15/64	.030	.085	④	None
1937, 40	AA-1	A-18361	7-12	RK-4	①	9/32	.022	.041	④	None
1937, 40	AA-1	A-18451	7-14	RK-92	①	9/32	.022	.041	④	None
1937, 60, 80, 90	AA-2	A-18362	7-13	RK-5	①	13/64	.022	.085	④	None
1937, 60, 80, 90	AA-2	A-18452	7-15	RK-93	①	13/64	.022	.085	④	None
1938, 40	AAV-1	A-18681	7-17	RK-6	②	③	.022	.041	④	None
1938, 40	AAV-1	A-18691	7-19	RK-94	②	③	.022	.041	④	None
1938, 60, 80, 90	AAV-2	A-18682	7-18	RK-7	②	③	.022	.055	④	None
1938, 60, 80, 90	AAV-2	A-18692	7-20	RK-95	②	③	.022	.055	④	None
1939, 40	AAV-16	A-18971	7-24	RK-72	②	③	.022	.041	5/16	11/64
1939, 60, 80, 90	AAV-26	A-18972	7-22A	RK-8	②	③	.020	.055	5/16	11/64
1939, 60, 80, 90	AAV-26	A-18982	7-23A	RK-8	②	③	.020	.055	5/16	11/64
1940, 40, 50	AAV-16	A-19181	7-32	RK-72	①	③	.022	.041	53	11/64
1940, 60, 70, 80, 90	AAV-26	A-19192	7-33	RK-74	①	③	.022	.055	53	11/64
1940, 60, 70, 80, 90	AAV-26	A-19182	7-34	RK-73	①	③	.022	.055	53	11/64
1941, 50	AA-1	380067	7-47	RK-115	①	None	.022	None	None	None
1941, 50	AAV-16	380066	7-46	RK-114	①	③	.010	.080	53	11/64
1941, 60, 70, 90	AA-1	380065	7-45A	RK-117	①	None	.022	None	None	None
1941, 60, 70, 90	AAV-16	380064	7-44	RK-116	①	③	.010	.080	53	11/64
1941-42, 40	AAV-16	380029	7-37	RK-72	①	③	.022	.041	53	11/64
1941-47, 40, 50	AAV-16	380106	7-66	RK-72	①	③	.022	.041	53	11/64
1942, 50	AA-1	380026	7-56A	RK-124	①	None	.022	None	None	None
1942, 50	AAV-16	380103	7-59A	RK-114	①	③	.010	.080	53	11/64
1942, 60, 70, 90	AA-1	380095	7-55A	RK-123	①	None	.022	None	None	None
1942, 60, 70, 90	AAV-16	380104	7-60A	RK-116	①	③	.010	.080	53	11/64
1946-47, 70	AAV-26	380097	7-57	RK-73	①	③	.022	.055	53	11/16
1948–49, 40, 50	AAV-167	380225	7-69	RK-140	①	③	.022	.080	53	11/64

STROMBERG CARBURETOR INDEX AND ADJUSTMENTS

NOTE—See text for details of these settings.

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
BUICK—(Continued)										
1948–49, 70	AAV-267	380226	7-70	RK-141	①	③	.022	.055	53	11/64
1950, 40, 50	AAUVB-267	380257	7-88	RK-151	①	③	.030	.080	53	.140
1950, 70	AAVB-267	380258	7-89	RK-152	①	③	.015	.055	53	.140
1951–52, 40, 50	AAUVB-267	380309	7-90	RK-168	①	③	.036	.080	53	.140
1951, 70	AAVB-267	380310	9-91	RK–169	①	③	.035	.055	53	.140
1952, 70	4AUV-267									

① With engine idling, fuel should be level with bottom of sight plug hole.
② With engine idling, fuel should be 1/32″ above bottom of sight hole.
③ Controlled by manifold vacuum.
④ See text for details of this mechanism.

Car and Model	Carb. Model	Part No.	Code No.	Repair Kit No.	Fuel Level	Economizer	Idle	Vacuum Spark	Fast Idle	Choke Unloader
CADILLAC AND LA SALLE (See Carter for additional applications)										
1935, 50	EE-15	A-17771		RK-22	15/32	21/64	.010	None	9/32	None
1936, 50	EE-15	A-17801		RK-23	15/32	9/32	.010	.041	9/32	None
1936, 60, 75	EE-25	A-18202		RK-17	5/8	21/64	.030	.031	15/64	None
1937, V8	AA-25	A-18352		RK-18	①	21/64	.022	None	11/32	7/32
1938, V8	AAV-25	A-18672		RK-19	①	②	.030	None	7/32	None
1939, V8	AAV-26	A-18962	205-3	RK-20	①	②	.040	None	38	11/64
1940, V8	AAV-26	A-19212	205-5A	RK-76	①	②	.040	.012	38	11/64
1941	AAV-26	380015	205-8	RK-108	①	②	.040	.012	32	11/64
1941	AAV-26	380048	205-9	RK-108	①	②	.040	.012	32	11/64
1942	AAV-26	380063	205-10A	RK-125	①	②	.040	.012	32	11/64
1946-48	AAV-26	380154	205-14A	RK-125	①	②	.040	.012	32	11/64

① With engine idling, fuel should be level with bottom of sight plug hole.
② Controlled by manifold vacuum.

Car and Model	Carb. Model	Part No.	Code No.	Repair Kit No.	Fuel Level	Economizer	Idle	Vacuum Spark	Fast Idle	Choke Unloader
CHRYSLER (See Carter for additional applications)										
1935-36, CZ, C8	EX-32	A-17863	4-5	RK-24	5/8	27/64	.012	Flush	None	None
1935-36, CZ, C8	EXV-3	A-17763	4-21	RK-25	5/8	②	.012	Flush	None	None
1935-36, C1, C9	EX-32	A-17723	4-4		5/8	72/64	.012	Flush	None	None
1935, C2	EE-22	A-17792	4-6		5/8	21/64	.040	.031	None	None
1935, C3	EE-22	A-18002	4-7		5/8	21/64	.040	.031	None	None
1936, C9	EXV-3	A-18263	4-53	RK-26	5/8	②	.012	Flush	None	None
1936, C11	EE-22	A-18262	4-51A	RK-28	5/8	21/64	.040	.031	None	None
1936-37, C10, C17	EE-22	A-18242	4-49B	RK-27	5/8	21/64	.040	.031	None	None
1937, C14	EE-22	A-18232	4-50	RK-29	5/8	21/64	.040	.031	None	None
1937, C14	AAOV-1	A-18431	4-71D	RK-31	①	②	.040	.031	1/8	7/32
1937, C15	AAOV-1	A-18441	4-72D	RK-32	①	②	.040	.031	1/8	7/32
1938, C19	AAV-2	A-18782	4-76D	RK-33	①	②	.040	.015	1/8	7/32
1938-40 Eight	AAV-2	A-18792	4-77D	RK-32	①	②	.040	.015	1/8	7/32
1941 Eight	AAV-2	380041	4-103A	RK-113	①	②	.030	.015	1/8	7/32
1942 Eight	AAV-2	380086	4-109	RK-113	①	②	.030	.015	1/8	7/32
1946–48 Eight	AAVS-2	380165	4-111	RK-132	①	②	.018	.018	1/8	7/32
1946–48 Eight	AAVS-2	380169	4-112	RK-132	①	②	.018	.018	1/8	7/32

① With engine idling, fuel should be level with bottom of sight plug hole.
② Controlled by manifold vacuum.

Car and Model	Carb. Model	Part No.	Code No.	Repair Kit No.	Fuel Level	Economizer	Idle	Vacuum Spark	Fast Idle	Choke Unloader
DODGE (See Carter for additional applications)										
1935-38	BXOV-2	A-19032	3-45		5/8	①	Flush	Flush	None	None
1935-38	BXOV-2	A-19042	3-46		5/8	①	Flush	Flush	None	None
1935	EX-22	A-17892	3-2C	RK-12	5/8	3/8	.018	Flush	None	None
1936	EXV-2	A-18212	3-26C	RK-13	5/8	①	.018	Flush	None	None
1936	EXV-2	A-18372	3-31A		5/8	①	.018	Flush	None	None
1937	EXV-2	A-18432	3-33A	RK-14	5/8	①	.018	Flush	None	None
1938	EXV-2	A-18712	3-36A	RK-15	5/8	①	.018	Flush	None	None

STROMBERG CARBURETOR INDEX AND ADJUSTMENTS

NOTE—See text for details of these settings.

DODGE—(Continued)

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
1939	BXV-3	A-18073	3-39A	RK-16	5/8	①	Flush	Flush	None	None
1939	BXV-3	A-18093	3-41A	RK-16	5/8	①	Flush	Flush	None	None
1940-41	BXV-3	A-18123	3-54A	RK-75	5/8	①	Flush	Flush	None	None
1940-41	BXV-3	A-18133	3-55	RK-75	5/8	①	Flush	Flush	None	None
1941	BXVD-3	380044	3-55B	RK-75	5/8	①	Flush	Flush	None	None
1942	BXVD-3	380080	3-66	RK-120	5/8	①	Flush	Flush	None	None
1942	BXV-3	380079	3-65	RK121	5/8	①	Flush	Flush	None	None
1946-48	BXV-3	380158	3-76	RK-130	5/8	①	Flush	Flush	None	None
1946-48	BXVD-3	380159	3-77	RK-131	5/8	①	Flush	Flush	None	None
1947-48	BXVD-3	380218	3-82	RK-143	5/8	①	Flush	Flush	None	None
1947-48	BXV-3	380219	3-83	RK-139	5/8	①	Flush	Flush	None	None
1949-52	BXVES-3	380251	3-95A,B,C	RK-149	5/8	①	Flush	Flush	None	None
1949-52	BXVD-3	380249	3-93A, B	RK-159	5/8	①	Flush	Flush	None	None

① Controlled by manifold vacuum.

FORD AND MERCURY

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
1935-42, V8	EE-1	380076	2-21A	RK-126	15/32	19/64	.030	None	None	None
1935-36, 85	EE-1	A-17691		RK-68	15/32	5/16	.030	None	None	None
1935-36, 85	EE-1	A-18231		RK-68	15/32	5/16	.030	None	None	None
1936-38, 85	EE-1	A-18271	①	RK-70	15/32	19/64	.030	None	None	None
1936-38, 85	EE-1	A-18281	①	RK-70	15/32	19/64	.030	None	None	None
1936-38, 85	EE-1	A-18291	①	RK-70	15/32	19/64	.030	None	None	None
1936-38, 85	EE-1	A-18301	①	RK-70	15/32	19/64	.030	None	None	None
1936-38, 60	EE-7/8	A-17690	②	RK-66	15/32	9/32	.030	None	None	None
1936-38, 60	EE-7/8	A-17800	②	RK-66	15/32	9/32	.030	None	None	None
1936-38, 60	EE-7/8	A-17860	②	RK-66	15/32	9/32	.030	None	None	None
1936-38, 60	EE-7/8	A-17910	②	RK-66	15/32	9/32	.030	None	None	None
1936-38, 60	EE-7/8	A-17900	②	RK-66	15/32	9/32	.030	None	None	None

① Marked "97" on side of main body.
② Marked "81" on side of main body.

LINCOLN

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
1935, K	EE-22	A-18042	40-4		9/16	21/64	.030	None	None	None
1936-39, K	EE-22	A-18282			9/16	21/64	.030	None	None	None
1936-37 Zephyr	EE-1	A-18041			15/32	19/64	.030	None	None	None
1938 Zephyr	EE-1	A-18411			15/32	19/64	.030	None	None	None

NASH AND LAFAYETTE (See Carter for additional applications)

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
1935, 80	EE-22	A-18062		RK-38	5/8	1/4	.030	None	None	None
1935-36, 20	EX-32	A-18063		RK-34	5/8	27/64	.012	None	None	None
1935-36, 40	EX-22	A-18132		RK-35	5/8	23/64	.012	None	None	None
1935-36, 80	EE-1	A-18061		RK-37	1/2	7/32	.030	None	None	None
1936, 10	AX-2	A-18272		RK-36	5/8	5/16	.012	None	None	None
1936, 40	AX-2	A-18322	8-25A	RK-39	5/8	21/64	.012	None	None	None
1937, 20	EX-32	A-18143	8-26A	RK-40	3/4	27/64	.012	None	None	None
1937, 80	EE-1	A-18141	8-27	RK-41	1/2	7/32	.030	None	None	None
1937, 80	EE-1	A-18151	8-28		1/2	7/32	.030	None	None	None
1937-38, 10	AX-2	A-18322	8-25A	RK-39	5/8	21/64	.012	None	None	None
1938, 80	EE-1	A-18331	8-29	RK-42	1/2	7/32	.030	None	None	None
1939, 10	EE-1	A-18471	8-30B	RK-64	15/32	5/16	.030	None	None	None

STROMBERG CARBURETOR INDEX AND ADJUSTMENTS

NOTE—See text for details of these settings.

Car and Model	Carb. Model	Part No.	Code No. Note A	Repair Kit No. Note B	Fuel Level Inch Note C	Throttle Position for Economizer Valve, Inch Note D	Throttle Valve Location for Idle, Inch Note E	Throttle Valve Location for Vacuum Spark Control, Inch Note F	Fast Idle Setting Note G	Choke Unloader Setting Note H
OLDSMOBILE (See Carter for additional applications)										
1935 Six	EX-22	A-18092	5-7A	RK-45	5/8	7/16	.018	None	None	None
1935 Six	EX-22	A-18022	5-6A	RK-45	5/8	7/16	.018	None	11/16	None
1935 Eight	EE-1	A-18021	5-5A	RK-46	15/32	21/64	.010	None	11/16	None
PACKARD (See Carter for additional applications)										
1935 Std. 8	EE-23	A-17892	10-2A	RK-48	5/8	9/32	.030	None	15/64	None
1935, "120"	EE-14	A-17701	10-4F	RK-47	15/32	21/64	.030	None	None	None
1935 Super 8	EE-23	A-17882	10-1A	RK-49	5/8	9/32	.030	None	15/64	None
1935-36 Twelve	EE-3	A-17883	10-3A	RK-98	9/16	7/32	.030	None	③	None
1936 Eight	EE-14	A-18051	10-24C	RK-50	15/32	21/64	.020	None	None	None
1937-38 Super 8	EE-23	A-18392	10-28	RK-52	5/8	9/32	.020	.015	15/64	None
1937-38 Twelve	EE-3	A-17893	10-27C	RK-53	9/16	7/64	.053	None	③	None
1937 Eight	EE-14	A-18091	10-29C	RK-51	15/32	21/64	.030	Flush	None	None
1938 Eight	EE-14	A-18161	10-30B	RK-54	15/32	5/16	.030	Flush	None	None
1939-40 Eight	EE-16	A-18341	10-33A	RK-79	15/32	5/16	.030	Flush	35/64	11/64
1939 Super 8	EE-23	A-19002	10-34A	RK-97	5/8	9/32	.020	.015	15/64	None
1940 Six	BXOV-26	A-19162	10-39E	RK-77	5/8	②	Flush	Flush	③	None
1940 Super 8	AAV-26	A-19172	10-40A	RK-106	①	②	.040	.012	7/64	11/64
1940 Super 8	AAV-26	A-19172	10-40D	RK-78	①	②	.040	.012	7/64	11/64
1940 Super 8	AAV-26	A-19172	10-40E	RK-107	①	②	.022	.012	7/64	11/64
1941 Six	BXOV-26	380039	10-45A	RK-109	5/8	②	.010	Flush	③	None
1941 Six	BXOV-26	380049	10-46A	RK-109	5/8	②	.010	Flush	③	None
1941 Eight	EE-16	380050	10-47A	RK-79	15/32	5/16	.030	Flush	35/64	11/64
1941 Super 8	AAV-26	380087	10-44C	RK-110	①	②	.022	.012	7/64	11/64

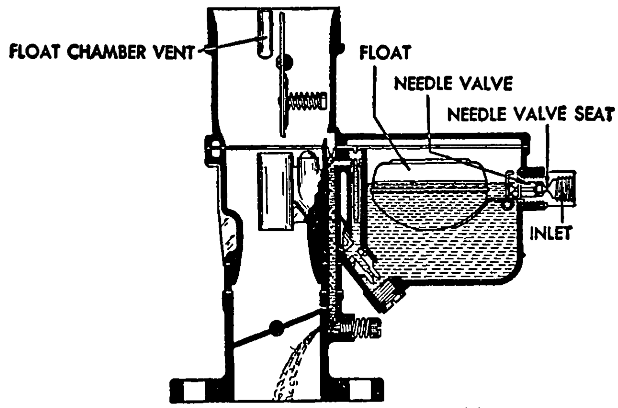
① With engine idling fuel should be level with bottom of sight plug hole.
② Controlled by manifold vacuum.
③ See text for details of this mechanism.

Car and Model	Carb. Model	Part No.	Code No.	Repair Kit No.	Fuel Level	Economizer	Idle	Vacuum Spark	Fast Idle	Choke Unloader
PLYMOUTH (See Carter for additional applications)										
1947, P15	BXV-3	380220	3-84	RK-139	5/8	①	Flush	Flush	②	None

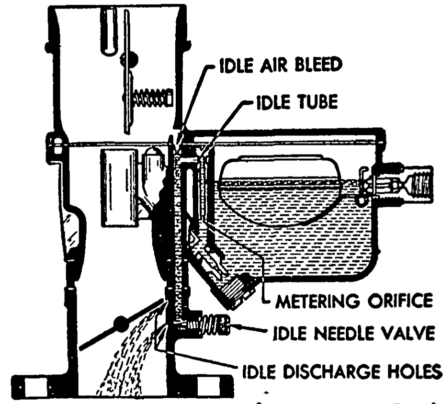
① Controlled by manifold vacuum.
② See text for details of this mechanism.

Car and Model	Carb. Model	Part No.	Code No.	Repair Kit No.	Fuel Level	Economizer	Idle	Vacuum Spark	Fast Idle	Choke Unloader
STUDEBAKER (See Carter for additional applications)										
1935 Dic.	EX-23	A-17922	6-9	RK-56	5/8	3/8	.012	None	11/64	None
1935, 1B, 1C	EE-1	A-17661	6-10	RK-57	15/32	21/64	.030	None	38	None
1936 Dic.	EX-23	A-18222	6-49A	RK-58	5/8	3/8	.012	None	11/64	None
1936 Pres.	EE-1	A-17921	6-50	RK-59	15/32	21/64	.030	None	38	None
1936 Pres.	EE-1	A-17931	6-52	RK-59	15/32	21/64	.030	None	6	None
1937 Dic.	EX-23	A-18402	6-62A	RK-58	5/8	7/16	.012	Flush	11/64	None
1937 Pres.	EE-1	A-18401	6-63	RK-61	15/32	21/64	.030	Flush	6	None
1938-39 Com.	BXO-26	A-18652	6-69A	RK-62	5/8	27/64	.010	Flush	5/32	None
1938-39 Pres.	AAO-161	A-18371	6-70A	RK-63	①	23/64	.020	Flush	None	7/32
1939-40 Champ.	BXV-25	A-19282	6-91A		5/8	②	.010	Flush	None	None
1939-40 Champ.	BXV-2	A-19272	6-90		5/8	②	.010	Flush	None	None
1940 Com.	BXO-26	A-19222	6-84	RK-62	5/8	27/64	.010	Flush	11/32	None
1940 Pres.	AAO-161	A-18611	6-85	RK-63	①	23/64	.020	Flush	None	7/32
1941-42 Com.	BXOV-26	380036	6-98A	RK-112	5/8	②	.010	Flush	11/32	None
1941 Pres.	AAV-26	380038	6-97B	RK-111	①	②	.020	Flush	7/64	11/64
1941-42 Pres.	AAV-26	380038	6-97C	RK-111	①	②	.015	Flush	7/64	11/64
1946-50 Com.	BXOV-26	380178	6-104	RK-112	5/8	②	.010	Flush	11/32	None
1951-52 Com.	AAUVB-26	380278	6-107	RK-163	21/32	②	.040	.020	11/32	None

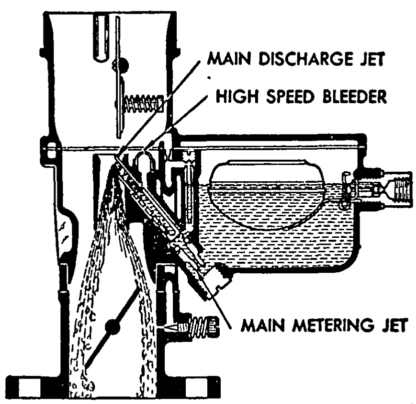
① With engine idling, fuel should be level with bottom of sight plug hole.
② Controlled by manifold vacuum.



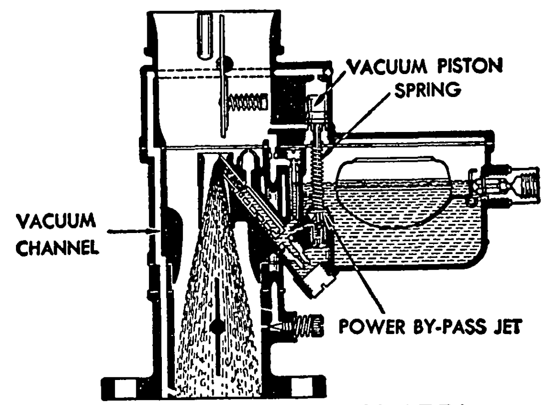
FLOAT SYSTEM
Fig. 432H



IDLE SYSTEM (2ND STAGE)
Fig. 432J



MAIN METERING SYSTEM
Fig. 432K



POWER SYSTEM
Fig. 432L

STROMBERG

All Stromberg carburetors, regardless of size or model, are quite similar in general construction, and operate as follows:

FLOAT SYSTEM—Fig. 432H. Fuel enters the carburetor at the gasoline inlet flowing through the float needle valve and seat into the float chamber where it is maintained at a definite level by the float. (The illustration shows the first step of operation of the idle system.)

IDLE SYSTEM—Fig. 432J. At closed throttle or slow engine speeds, the fuel is delivered through the idle system. The fuel is taken from the base of the main discharge jet, flowing into the bottom of the idle tube where it is metered. From the tube it flows through the connecting channel where air from the idle air bleed is mixed with it so that a mixture of air and fuel passes down the channel and is discharged from the idle discharge holes. The idle needle valve controls the quantity of fuel discharged from the primary hole, thereby effecting the mixture ratio.

MAIN METERING SYSTEM—Fig. 432K. This system controls the flow of fuel during the intermediate or part throttle position. The fuel flows from the float chamber into the main metering jet and then into the base of the main discharge jet. Air is bled through the high speed bleeder into the main discharge jet so that a mixture of air and fuel is discharged from the main discharge jet into the carburetor barrel.

The main discharge jet is designed so that if any vapor bubbles are formed in the hot gasoline, the vapors follow the outside channel around the main discharge jet, instead of passing through the jet tube. These vapor bubbles collect and condense in the dome-shaped high speed bleeder and thereby eliminate percolating troubles.

POWER SYSTEM—Fig. 432L. For maximum power or high speed operation, a richer mixture is required than that necessary for normal throttle opening. A vacuum controlled piston automatically operates the power by-pass jet in accordance with the throttle opening. With the throttle closed, a high manifold vacuum is present and the vacuum piston is moved to its "up" position against the tension of the spring. When the throttle is opened to a point where additional fuel is required for satisfactory operation, the manifold vacuum decreases sufficiently so that the spring on the piston moves the piston down and thereby opens the power by-pass jet to feed additional fuel into the Main Metering System.

ACCELERATING SYSTEM—Fig. 432M. For smooth and rapid acceleration, it is necessary to supply momentarily, an extra quantity of fuel when the throttle is suddenly opened. In most designs, the accelerating pump is directly connected to the throttle, so that when the throttle is closed, the pump piston moves up, taking in a supply of fuel from the float chamber through the inlet check valve into the pump cylinder. When the throttle valve is opened, the piston on its down stroke has a tendency to compress the fuel in the cylinder, which action closes the inlet check valve, forces open the by-pass jet, and discharges a metered quantity of fuel through the pump discharge nozzle. This occurs only momentarily during the accelerating period. The pump duration spring provides a follow-up action so that the discharge carries out over a period of time.

FIXED THROTTLE POSITION—Fig. 432N. When the desired speed is reached and the throttle is held in fixed position, the compression of the fuel in the pump cylinder decreases sufficiently so that the spring in the by-pass jet returns the valve to its seat and the fuel ceases to discharge from the pump nozzle. With the throttle held in a fixed position, the fuel flows only through the main metering system.

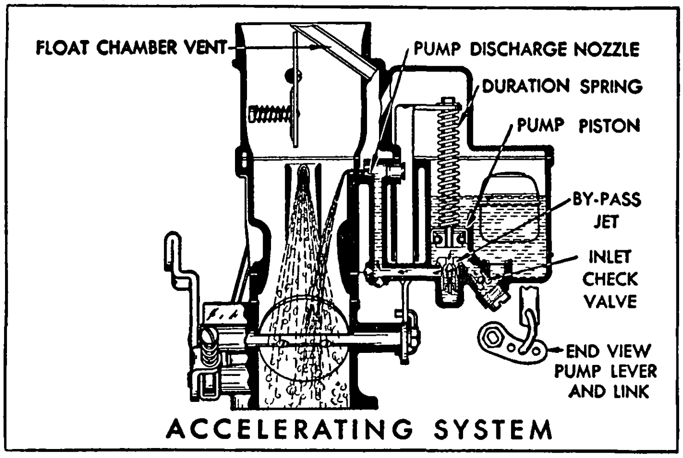


Fig. 432M

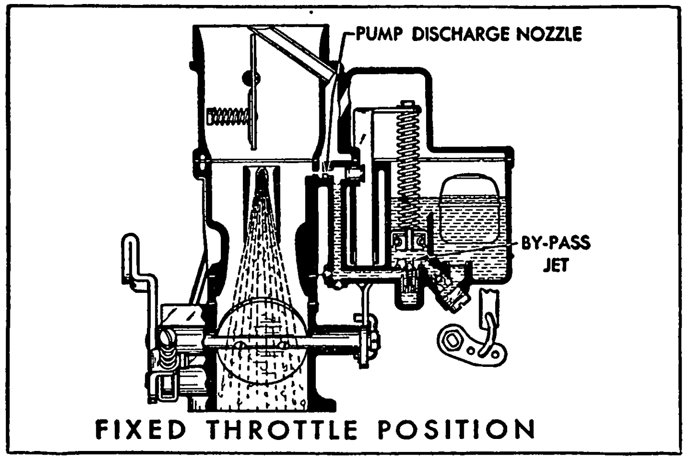


Fig. 432N

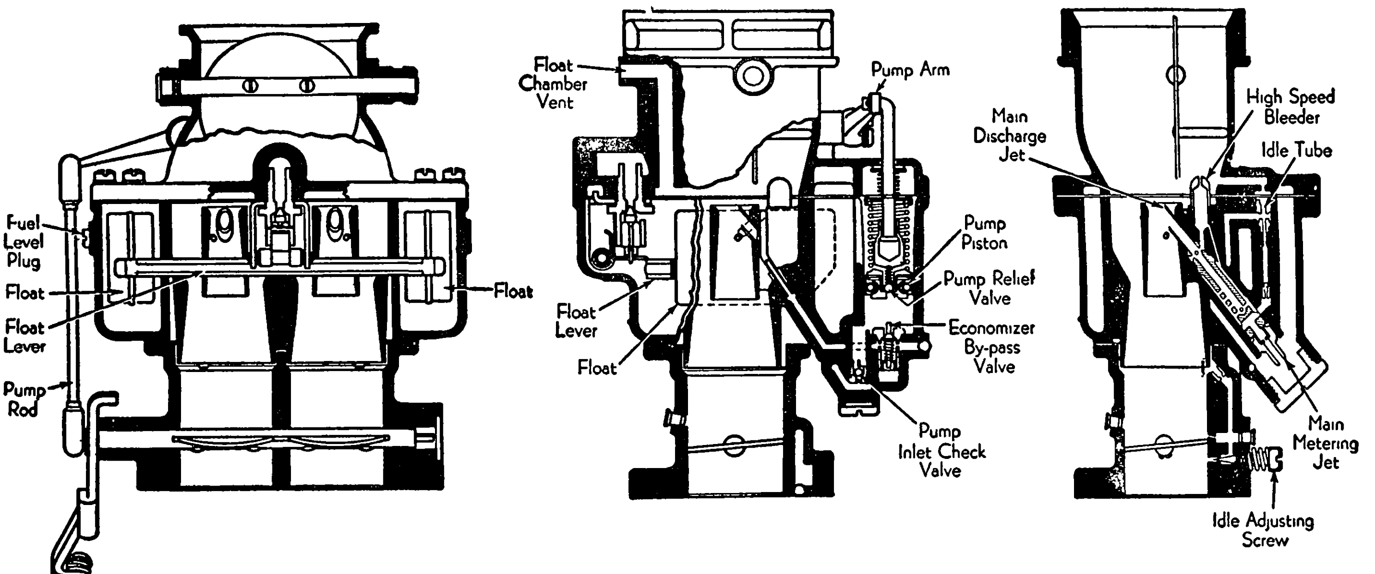


Fig. 433 STROMBERG DUAL CARBURETOR Series AA with mechanically operated power syst m

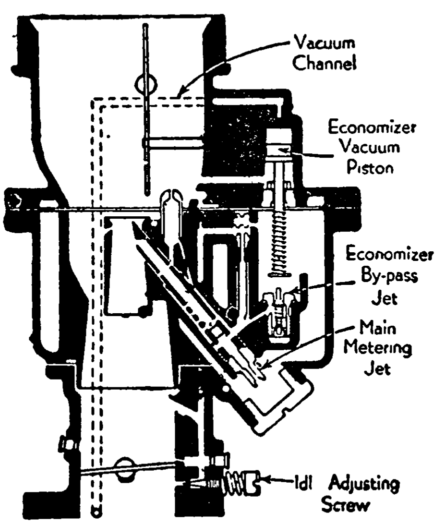


Fig. 434
STROMBERG DUAL CARBURETOR
S ri s AAV with vacuum perated pow r syst m

The pump system is vented to the outside air and thereby eliminates any fuel being delivered unnecessarily after the pump stroke is completed.

STROMBERG SYMBOL EXPLANATION

AA Series—These carburetors, which include models AA, AAO, AAV and AAOV, are of the dual barrel downdraft type. The float chamber encircles the two barrels and is provided with two floats. The AAV models are the same as the AA except that the former have a vacuum power system The letter "O" in models AAO and AAOV simply means that the throttle barrel is ⅛ inch oversize. See Figs 433 and 434.

AX, BX, EX—These carburetors, Fig. 435, are of the single barrel downdraft type and operate under the same basic principles as the AA series

On BXOV, BXV, BXVD and EXV models, the economizer or power jet action is controlled by manifold vacuum, as indicated by the letter "V", while on AX, BXO and EX units, power jet action is controlled mechanically by the accelerating pump piston. The letter "O" in models BXO and BXOV means that the throttle barrel is ⅛ inch oversize The letter "D" in model BXVD signifies that the unit is equipped with a dash-pot device to close the throttle slowly This is used on Dodge cars with Fluid Drive

EE Series—Fig. 436. This series is of the dual barrel downdraft type and operates under the same basic principles as other Stromberg models The chief difference between this series and the AA dual barrel type is that the EE's have only one float in the float chamber.

STROMBERG SERVICE NOTES

While the step-by-step service procedure illustrates the method of overhauling the AA series dual barrel carburetors and the BXV single barrel units, it may also be used as a guide in overhauling other Stromberg units. After disassembling a carburetor, make the following inspection:

Throttle Shaft—Inspect for wear on bearing surfaces Check pump rod holes for wear and also to see that throttle

lever is not loose on shaft. Replace assembly if necessary.

Throttle Valves—See that the throttle valves are not bent and are free from burrs or sharp edges.

Main Discharge Jets—Inspect tips of jets to make certain they are not damaged, and that the wall is not distorted to deform the holes.

Throttle Valve Body—Be sure that the idle discharge holes and the barrels of the body are clean of all carbon deposits. A comparatively small amount of carbon in the barrel may have the effect of decreasing the bore enough to prevent the throttle valves from resting at the correct angle when closed. This can have serious effects on performance because the distance from the throttle valve when closed, to the edge of the idle discharge hole must be kept within close limits to the specified dimension. This dimension is listed in the *Stromberg Adjustment* table under the heading "Throttle Valve Location for Idle". In most cases the tolerance is plus or minus .004 inch.

Check the size of the upper idle discharge hole by removing the plug in the body and inserting the shank of the correct size drill into the idle discharge hole. The discharge hole for the idle needle valve should be checked in the same manner.

Check wear of throttle shaft bearing. There should not be more than .003 inch play, otherwise air leaks will interfere with performance.

Vacuum Piston—Make certain that the surface of the piston is thoroughly clean. Don't use any abrasive material for polishing the piston surface. Inspect for wear or damage. Replace if necessary.

Choke Shaft—Inspect for wear on bearing surface, and for looseness of lever on stem.

Main Body—Make certain the body is thoroughly clean and that all passages are free of foreign material. Check high speed and idle air bleeders for correct sizes, using a drill shank as a gauge.

Air Horn—Make certain that the vacuum cylinder is thoroughly clean. Check wear of choke shaft bearing surfaces.

Installing Throttle Valves—Before removing throttle valves, mark the valves and barrels so that each valve can be put back in the same barrel from which it was removed. Do this with a scriber, by scratching one line on one valve and one barrel, and by scratching two lines on the other valve and barrel. Also mark each throttle valve so it can be reassembled in the shaft in the original position. Make a scriber mark on each valve along both edges of the shaft. These lines will allow positioning the valves accurately when they are again assembled.

To install, assemble the throttle stem and valves, leaving the screws loose at first. Assemble each valve in the same barrel according to the marks previously made. With the valves held closed, hold the throttle body to the light and check the amount of clearance between the valve and body. If the clearance is excessive at any particular section of the valve, shift the valve in the shaft until it fits the barrel with the least amount of light showing around the edge. Fasten screws securely.

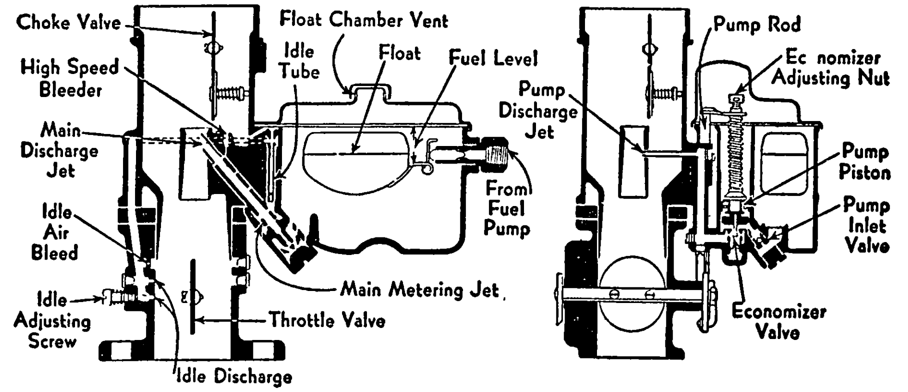


Fig. 435 STROMBERG SINGLE BARREL CARBURETORS. Models BXO, AX, EX with mechanically operated power system. Models BXOV, BXVD and EXV are the sam except they have vacuum operated power systems

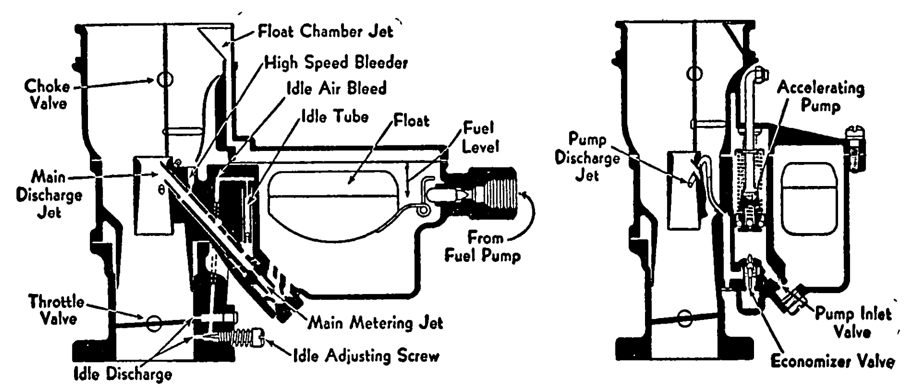


Fig. 436 STROMBERG DUAL CARBURETOR. Model EE

SERVICE PROCEDURE

STROMBERG AA SERIES DUAL CARBURETOR

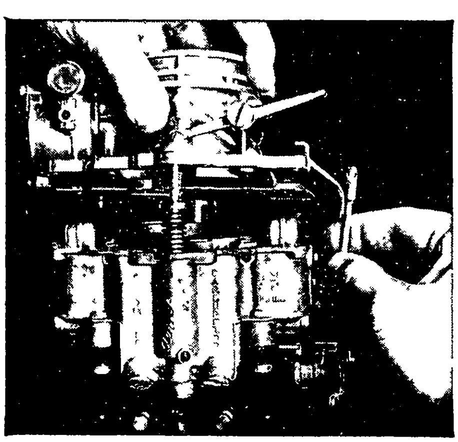


Fig. 437 Rem ve gas lin c nnecti n and strainer. Disc nn ct ch k and pump r ds. Remov pump fulcrum screw (left-hand thr ad), c ver screws and air h rn with fl at attach d. Rem ve and scrap accel r- ating pump pist n

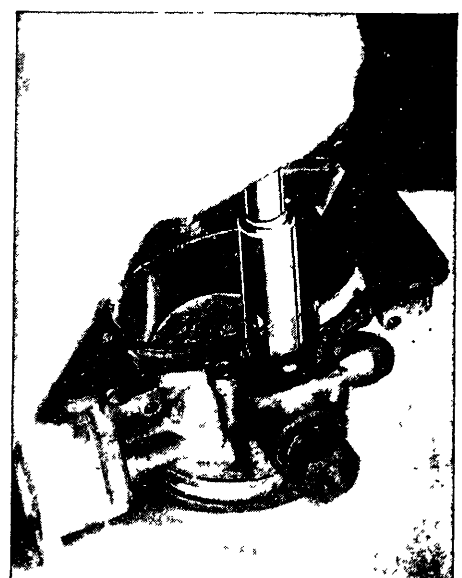


Fig. 438 R m v fl at fulcrum pin and fl at, and needl valv seat. Scrap needle and seat and air h rn gasket

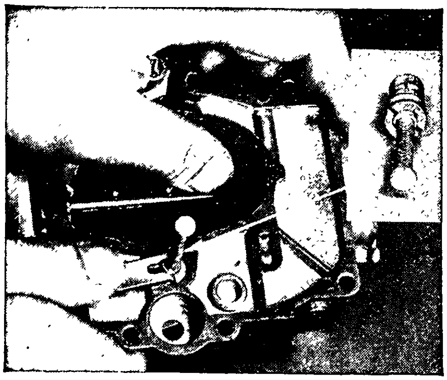


Fig. 439 If carburetor is equipped with aut matic ch ke, remove these parts; then r m ve vacuum piston. (See *Automatic Choke* chapter)

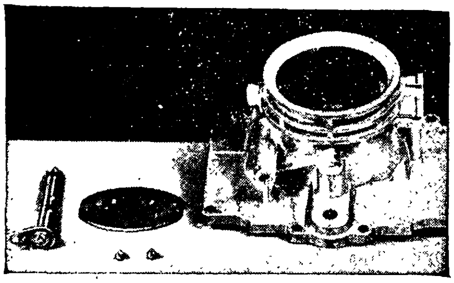


Fig. 440. Rem ve choke valve and stem fr m air horn

Fig. 441 Rem ve main discharge jet plugs and met ring jets. Scrap metering jets

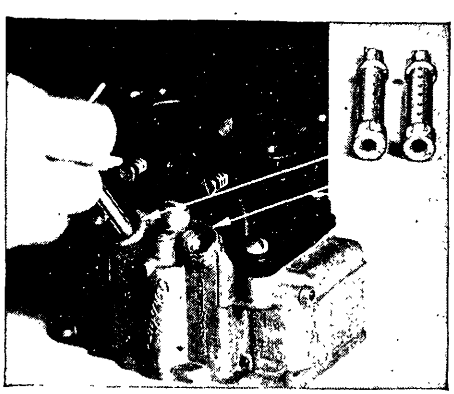


Fig. 442 R m v main discharg jets by scr wing t l T-24967 int bas of j t. Pull j ts fr m body. Thr ads f rmed in j t by to l will n t eff ct m t ring charact ristics of jet

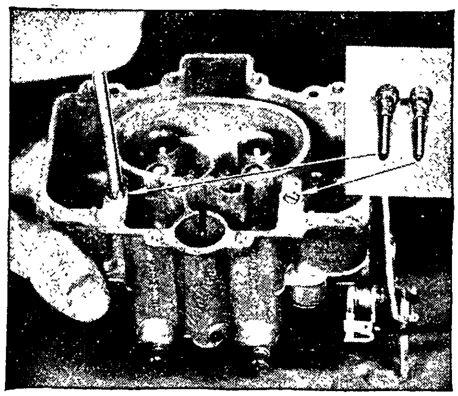


Fig. 443 Remove idle tubes (scrap)

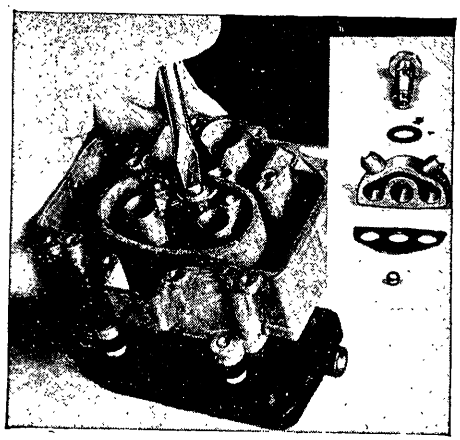


Fig. 444 Remove pump dischasge nozzle screw, nozzle and gasket. Place hand on top of main body and invert body to catch check ball. Scrap gaskets

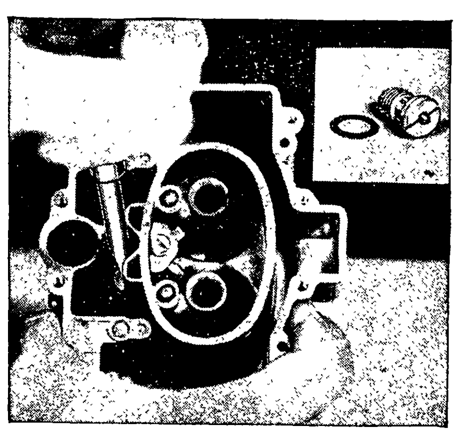


Fig. 445 With larg screw driver, rem ve pow r by-pass j t and gask t. Scrap b th parts. In AA carburet rs using two by-pass jets, th n with th l ng r stem valve is f r the pow r syst m, and the one with the sh rt r st m valv is f r th accelerating syst m

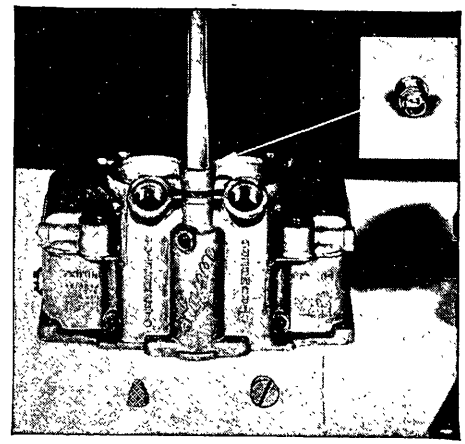


Fig. 446 Remove body screws and disassemble main body from thr ttle b dy. Scrap gasket

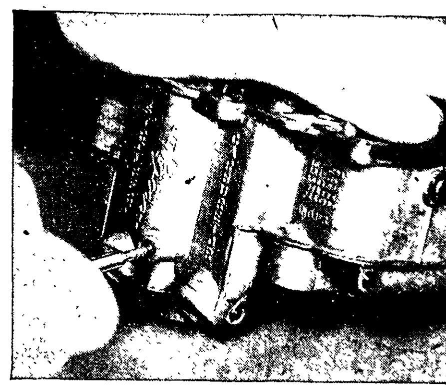


Fig. 447 Remove all lead ball plugs (use tool T-25052) and taper drive plugs fr m main and throttle bodies. B car ful not t damage plug seats in b dies

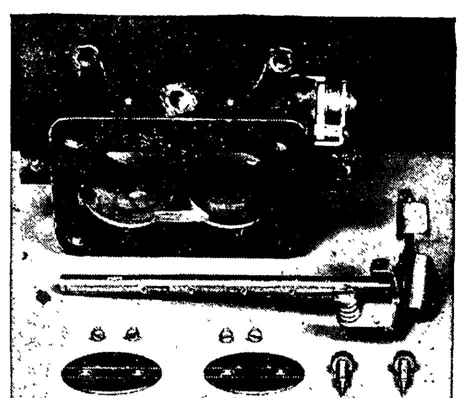


Fig. 448 Remove idle needle valves and springs. Scrap ne dl valves. Mark thr ttl valves and barr ls as utlined in t xt s each valv will b reassembled in same barrel. Th n r m v valves and thr ttle shaft. Insp ct all parts as utlined in text and in r assembling us all parts included in Repair Kit and any additi nal that inspecti n sh w d t b unfit f r further use

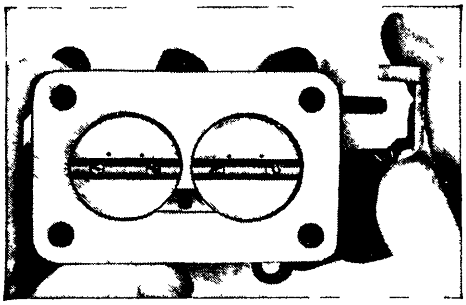


Fig. 449 Assemble throttle stem and valves (see instructions in text). Then seat ne dle valves lightly with fingers and turn n full turn off seat

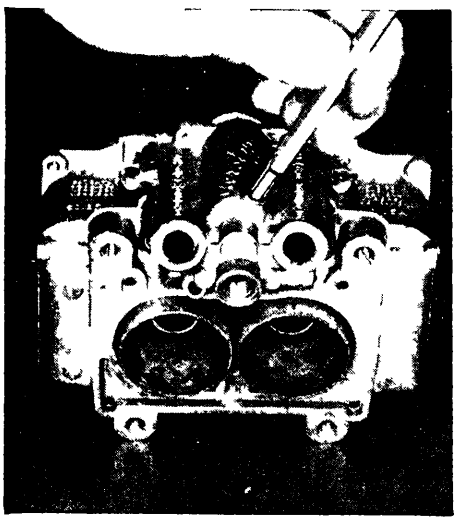


Fig. 450 Assemble lead ball plugs in main body

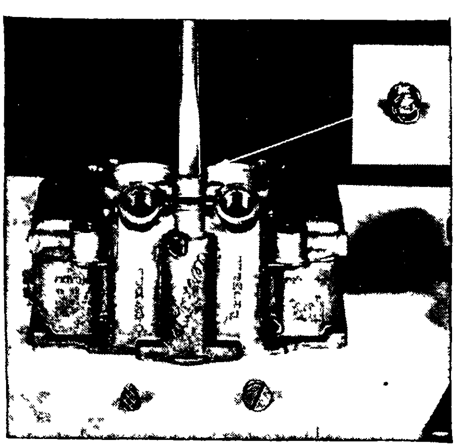


Fig. 451 Assembl n w pump inl t ch ck valve

Fig. 452 Assemble strainer, using tool T-25097. Place strainer over rounded end of pin

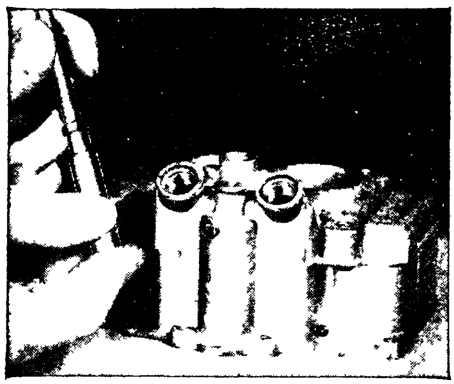


Fig. 453 Insert strainer in tubular section of tool

Fig. 454 Remove pin and place tubular section in main body, then use reverse end of pin to slide strainer into place. Assemble plug

Fig. 458 Assemble ch k shaft and valv , being certain that valv fits as evenly as p ssible ar und entir edge, oth rwis hard starting may r sult

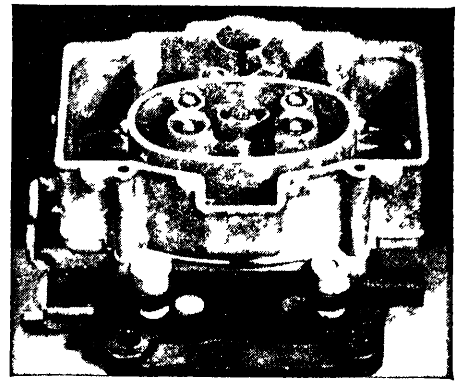


Fig. 455 Assemble main body and thr ttle body. Assemble main discharge j ts (t l T-24967). Be sure they are p siti n d s that flat surface of jet is parallel with direction of air flow. Use new lead gasket if one was originally supplied (s me mod ls do not have gasket). Assemble main m t ring jets (tool T-24924) and main j t plugs

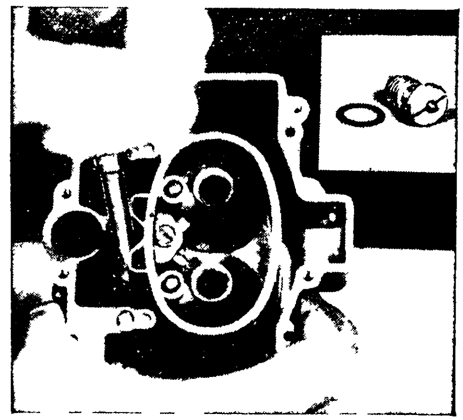


Fig. 456 Assemble power by-pass jet and gasket

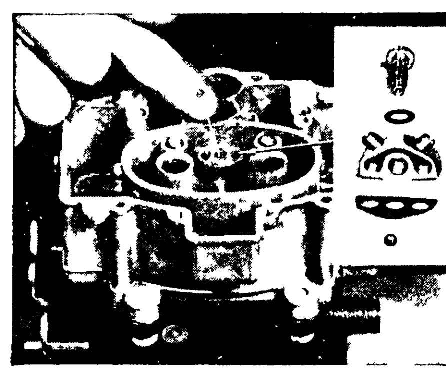
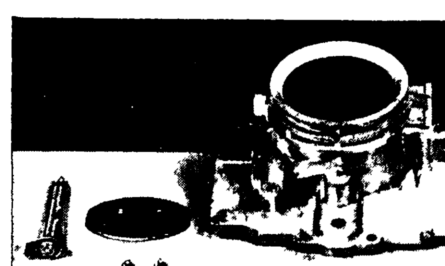


Fig. 457 Assemble pump outlet ball ch ck valve, nozzle gasket, nozzle, gasket and nozzle scr w



SERVICE PROCEDURE

STROMBERG BXO SINGLE BARREL CARBURETOR

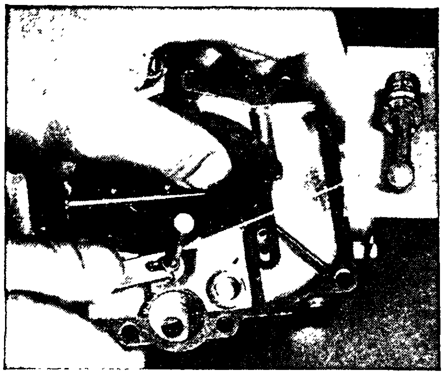


Fig. 459 With t o o l T-24733, assemble vacuum p w r piston. Hold tool flat against gask t surface to avoid damage to piston r t l. Do n t lubricate piston or its cylinder. Pist n must operate freely without lubrication

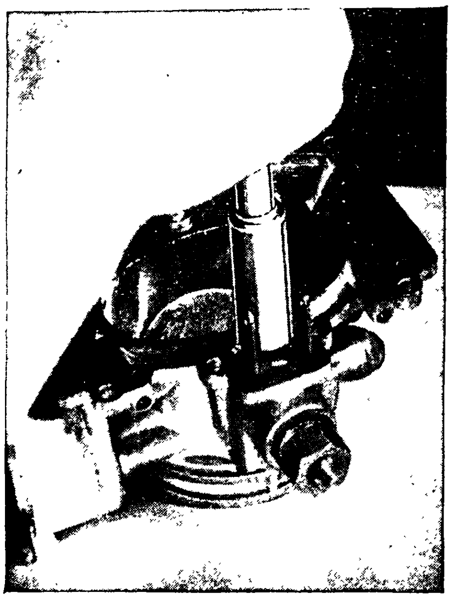


Fig. 460 Assemble float needle valve seat, gaskets and hanger (use tool T-20140). Assembl fl at needle valve and clip to float lever

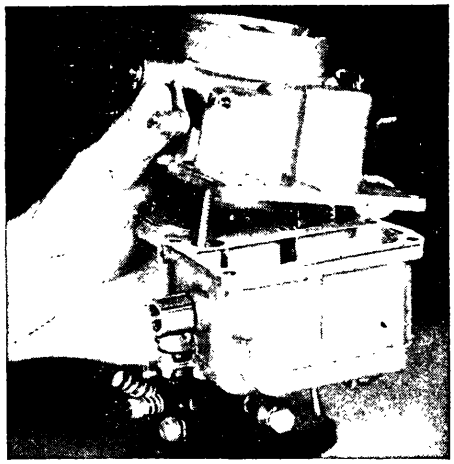


Fig. 465 R e m o v e choke fast idle rod, cover screws and air horn

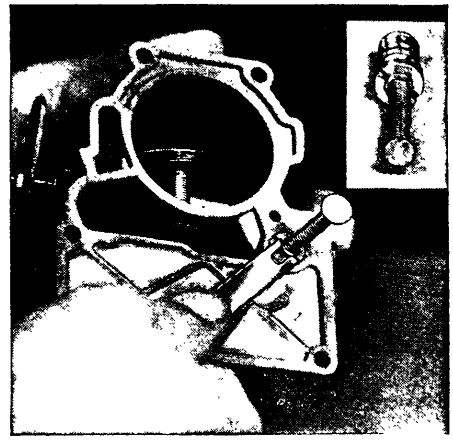


Fig. 466 Remove vacuum piston (use t ol T-24733). If c a r b u r e t o r has aut matic choke, remove the parts before proc eding

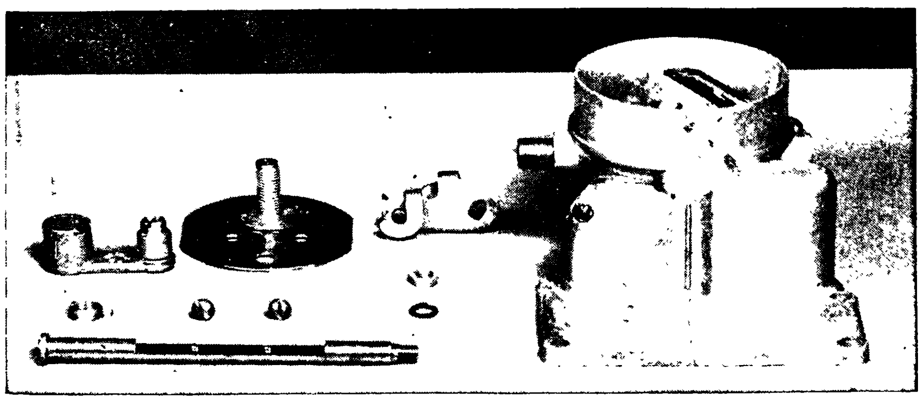


Fig. 467 Remove choke valves and related parts. Remove choke stem together with lever and spring

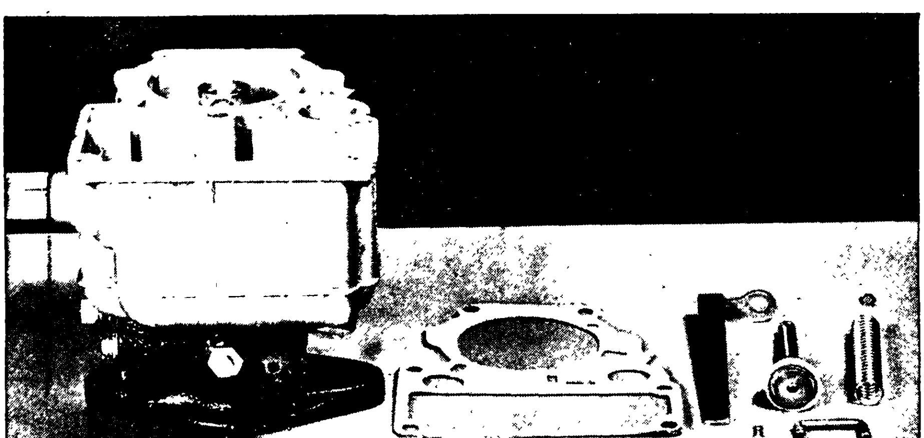


Fig. 468 Rem ve pump and r lated parts

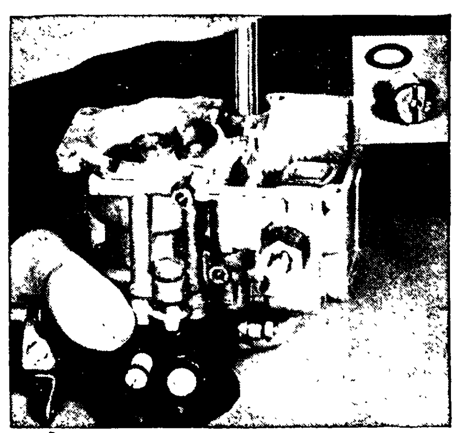


Fig. 469 Remove pump by-pass jet and gasket. Scrap b th parts

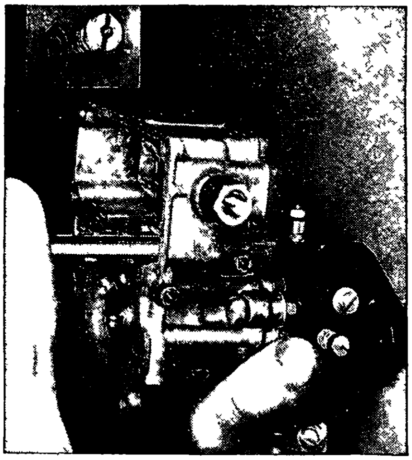


Fig. 470 Rem v power by-pass jet (scrap)

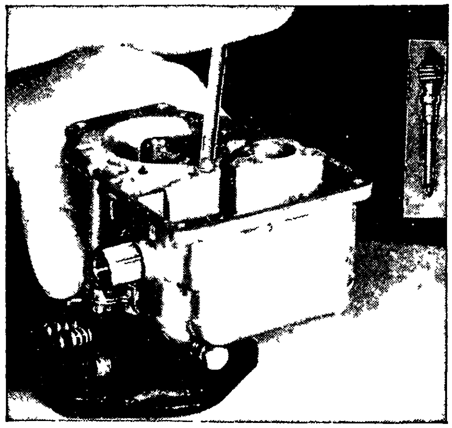


Fig. 471 Remove idle tube (scrap)

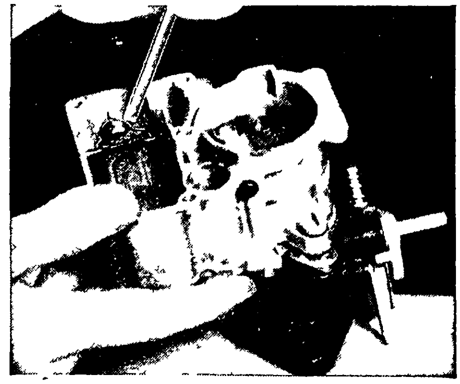


Fig. 472 Remove float needle valve and seat (scrap parts)

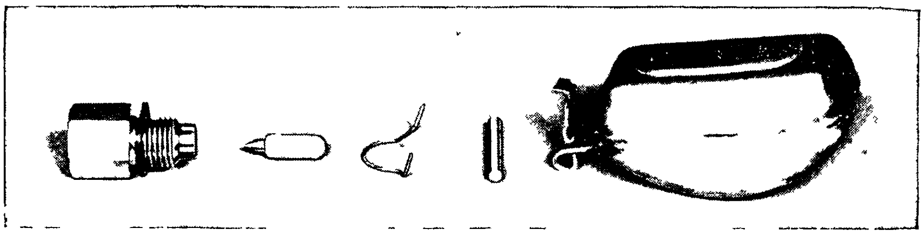


Fig. 473 Remove float fulcrum clip and take out float

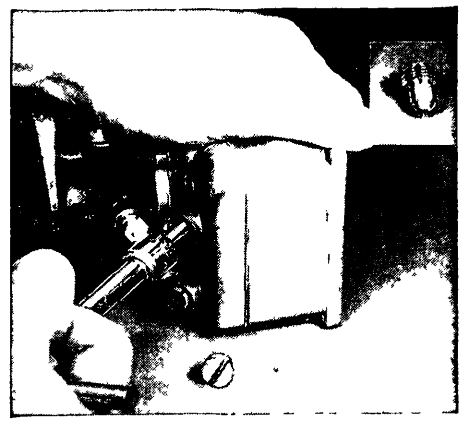


Fig. 474 Remove main discharg j t plug (t o o l T-19099) and metering j t (t l T-24924). Scrap met ring jet

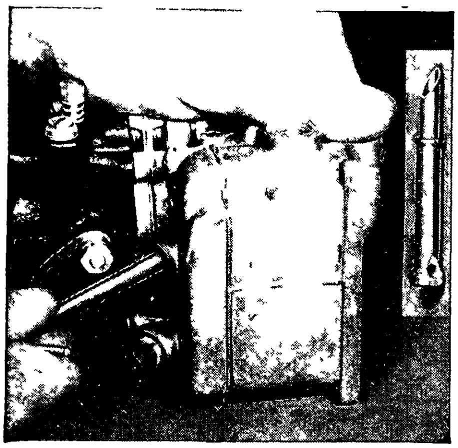


Fig. 475 R m ve main discharge jet by scr wing t l T-24967 into base of jet. Pull jet from body. The threads formed by th t l will n t effect the metering characteristics of the jet

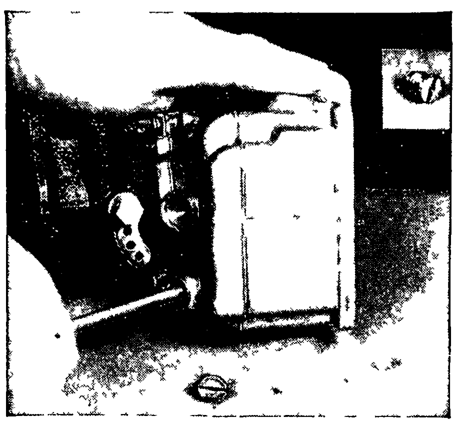


Fig. 476 Remove pump inlet check valve plug and valve. Scrap valve. Disassemble main body from throttle body

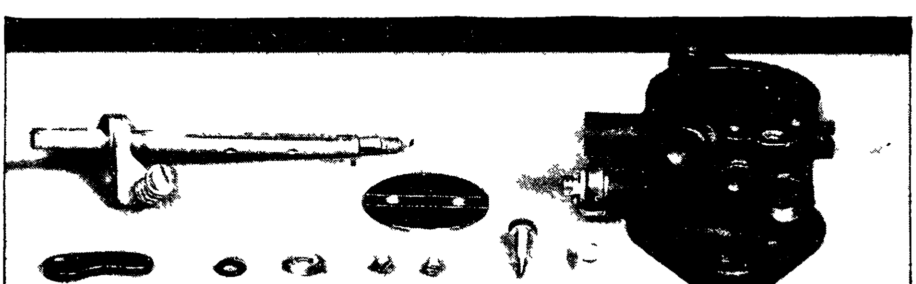


Fig. 477 R m ve idle needle valv (scrap). With a scriber make lin s n the valve al ng b th edges of th shaft s that the valv can b r ass mbl d in the same p siti n. Then rem v thr ttle st m nut, pump lever, thr ttle valv and stem

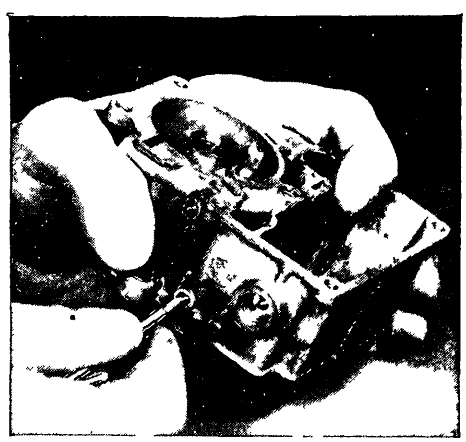


Fig. 478 Rem v all lead ball plugs (use t l T-25052), taper drive plugs and screw plugs fr m main and throttl b dies. B careful n t t damage seats in main b dy. Inspect all parts as utlined in text and use all parts included in th R pair Kit and any additi nal f und t be unfit for furth r use

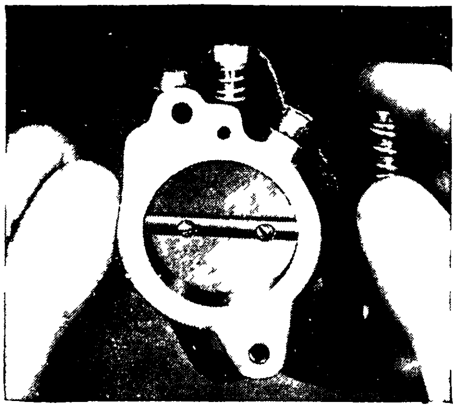


Fig. 479 Ass mble throttle stem and valve according to markings previously made. H ld valve cl sed and hold throttle body t light t check amount of clearance betw en valve and body. If clearance is excessive at any particular section, shift the valve until it fits the barrel with the least amount of light showing. Fasten screws securely

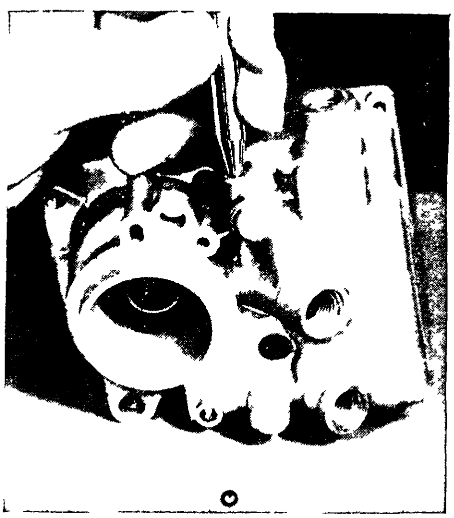


Fig. 480 Assemble lead ball plugs and tap r drive plugs, using ball set tool

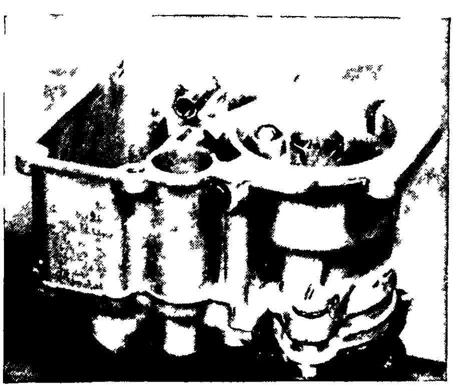


Fig. 481 Assemble main b dy and spac r nto thr ttl b dy, using new gaskets. Assembl main discharge j t (tool T-24967). P siti n jet s that its flat surface is parallel with directi n of air flow

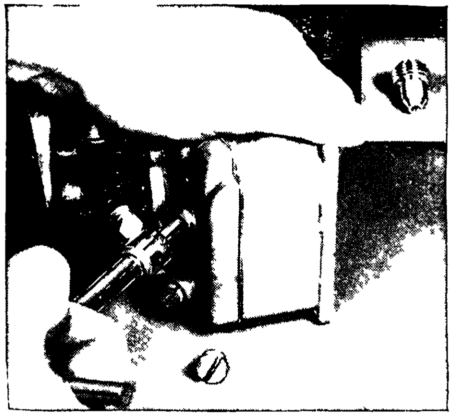


Fig. 482 Assemble m a i n metering j e t (tool T-24924). Assemble main jet plug. The shoulder of the plug is tapered and fits into tapered seat, thereby making a gasket unnecessary

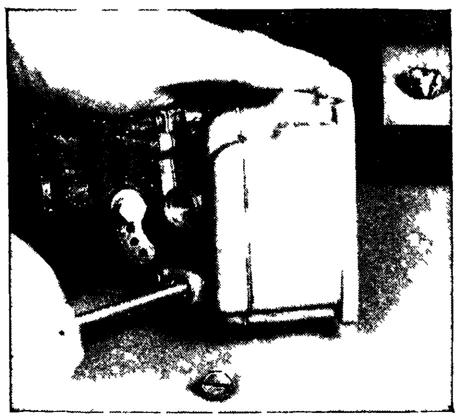


Fig. 483 Assemble pump inlet check valve and plug

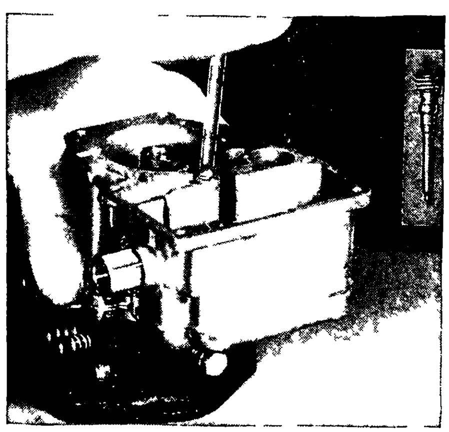


Fig. 484 Assemble idl tube. Use screw driver having small n ugh blade t av id damaging countersink in main b dy. T larg a screw driver will make a burr on th gasket surface

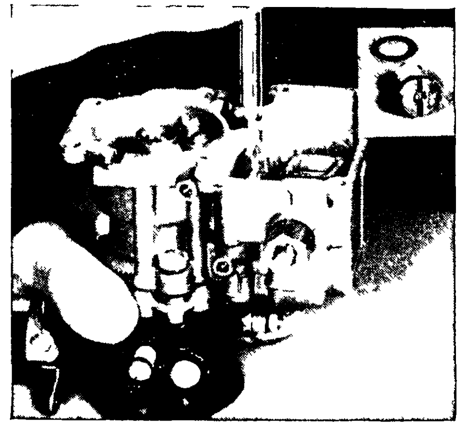


Fig. 485 Assemble pump by-pass j t and gasket. This jet is distinguished fr m p w r by-pass jet by the fact that the valve st m does not extend into th sl t n the pump by-pass j t

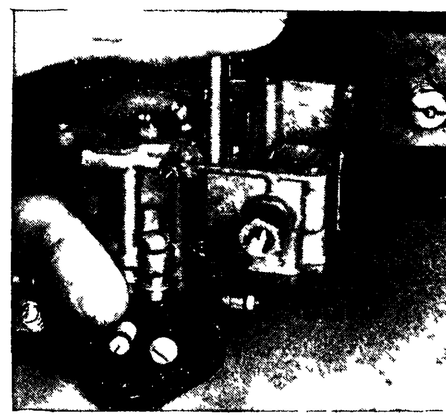


Fig. 486 Assemble power by-pass j t and gasket. In the power by-pass jet th st m extends above the t p f the jet

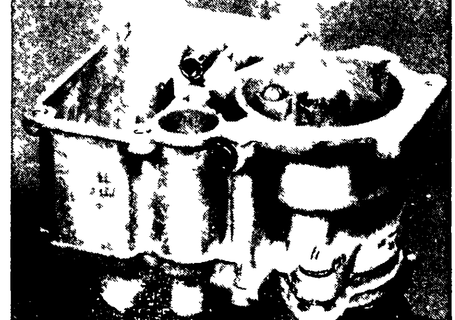


Fig. 487 Assemble float needl valv seat and gask t

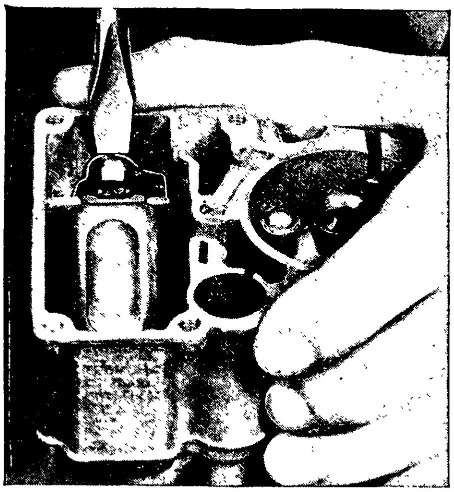


Fig. 488 Assemble float and related parts

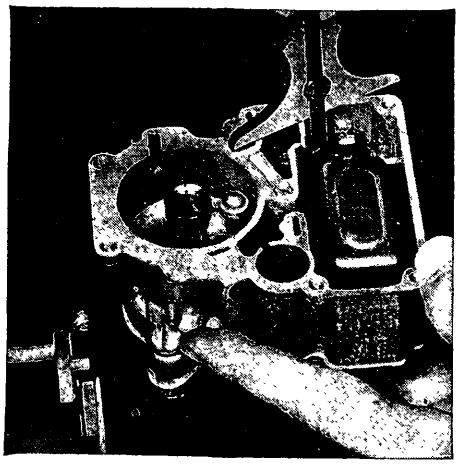


Fig. 489 Check fuel level as directed in t xt. If a change is necessary, use tool T-24733 and b nd float lever as required

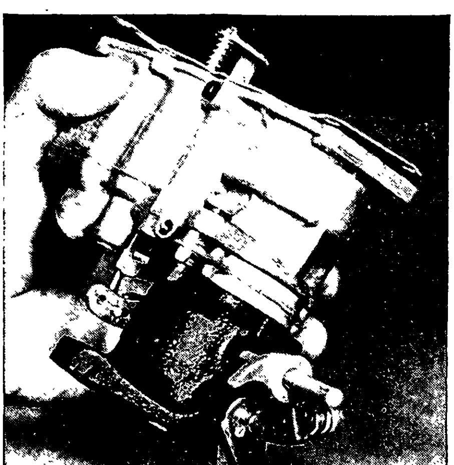


Fig. 490 Assemble pump pist n int b dy, making sure th re ar n creases n edge of l ather. Plac spring n pist n r d. Plac gasket n b dy and ass mbl pump r d. Assemble pump link in rod and l v r with groove in pump link assembled in lev r. Place hairpin c tter in gr ve in lower nd f pump link

Fig. 491
Place choke return spring and lever on shaft and assemble shaft into air horn. Assemble choke valve so that least amount of light is showing around edge of valve when closed. Assemble fast idle rod lever lockwasher and nut

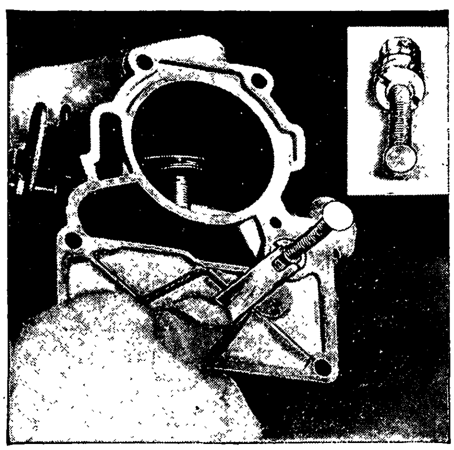


Fig. 492 With tool T-24733 assemble vacuum piston. Do not lubricate piston or its cylinder. Hold tool flat against gasket surface to avoid damage to part or tool

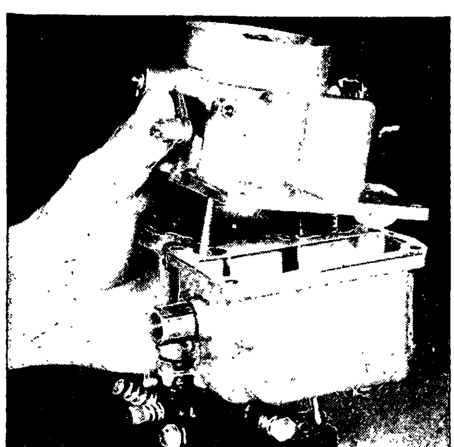


Fig. 493 Ass mbl air h rn n main b dy. C nnect fast idl r d and make c rtain that linkage m ves fre ly

STROMBERG ADJUSTMENTS

FUEL & FLOAT LEVEL

AA Series—Figs. 493A-B-C-D. The fuel level in these carburetors is correct if, with the engine idling, the fuel level corresponds to the bottom of the sight plug hole. This applies to all models except Buick 1938, '39 and '40 when level is checked while carburetor is on the manifold, in which case, the level should be $\frac{1}{32}$ inch above the threads of the sight plug hole.

CAUTION—When checking the fuel level with the engine running, do so only with the air horn in place, as there is grave danger of personal injury or fire if a backfire through the manifold occurs.

If the fuel level is incorrect, remove the air horn and hold it inverted. Place the float gauge (tool T-24971) on the cover gasket. Bend the float lever arm until the top of the vertical guides of the gauge are flush with the top of the floats. The float guides should also be parallel with the side of the floats without drag.

AX, BX, EE, EX—The fuel level should be as specified in the *Stromberg Adjustment chart*. This dimension is measured below the top surface of the float chamber with the gasket removed and engine idling.

The fuel level should be measured with a depth gauge, Fig. 489. When

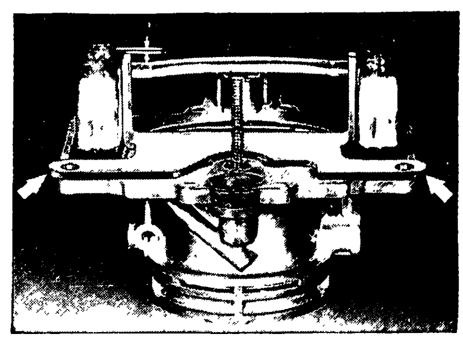


Fig. 493A Check float setting with gauge shown and according to instructi ns given in text

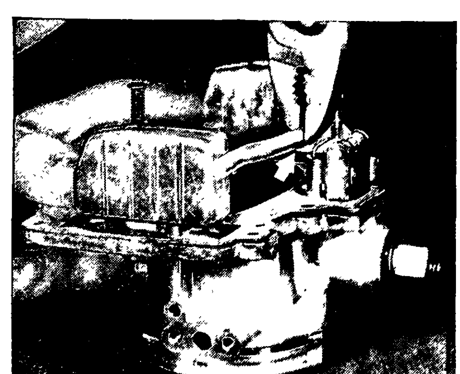


Fig. 493B If float p siti n has t b chang d, bend cent r secti n f fl at l ver with pliers as shown

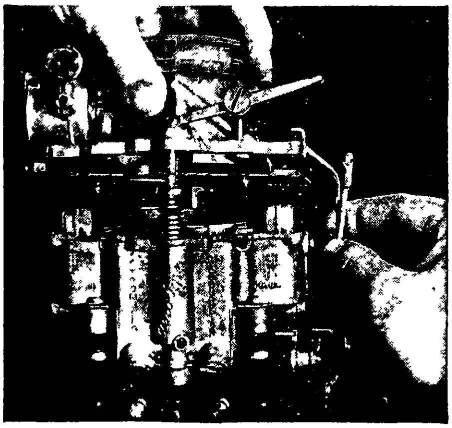


Fig. 493C Assemble pump piston into air h rn. Assemble air horn onto main body, making sure pump p i s t o n is free from cr ases r curled edges when placed into cylinder. Attach cover screws

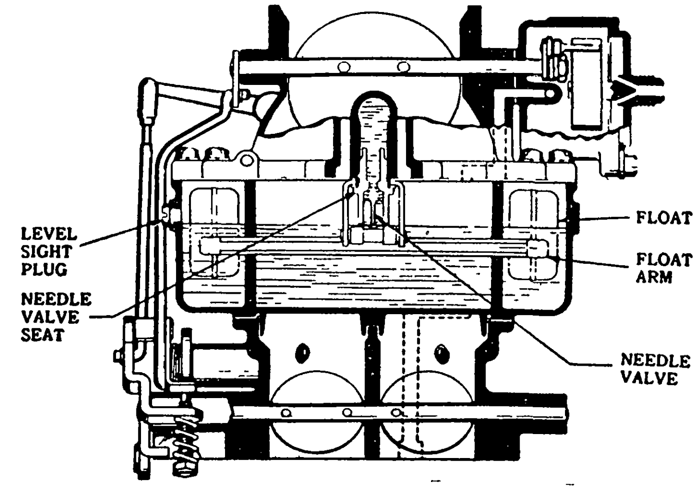


Fig. 493D After checking fuel level as outlined in text, assembl pump rod and choke rod. Adjust choke rod according to specificati ns given in *Stromberg Adjustment* table

checking, use care not to touch the float and take measurement about ⅛ inch away from the side of the float chamber.

If a change is required, bend the float lever arm to the desired position.

IDLE ADJUSTMENT

DUAL CARBURETORS — Run the engine until thoroughly warm and choke valve is wide open. Set the throttle stop screw so the engine runs at a speed equivalent to 7 or 8 mph in high gear. Adjust the two idle screws until the engine runs smoothly without rolling or stalling at this speed. Adjust one barrel at a time. Turn the screws clockwise to lean the mixture and counter-clockwise to enrich the mixture. If a smooth idle is not obtained, remove the screws and check for dirt around the screw seats.

SINGLE CARBURETORS—Adjustment is made in the same manner as for dual carburetors except that only one idle needle valve is used.

ANTI-STALL DEVICE DODGE 1939-52

BXOV—On Dodge cars with Fluid Drive, the carburetor is equipped with a built-in dash-pot, Fig. 494, which is designed to close the throttle slowly. When the engine is under load and throttle depressed, the dash-pot piston is in the upward position and the chamber is full of fuel.

When the throttle is released and the linkage returns to its idle position, the piston tends to return to the lower part of the chamber. However, in order for the piston to do so, the fuel must be discharged through the restricted opening of the dash-pot check valve. This restriction retards the closing of the throttle and avoids a too rapid return to idle, which could cause the engine to stall.

The normal travel of the dash-pot piston should not be less than $\frac{5}{16}''$ nor more than $\frac{11}{32}''$ with all slack removed from the linkage. To adjust, turn the adjusting screw as required. The distance may be checked by placing a rule along the piston stem, allowing the rule to rest on the casting alongside of the stem retainer. Then move the linkage up and down by hand, noting the amount of travel indicated by the rule.

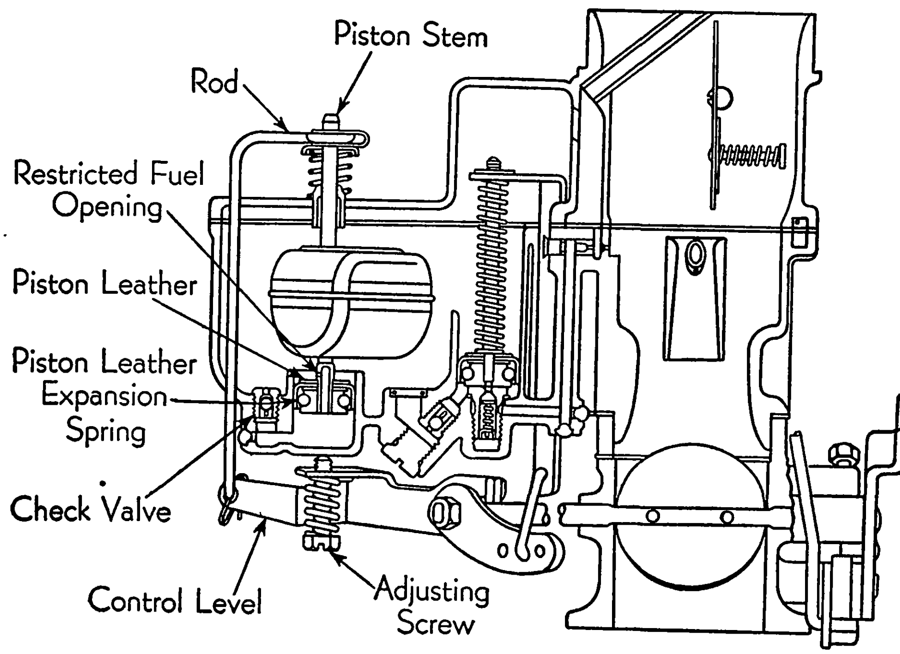


Fig. 494 STROMBERG BXVD. Slow closing throttle device. Later m dels d not hav spring on dash-pot piston stem

DASHPOT & KICKDOWN SWITCH DODGE 1949-52 WITH AUTOMATIC TRANSMISSION

BXVES-3—The purpose of the dashpot, Fig. 494A, is to retard closing of the throttle to prevent stalling upon sudden release of the accelerator pedal. Its function is the same as the anti-stall device described above for BXOV carburetors used on Dodge cars with Fluid Drive.

When the car speed is below 8 mph in the low speed range and below 15 mph in the high speed range, the transmission governor points close. The magnetic unit is electrically energized and its core attracts the ball check onto its seat. When the throttle is allowed to close, fuel from the dashpot cylinder is then forced through channel 9 up through the vertical channel and discharges only through orifice 10 into the float chamber. This action retards the closing of the throttle valve.

The adjustment screw controls the amount of travel of the dashpot piston. It is normally adjusted to provide $\frac{13}{32}''$ to $\frac{7}{16}''$ travel.

When the throttle is allowed to close at car speeds above 8 mph in the low speed range or above 15 mph in the high range, the transmission governor points are open and the dashpot solenoid is not energized. The dashpot piston moves downward and pressure closes the inlet check valve. Fuel is then forced through the lower channel and discharged at orifices 5 and 10 into the float chamber, with no retarding of throttle movement.

KICKDOWN SWITCH—The purpose of the kickdown switch, Fig. 494A, is to provide the operator with optional con-

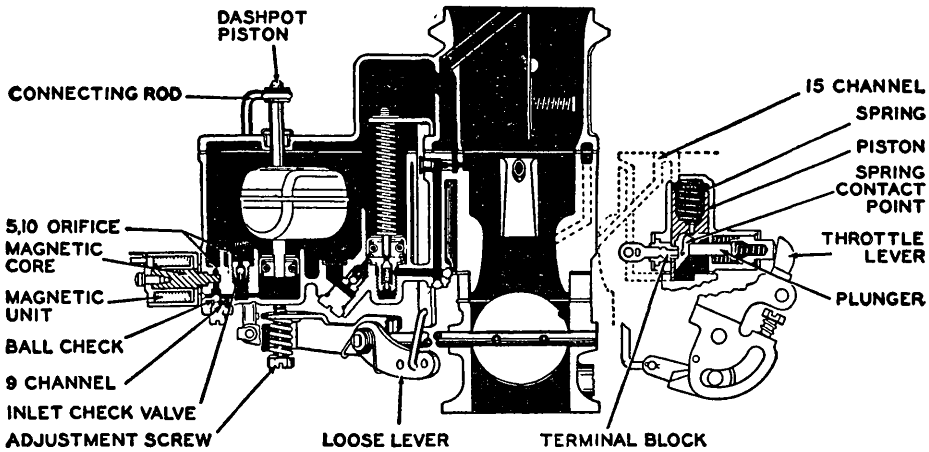


Fig. 494A Schematic view of dashpot and kickdown switch used on BXVES-3 carburetors on Dodge cars with automatic transmission

trol of the transmission to secure the greatest possible acceleration under all conditions.

Below speeds of 35-40 mph, greater acceleration is possible in third gear. Therefore, when traveling less than 35-40 mph, and quick acceleration is desired, the kickdown switch will automatically return the transmission from fourth to third gear. This is accomplished by quickly depressing the accelerator pedal to the floor. The circuit to the transmission solenoid is then completed through the plunger, spring contact point on the piston and the terminal block. This causes the transmission to shift down immediately and automatically. The transmission will remain in third, once shifted, until the accelerator is released.

At car speeds above 35-40 mph, greater acceleration is possible in fourth gear, so the switch prevents any shift down upon acceleration. Channel 15 leads from the large venturi to the cylinder above the pistion. At higher speeds the air velocity through the venturi creates sufficient suction to raise the piston against the force of the spring. The contact point moves with the piston, leaving a gap or space between the end of the plunger and the contact block when the throttle is fully depressed. Thus the circuit is open and the transmission remains in fourth gear.

No adjustment of the switch parts is necessary for the proper functioning of the switch. However, it is important that all parts are thoroughly clean to permit free travel and make good contact at the proper time. The tang or ear of the throttle lever should be adjusted to provide $\frac{1}{32}$" minimum travel of the switch plunger when the throttle has reached wide open position. With the throttle valve in wide open position, the switch plunger should have a minimum of $\frac{1}{64}$" over travel.

FAST IDLE DEVICE

This device consists of a fast idle cam operating in conjunction with the automatic choke to provide the proper throttle opening for a cold engine, thereby preventing the engine from stalling during the warm-up period. Consult the *Stromberg Adjustment* chart and adjust as follows:

AA-1, AA-2, AAV-1, AAV-2—Buick, Fig. 495. The fast idle control consists of a thermostatically operated cam mounted on the intake manifold heat jacket. This cam serves as a stop for the throttle adjusting screw.

If adjustment is required, loosen nut "E" and rotate the cam hub in the direction necessary to place the pointer directly above the nut "E". A momentary opening of the throttle is necessary to allow the cam to adjust itself for any temperature position. This is because the thermostat spring is not capable of rotating the cam while the idle adjusting screw is contacting the cam.

Warm up the engine. The throttle screw should now contact the cam on its thin portion and within the ¼" limit adjoining the first raised section. If not, rotate the pointer slightly. If necessary to move the pointer more than 5° from its vertical position, install a new cam assembly.

AAV-2, AAOV-1—Chrysler. With fast idle screw held against first step of fast idle cam, choke valve should be open so that the proper size drill can be placed between the valve and air horn. The amount of opening can be adjusted by changing the position of the rod in the ball joint.

AAV-16, AAV-26—Except on Buick models equipped with vacuum starter switch, adjust as follows: Hold the throttle stop screw on the high lobe of the fast idle cam. Close choke valve as far as possible. The opening that remains should be as specified in the adjustment chart. If not, bend the fast idle rod as required.

AAV-16, AAV-26—On Buick cars equipped with vacuum starter switch, proceed as follows: When checking the switch mechanism, the fast idle cam setting is automatically obtained. To check, hold a drill of the required size between the choke valve and air horn. In this position, the locking lever, Fig. 496, should just clear the loose lever while throttle is opened and closed. If not, bend the fast idle rod as required.

AA-25, AAV-25—The fast idle feature is accomplished by a passage entering the throttle barrel below the throttle valve to feed additional fuel with closed throttle. The pull of the vacuum piston should be set in accordance with the choke valve opening.

Remove the drive plug from the passage and insert the shank end of a 34 drill. The choke valve should then be opened until the piston comes to rest on the drill. In this position, the choke valve should be opened so that the specified size drill (see Adjustment chart) can be placed between the valve and air horn.

On La Salle carburetors, change the position by loosening the nut between the lever and the piston link. On Cadillac carburetors, bend the lever between the choke valve and piston link.

BXO-26, BXOV-26—Packard and Studebaker, Fig. 497. On Studebaker 1940 and later models, as well as Packard, hold the throttle stop screw on the low lobe of the fast idle cam and against the step, as shown. Close choke valve as far as possible. The opening that remains should be as specified in the Adjustment chart. If not, bend rod at the point indicated.

On Studebaker 1938-39 models, adjust by bending the lip on the fast idle lever.

EE-1 & EE-22 on Buick—Follow same procedure outlined for AA-1 carburetors.

EE-1 on Oldsmobile—To adjust, screw the fast idle rod in or out of the ball joint to obtain the proper choke valve location.

EE-1 on Studebaker—On models having the combination fast idle rod and cam, screw the fast idle rod in or out of the ball joint to locate the choke valve properly.

On models having a separate rod and cam, adjust by bending the choke stem pin.

EE-3 on Packard V12—To locate the choke valve properly, turn the throttle stop screw in 6¾ turns beyond the point of contact with the ear of the fast idle weighted lever. The throttle valve must

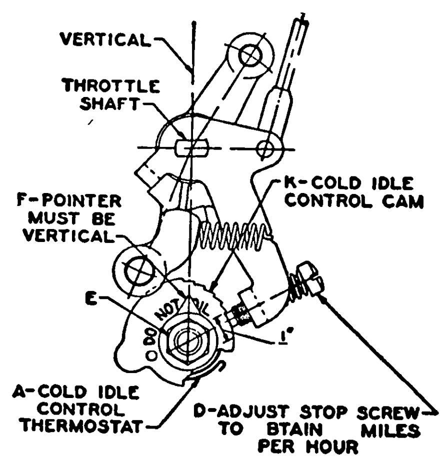


Fig. 495
STROMBERG AA-1, AA-2, AAV-1, AAV-2 on Buick.
Sh wing fast idle c ntrol

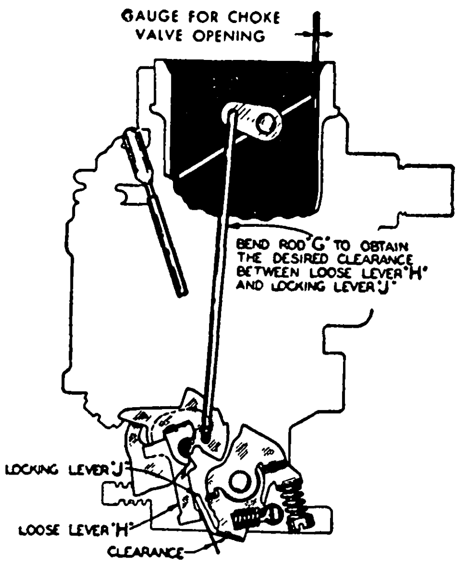


Fig. 496
STROMBERG AAV-16, AAV-26 on Buick. Showing starter switch and fast idle mechanism

be fully closed and all slack removed from linkage.

EE-15, EE-25 on Cadillac and La Salle—Follow same procedure outlined for AA-25 carburetors.

EE-16 on Packard—To locate the choke valve, bend the fast idle rod as required.

EE-23 on Packard—To locate the choke valve properly, adjust the set screw on the choke lever.

EX-22 on Oldsmobile—Screw the fast idle rod in or out of the ball joint.

EX-23 on Studebaker—Screw the fast idle rod in or out of the ball joint.

CHOKE UNLOADER

On some models that are equipped with automatic choke, if the engine should become flooded, the choke valve

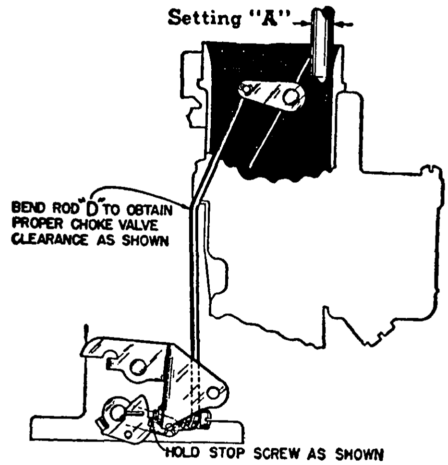


Fig. 497
STROMBERG BXO-26, BXOV-26 on Packard & Studebaker. Showing choke release and fast idle mechanism

can be partially opened by depressing the accelerator pedal to the full extent of its travel. In order to function properly, the choke valve must open to the dimension given in the *Stromberg Adjustments* chart.

To check, hold the throttle wide open and insert the correct size drill between the choke valve and air horn. If the drill does fit into the opening, adjust as follows:

AAV-16 & AAV-26: Bend ear of throttle lever, Fig. 498.

AAV-2 & AAOV-1 on Chrysler: Bend extended arm of fast idle cam.

BXO-26 & BXOV-26: Amount of opening controlled by fast idle rod (see Fast Idle Adjustment).

AA-25, AAO-161: Bend choke stem pin or deflooder rod.

EE-16 on Packard: To measure the choke opening, open the throttle wide from the *throttle lever side—not from fast idle lever side.* To adjust, bend ear of fast idle lever.

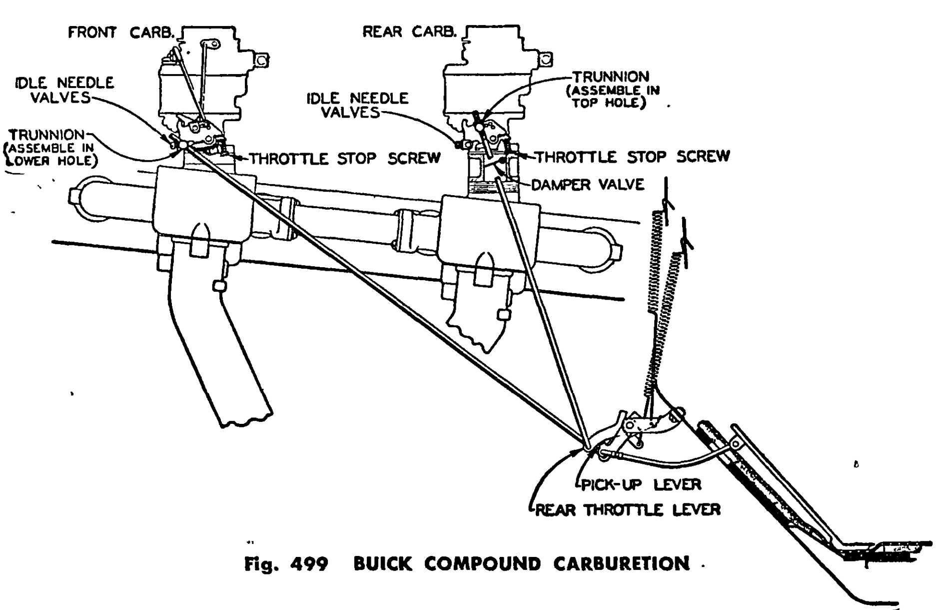


Fig. 499 BUICK COMPOUND CARBURETION

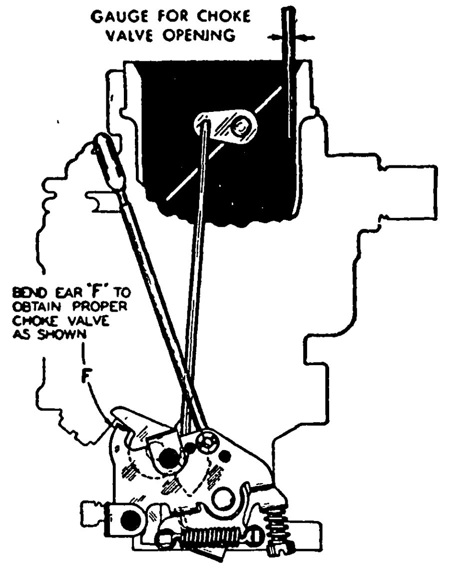


Fig. 498
STROMBERG AAV-16, AAV-26 Showing choke release m chanism

BUICK COMPOUND CARBURETION

On Buick engines with compound carburetion, two dual barrel carburetors are used. The front carburetor is a complete unit, while the rear carburetor contains only a float system, idling system and main metering system. The two carburetors are installed on one dual manifold, Fig. 499. The outside branch of the manifold is connected to the outside barrel of both carburetors, and feeds cylinders 1, 2, 7 and 8. The inside branch is connected to the inside barrel of both carburetors and feeds cylinders, 3, 4, 5, 6.

A damper valve is used between the rear carburetor and the manifold. An offset weight has a tendency to keep the valves in closed position. When the throttles of the rear carburetor are opened, the air flowing through the unit forces the damper valves open. The valves in the damper are not a tight fit in closed position and there is sufficient clearance to allow the idle system of the rear carburetor to function along with the idle system of front carburetor up to approximately 22 mph.

Moving the accelerator pedal beyond idle speed opens the throttle of the front carburetor only and it supplies the fuel mixture up to about 75 mph in addition to the fuel delivered through the idle system of the rear carburetor.

Additional movement of the accelerator pedal causes the pick-up lever to start opening the throttle of the rear carburetor. This allows air to flow through the rear unit which forces damper valves to open and rear carburetor begins to function. When the throttles of both carburetors are fully opened, the front and rear carburetors feed equally. With full throttle, the function of both carburetors varies with car speed as follows:

Below 15 mph in high gear the front carburetor main metering system is feeding mixture. Rear carburetor is not functioning.

From 15 to 20 mph in high gear the

damper valves begin to open. Front carburetor main metering system is functioning and rear carburetor main metering system is just starting to feed mixture.

From 35 to 40 mph in high gear, damper valves are wide open and both carburetor systems are functioning.

Throttle Rod Adjustment—Floor mat must be in place because it serves as a stop for "open" position of accelerator pedal. Disconnect rod from rear carburetor. If carburetor is not cold enough to cause the starter switch to make contact, move the choke rod to the closed position. Move the accelerator pedal to the floor mat and hold it down. Adjust the trunnion of the front carburetor rod, Fig. 499, so that the throttles of the front carburetor are wide open. Adjust the trunnion of the rear carburetor rod so that throttles are in wide open position.

IDLE ADJUSTMENT—Warm up the engine thoroughly and turn off the ignition. Back off both throttle adjusting screws until throttles are fully closed. Ends of adjusting screws should be set to barely contact the thin section of the cold idle cam on front carburetor, and throttle body on rear carburetor, *when throttles are fully closed.*

Turn each throttle adjusting screw ¾ turn clockwise to open each throttle the same amount. Turn idle needle valves "IN" on both carburetors until closed position can be felt. Do not force needle valves on their seats as it will damage them. Open each valve one turn. Turn on ignition switch and start engine. If either idle speed or idle mixture needs additional adjustment, turn each throttle adjusting screw the same amount in the desired direction, and each idle needle valve same amount in the desired direction. Turn each needle ⅛ turn at a time when adjusting mixture or speed.

If vacuum gauge is used, set idle needle valves so gauge will show one inch less than maximum reading.

TILLOTSON

Willy's 1935-36—Turn the main adjusting screw out, counter-clockwise, at least two full turns. Turn the idle adjusting screw in, clockwise, one full turn to its seat. Start the engine and run it until it is warm. Set the throttle to run the engine equivalent to a car speed of 25 to 30 MPH. With the engine running at this speed, turn the main adjusting screw clockwise a half turn at a time until the engine slows down for want of fuel. Then turn it in the opposite direction a quarter turn at a time until the maximum speed of the engine is obtained at the above throttle setting. From this point, lean the mixture by turning the main adjusting screw three quarters turn clockwise.

Close the throttle and with the engine running slightly faster than normal idling speed, turn the idle adjusting screw counterclockwise until the engine misses. Then turn the screw in the reverse direction until the engine fires evenly.

Float Level—To check the float level, remove the upper carburetor body. Set the float so that the distance from the bottom of the float to the face of the carburetor body is $1\frac{25}{32}$".

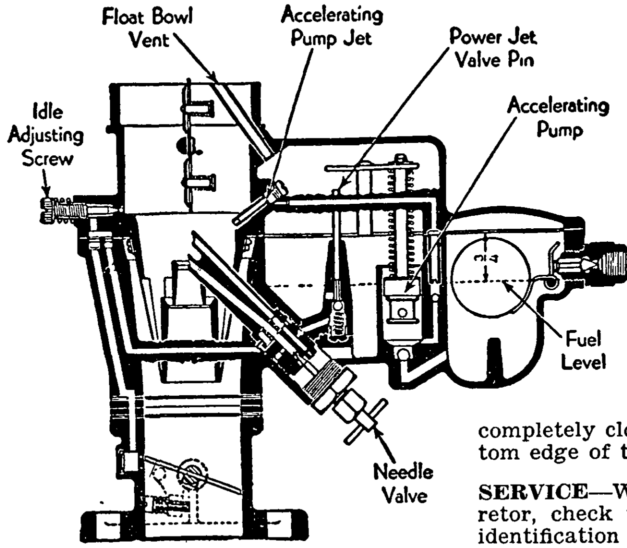


Fig. 500 TILLOTSON 1937-39 Willys

Willys, 1937-39—Fig. 500. To make an adjustment turn the needle valve in, clockwise, to its seat and then open it three complete turns. Turn the idle adjustment screw in, clockwise, to its seat and then open it ¾ turn. After the engine is thoroughly warm, and running at a speed approximately 25 MPH, turn the needle valve clockwise a quarter turn at a time until the engine misses for want of fuel. Then turn the needle valve counter-clockwise a quarter turn at a time until maximum speed is obtained. Then turn the needle valve ⅜ turn clockwise. Then adjust the idle screw. For average driving the needle valve should be 2⅜ turns open and the idle screw should be one turn open.

To set the float, remove the air horn and screws. Then bend the float lever so that the fuel level is exactly ¾ inch below the upper rim of the float bowl. Replace air horn and screws.

ZENITH

MODEL 228AV10

WILLYS, 1947-50—Figs. 501 through 506 illustrate the construction of this carburetor. It is a downdraft unit incorporating both primary and secondary venturi. The upper, pressed in section of the secondary venturi is sometimes called the discharge nozzle.

Balanced construction is also used, which is a method of venting the fuel bowl to maintain proper air-fuel mixtures even though the air cleaner may become restricted. This balancing is frequently referred to as an "inside bowl vent." A completely sealed bowl cover is essential in this type construction and six assembly screws are used to assure this seal.

A mechanically operated accelerating pump is used. The power jet or economizer system is controlled by engine manifold vacuum.

A two-hole idle system is used. The top edge of the throttle valve, when completely closed is .010" below the bottom edge of the upper idling hole.

SERVICE—When servicing the carburetor, check the numbers on the metal identification disc pinned to the top of the float bowl cover. Inside number, next to the pin, is the Zenith outline assembly number, and the one next to the outer edge of the disc is the vehicle manufacturer's.

When the carburetor is disassembled, clean all parts thoroughly with cleaning solution and rinse in solvent. Blow out all passages in the air intake assembly, fuel bowl assembly and throttle body. Be sure all carbon deposits have been removed from the throttle bore and idle port. It is advisable to reverse flow of compressed air in all passages to insure that all dirt has been removed. Never use a wire or drill to clean jets.

Replace the float if it is loaded with gasoline, is damaged or if the float axle bearing is worn excessively. Inspect top side of float hinge for wear where it contacts fuel valve needle.

Replace the float axle if wear can be detected on the bearing surface.

Replace the fuel valve seat and needle because both parts wear and may cause improper float level.

Inspect the point of the idle adjusting needle. This must be smooth and free of ridges.

Inspect the throttle plate for burrs or damaged edges. Never clean a throttle plate with a buffing wheel or a sharp instrument.

Replace the throttle shaft and lever assembly if the shaft is badly worn or if the lever is loose on the shaft.

Examine the accelerating pump for wear on the pump piston, rod or pump link hole. Replace with a complete assembly.

Replace the power jet valve because extent of wear cannot be determined by visual inspection.

Replace the vacuum cylinder assembly because extent of wear cannot be determined by visual inspection. Worn cylinders result in poor idling and power jet action.

Inspect the pump lever for wear in the pump link hole.

Inspect the air shutter for bends, burrs or damaged edges. See that the poppet valve is in good condition and works freely.

Check the air shutter shaft bearing surfaces for wear. See that the shaft

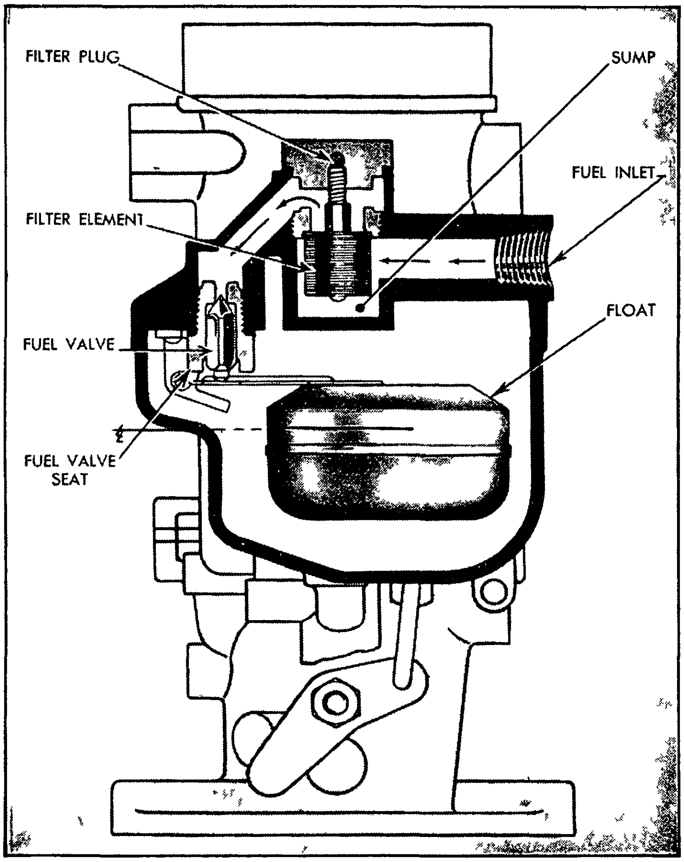


Fig. 501 Zenith 228 series. Float system

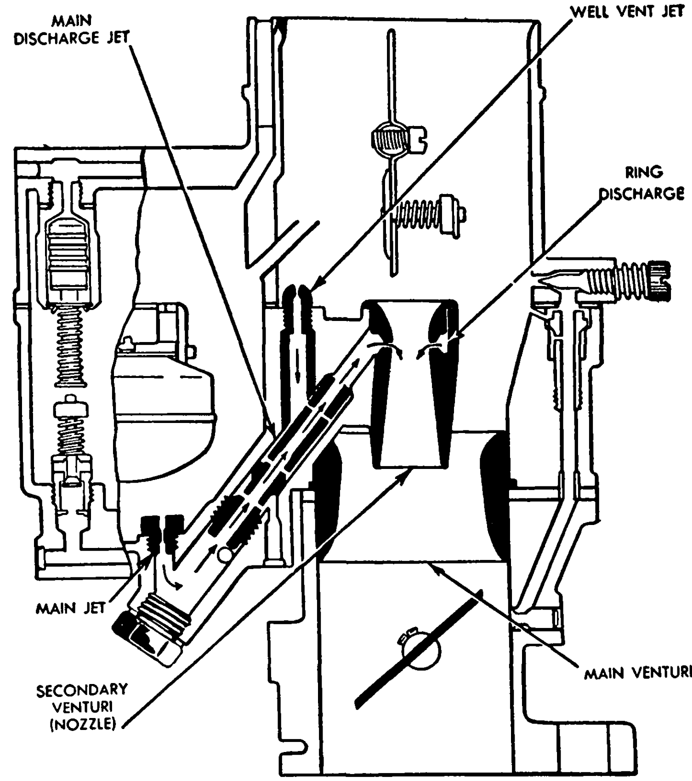
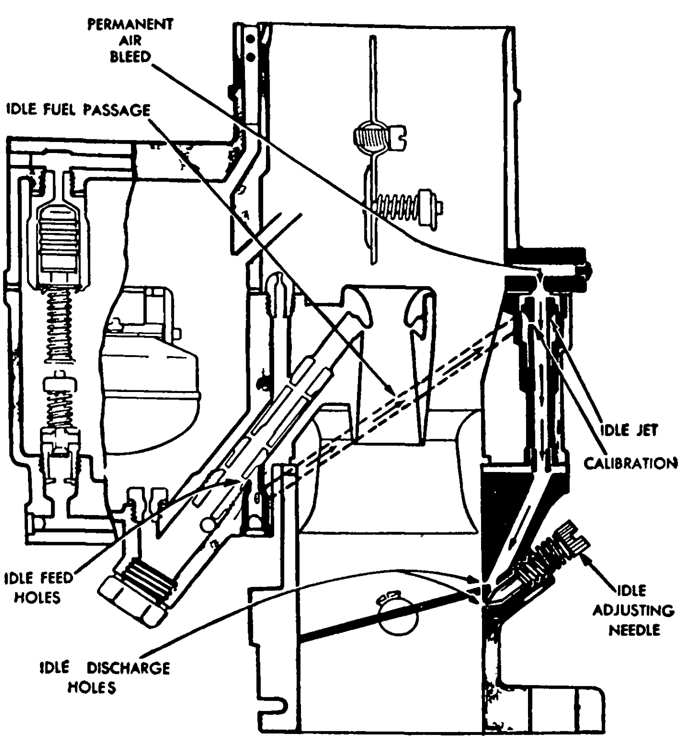


Fig. 503 Zenith 228 Series
High speed system (power jet not op rating)



TWO HOLE IDLE SYSTEM

Fig. 502 Zenith 228 Series. Idl system

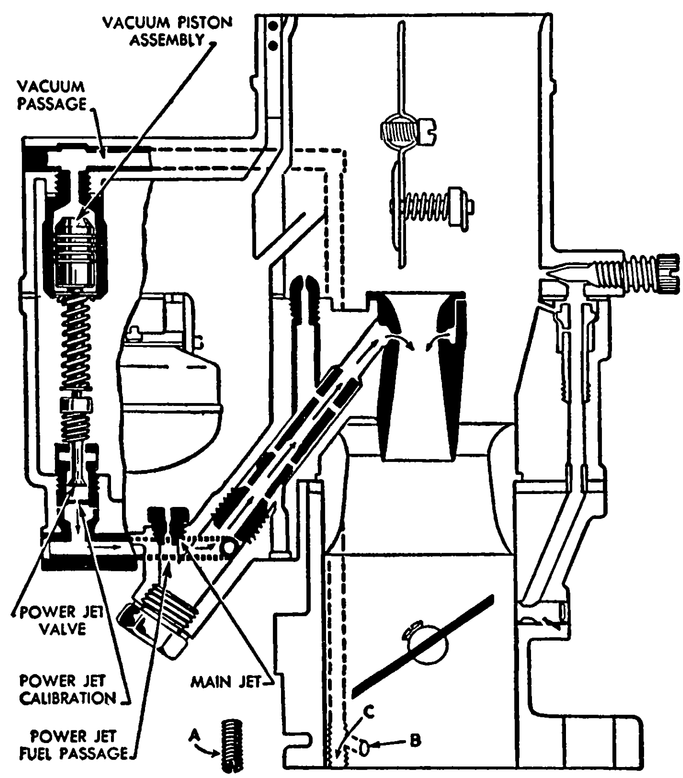


Fig. 504 Zenith 228 Series
High speed system (p wer j t p rating)

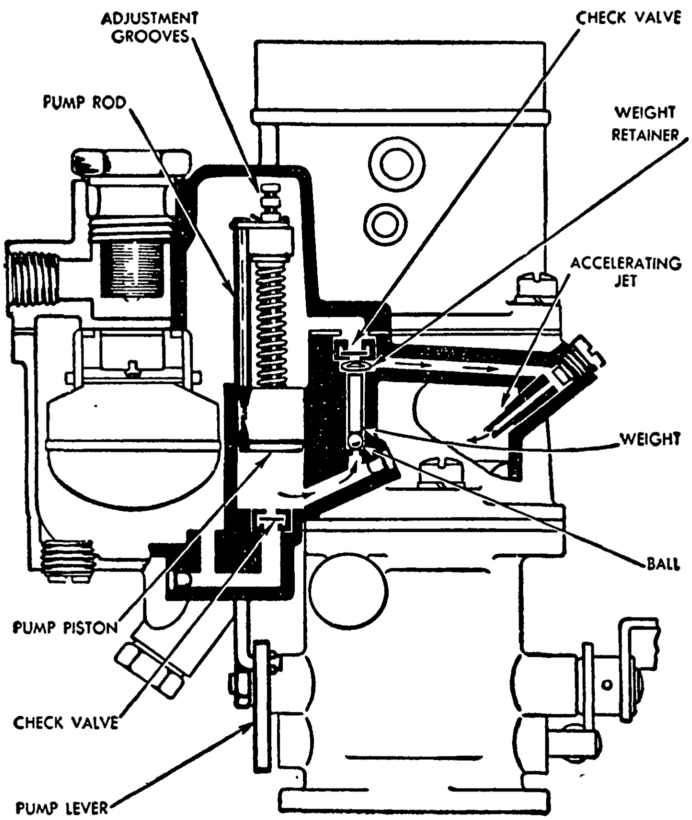


Fig. 505 Zenith 228 Series. Accelerating pump system

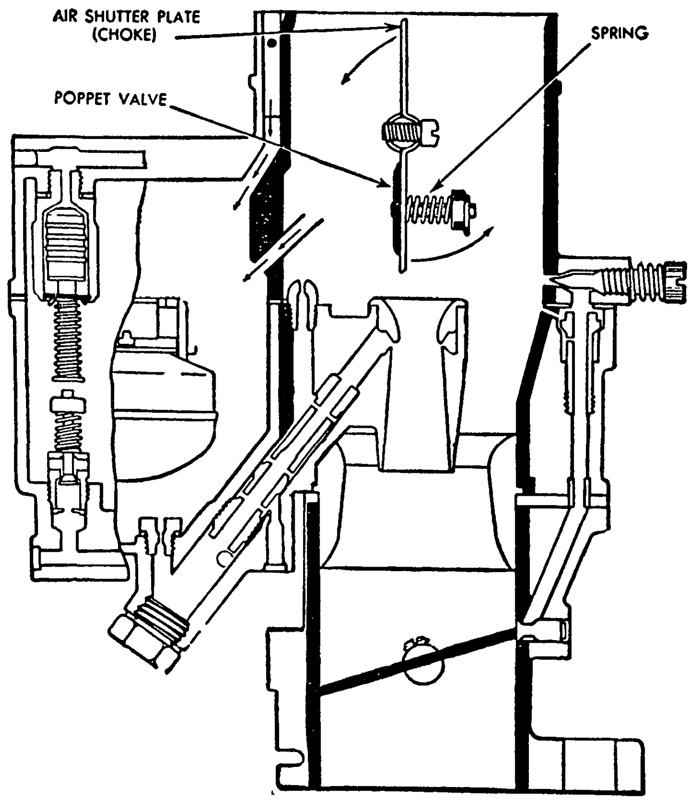


Fig. 506 Zenith 228 Series. Choke system

is straight and that the lever is tight on the shaft.

Replace the pump check valve and air vent check valve since they will be damaged when removed.

Inspect the machined surfaces of the air intake for dents, warpage or other damage. Air cleaner must fit tight or otherwise dirt will get into the engine at this point.

Examine the fuel bowl for loose discharge nozzle bushing. Examine inside bottom of bowl and all passages for evidences of corrosion or gum deposits.

FLOAT ADJUSTMENT—The float measurement should be the dimension shown in Fig. 507 when the float hinge is pressed with finger as shown to touch fuel valve seat. If float requires adjustment, grasp the float hinge with long thin nose pliers firmly and bend next to the float body.

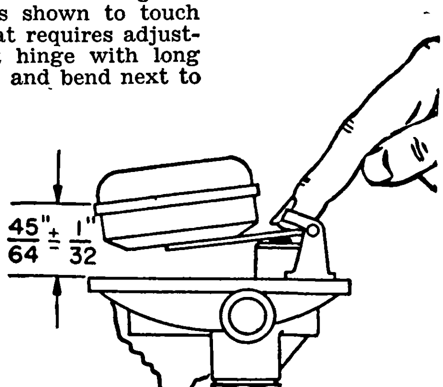


Fig. 507 Z nith 228 Seri s Float adjustm nt

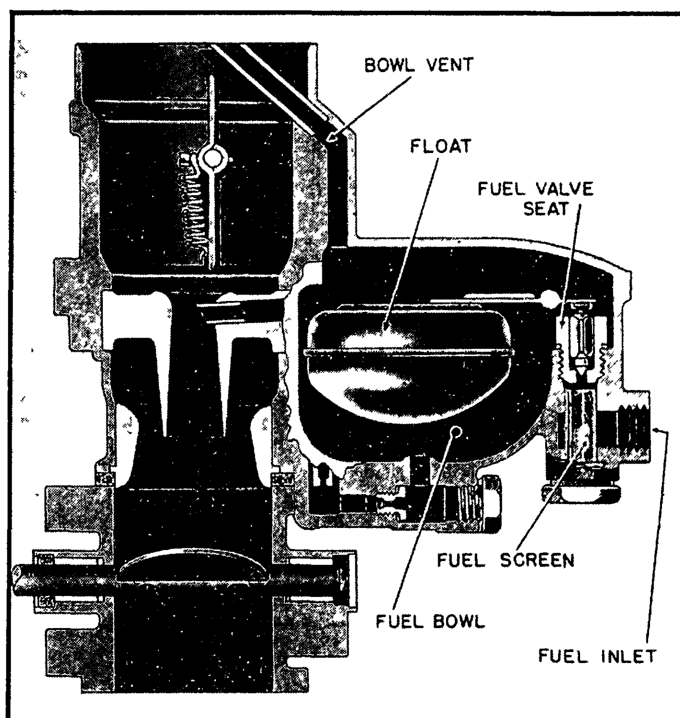


Fig. 508 Zenith 31. Fuel supply syst m

ZENITH 31 SERIES

WILLYS, 1951—Figs. 508 to 512 illustrate the construction of this carburetor. It is a downdraft unit, incorporating both

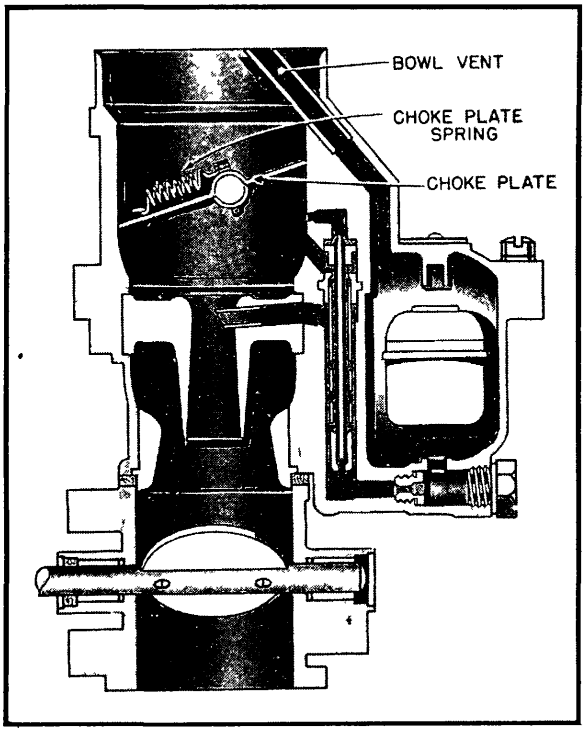


Fig. 509 Zenith 31. Choke system

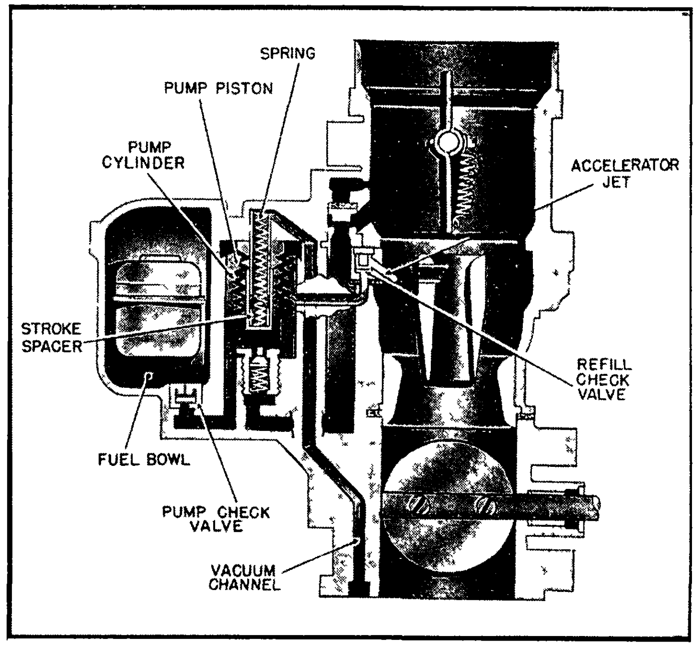


Fig. 510 Zenith 31. Accelerating pump system

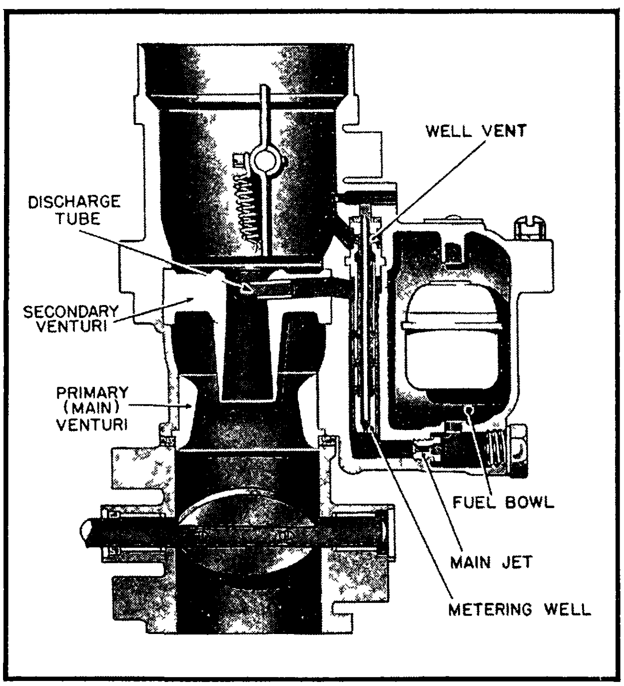


Fig. 511 Zenith 31. High speed system

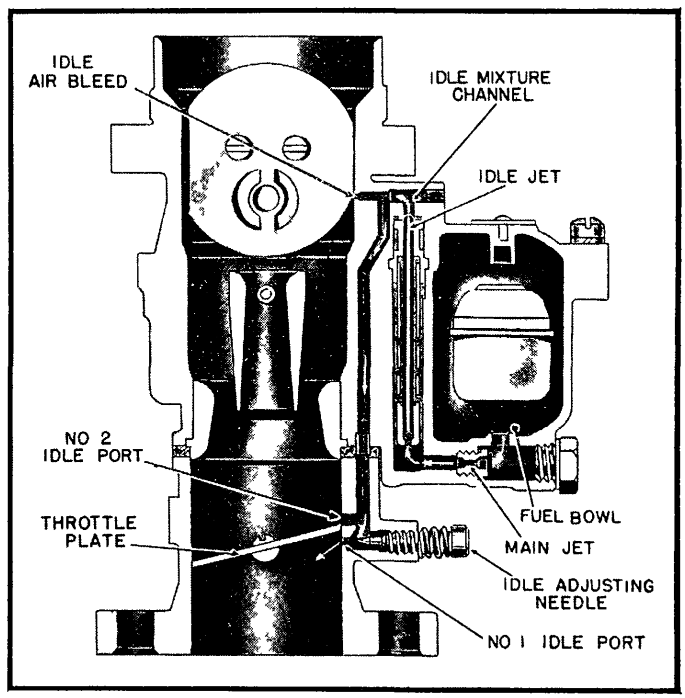


Fig. 512 Zenith 31. Idle system

a primary and secondary venturi The main discharge tube is located in one of the two supporting arms and terminates at the center of the secondary venturi

The 31 Series carburetor is balanced All air is taken from inside the air intake This balanced construction enables the carburetor to maintain correct air-fuel ratios even though the air cleaner may become restricted The accelerator pump and power (or economizer) systems are controlled by engine manifold vacuum.

CARBURETOR SERVICE

In servicing the carburetor, follow the procedure outlined for Model 228AV10

When adjusting the float, press down firmly on the float lever directly over the fuel valve and check for correct level Use C161-169 float level gauge as shown in Fig 513 A tolerance of plus or minus $\frac{1}{32}$" from the gauge setting is permitted An undamaged float will check within these limits If the float is damaged it should be replaced.

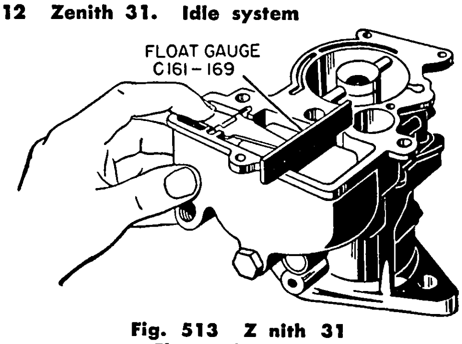


Fig. 513 Z nith 31
Fl at adjustment

CARTER

Figs. 1 and 2—The climatic control (automatic choke) is an integral part of the carburetor and consists primarily of two major assemblies; the thermostatic coil spring and housing assembly, and the assembly consisting of piston housing, choke shaft, lever, screen, and piston.

The operation of the automatic choke is governed by intake manifold vacuum, exhaust manifold temperature and velocity of air stream through air horn. On initial starting, as the engine fires, the vacuum created in the manifold pulls the piston down, exerting tension on the thermostatic spring and opening the choke valve far enough for initial running. Hot air is drawn from the "stove" on the exhaust manifold through the connecting pipe and screen to the automatic choke housing, and around the piston to the carburetor and intake manifold.

As the heat increases around the thermostatic spring, the spring loses its tension, allowing the choke to open gradually. After it reaches the full open position, it will remain open of its own weight. Sudden accelerations during warm-up period result in a decrease in manifold vacuum which would allow the coil to pull the choke valve to full choke position. During this time the increased air velocity striking the eccentric choke valve tends to push the valve open, thus preventing a "loading condition." When the engine is stopped, the thermostatic spring cools off, revolving the choke shaft allowing the choke to close.

SERVICE—On most models, the choke is protected by a screen in the hot air line to keep dirt and soot from entering the thermostatic housing. If the screen clogs, it will restrict the flow of hot air to the housing and cause loading.

Except for a check of the moving parts to see that they operate freely, and an occasional cleaning of the hot air line screen, adjustment of the unit itself should seldom be necessary, as the choke is properly calibrated at the factory.

If the initial and part throttle running mixture is too lean or too rich, revolve the thermostat housing as indicated on the housing face. Under normal conditions it will seldom be necessary to lean or richen the choke from the standard factory setting and then not more than one or two graduations.

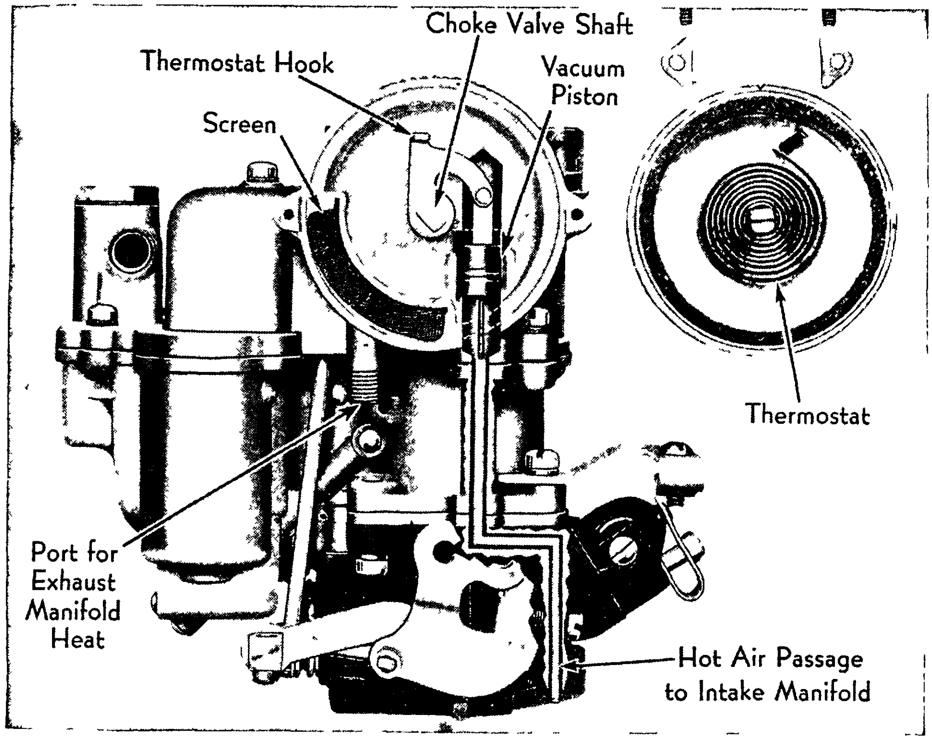
If the engine has a tendency to run rich during the warm-up period, revolve the choke housing clockwise one graduation mark at a time until the desired leaner mixture is obtained. Make no adjustments until the engine is cold.

To clean the screen on units having the vertical stroke piston, Fig. 1, simply remove the choke housing and take out the screen. If the piston has a circular stroke, Fig. 2, the carburetor will have to be removed from the engine to take out the screen.

NOTE—In servicing these chokes, refer to the step-by-step overhaul procedure given in the *Carburetor* chapter.

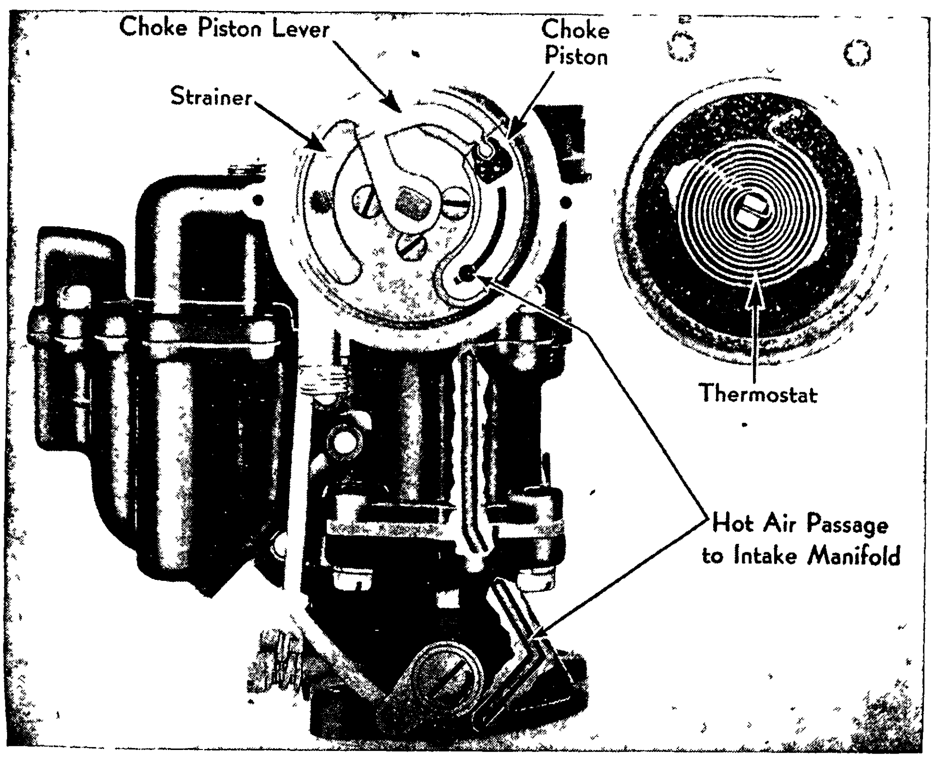
TROUBLE SHOOTING—A leak at the choke suction tube rubber gasket will decrease the action of the manifold vacuum on the choke piston which will tend to allow the choke to remain partially closed during low speed operation (during the warm-up period) and will result in poor gasoline economy at low speed. When a leak occurs at this point, then the gasket must be replaced.

If the choke air cleaner screen is clogged with dirt it will restrict the flow of warm air from the manifold stove and will cause slow opening of the choke, resulting in poor gasoline economy at low speeds. A clogged screen



Courtesy Carter Carburetor Corp.

Fig. 1 CARTER CLIMATIC CONTROL. With vertical stroke pist n



Courtesy Carter Carburetor Corp.

Fig. 2 CARTER CLIMATIC CONTROL. With circular stroke pist n

must be washed thoroughly with gasoline and blown out with compressed air. The screen should be cleaned every 5,000 miles and if damaged in any way should be replaced.

If the choke cover cork gaskets are shrunk or broken they will allow cold air to enter the cover, thereby slowing the opening action of the choke. A new gasket should be installed.

A leaking choke heater tube or connection should either be replaced or tightened for an air leak at this point will prevent the control from functioning properly.

A sticking choke valve may be caused by a bent shaft, an improperly installed choke valve or a warped air horn, which may be caused by clamping the air cleaner to the horn too tightly. If the choke valve sticks open, it will result in hard starting. If it sticks closed or partly closed it may result in hard startind and will undoubtedly cause poor gasoline economy and affect all engine performance. Sticking parts should be freed and damaged parts should be replaced.

The choke linkage may be sticking, bent, or improperly adjusted. All of these troubles will give the same results as a sticking choke valve and should be corrected so that the choke valve will be free to fall of its own weight.

In rare cases, sufficient grit may get by the choke air cleaner screen to cause the choke piston to be slow in its action or become entirely stuck. In either case, the result will be the same as the troubles described with the choke valve. If the piston and cylinder cannot be cleaned properly or if they are worn, they should both be replaced.

The thermostatic coil should never be removed from the cover. If damaged the entire cover must be replaced.

DELCO-REMY

Fig. 3—This choke is attached to the side of the intake manifold and consists primarily of a bellows and thermostatic spring. The operation of the choke is governed by intake manifold temperature and manifold vacuum.

The thermostatic spring has one end secured to the choke shaft, which by means of linkage, controls an offset choke valve in the carburetor air horn. The other end of the spring is connected to a spring-loaded bellows.

When the engine cools, the thermostatic spring increases the tension on the choke valve and chokes the carburetor in accordance with variation in temperatures. When starting a cold engine, the choke valve will be held closed or nearly so, depending on the temperature, until enough fuel has been drawn into the cylinders to produce initial firing. As soon as the engine fires, vacuum in the intake manifold rises rapidly, which collapses the bellows and rotates the thermostat spring in the proper direction to decrease the initial tension and thus partially open the choke valve. After the engine has reached its operating temperature, the automatic choke is inoperative, having no further function in engine performance.

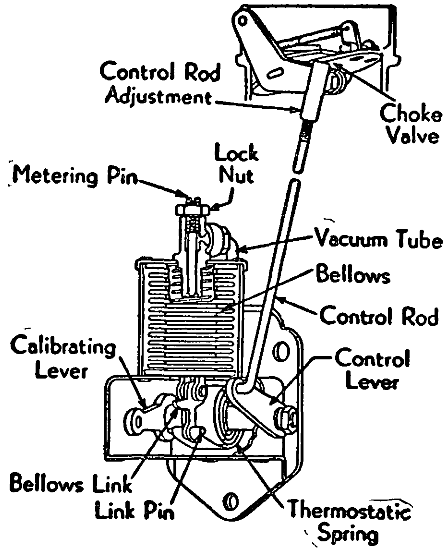


Fig. 3 DELCO-REMY
Buick 1935-36; Oldsmobile 8, 1935

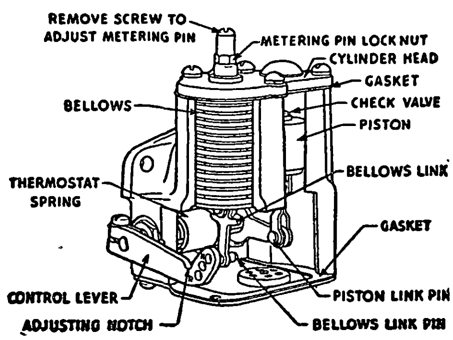


Fig. 4 DELCO-REMY
Oldsmobile 6, 1935

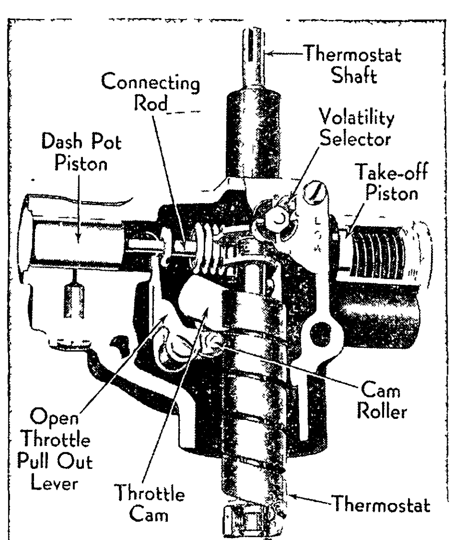


Fig. 5 DELCO-REMY
Buick 1937-38

SERVICE—Except for check of moving parts to see that they work freely and an occasional check of the control rod adjustment, the choke should not require any attention.

If the control rod is too short, the initial and part throttle running mixture will be too rich; if too long, mixture will be too lean. When rod is correctly adjusted, the choke valve should just close at approximately 60° F.

To adjust the control rod, remove the air cleaner and disconnect the rod from the control lever. Hold the choke valve closed and control lever down. Then adjust the length of the rod until the rod just fits in notch in control lever.

DELCO-REMY Fig. 4—The operation of this type choke is the same as described for Fig. 3 except that a dash-pot is an integral part of the choke unit and operates as follows:

The dash-pot, which consists of a cylinder, piston and check valve, is connected to the thermostatic spring shaft by means of a link and pin. It operates during the warm-up period only and provides smooth acceleration since it retards opening of the choke valve due to large increase of intake air velocity.

SERVICE—The control rod is adjusted the same as described for Fig. 3 except that the choke valve should close at approximately 70° F.

When checking moving parts, see that the dash-pot piston is free by pushing the control rod lever up and allowing it to drop back. If it does not drop back quickly to its original position, disassemble and check the dash-pot as follows:

Lift valve from its seat in top of piston and see that it is free. Make sure valve and seat are free from oil and dirt. Check valve spring tension by holding piston in inverted position. Tension should be sufficient to hold valve closed under these conditions.

DELCO-REMY, Fig. 5—This type choke is attached to the inner side of the carburetor with lower end of the thermostat housing contacting the exhaust manifold.

The choke valve in the air horn is connected by a flexible shaft to the choke control shaft. The temperature control is obtained by means of a thermostat which is wound around and secured directly to the thermostat shaft by means of the thermostat calibrating screw. The thermostat shaft is connected to the choke valve in the air horn by a flexible shaft. The other end of the thermostat spring is connected through a gear and rack to a spring-loaded vacuum piston which is operated by manifold vacuum. At temperatures of 85 degrees or below, the choke valve is completely closed but at normal engine operating temperature the choke valve is completely open. The variation in manifold vacuum is used to operate the "take-off" piston in the control unit. When there is little or no vacuum being created in the engine manifold, the take-off piston is held forward, towards the center of the control unit by the take-off spring. As the amount of vacuum increases, the take-off piston is pulled back in its cylinder. This movement is retarded to some extent due to the action of the dash-pot piston which is secured to the opposite

end of the connecting rod. The movement of the take-off piston and dash-pot is transmitted through a gear and rack to the choke valve.

ADJUSTMENTS—The fuel volatility selector takes care of variations in various brands of fuel. An adjustment can be made at the cover plate without dismantling the control unit. The selector pointer is set one notch from its extreme low position for regular gasolines The notches toward the high position provide adjustments to cover the most volatile brands of gasoline. Setting the selector in the low volatility positions gives a richer mixture and setting it in high volatility positions gives a leaner mixture.

TROUBLE SHOOTING—If the unit is thought to be at fault it should be checked on the engine to determine if the trouble is in the control Since the moving parts of the unit are enclosed, remove the air cleaner so that you can observe the action of the carburetor choke valve The choke valve should be free and when opened or closed manually should return to its original position With the engine cool and stopped, push the throttle wide open After a delay of 7 to 10 seconds the choke valve should slowly move toward the open position

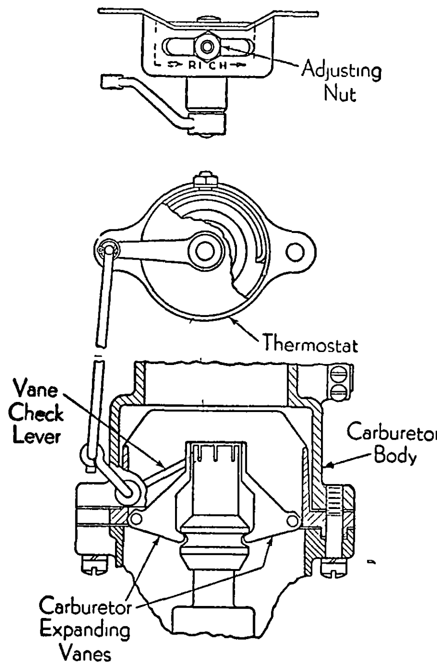


Fig. 6 DETROIT
Cadillac V12, V16 1935-36

Close the throttle and the choke valve should return at once to its original position. If this action is not obtained, check the pistons for binding or sticking.

Start the engine when cool. The choke valve should move toward the open position as the engine starts to run. If this action does not occur, check for obstructed vacuum passage, leakage at the choke gasket due to loose attaching bolts, vacuum leak around the screw plug in the end of the take-off cylinder due to looseness or damaged gasket, or sticking pistons. Accelerate the engine while it is still cool. The choke valve should move toward the closed position momentarily and then resume its original position. Failure to do this indicates a sluggish dash-pot piston, weak or broken piston pullout lever spring, or binding parts.

DETROIT

Fig. 6—This automatic choke is only used with Detroit carburetors which are of the expanding vane type. The automatic choke restricts the expanding of the vane until the engine is warm. It is mainly a thermostat which is mounted on the exhaust manifold. The movable end of the thermostat is connected to a vane check on the carburetor through a rod and levers When the engine is cold

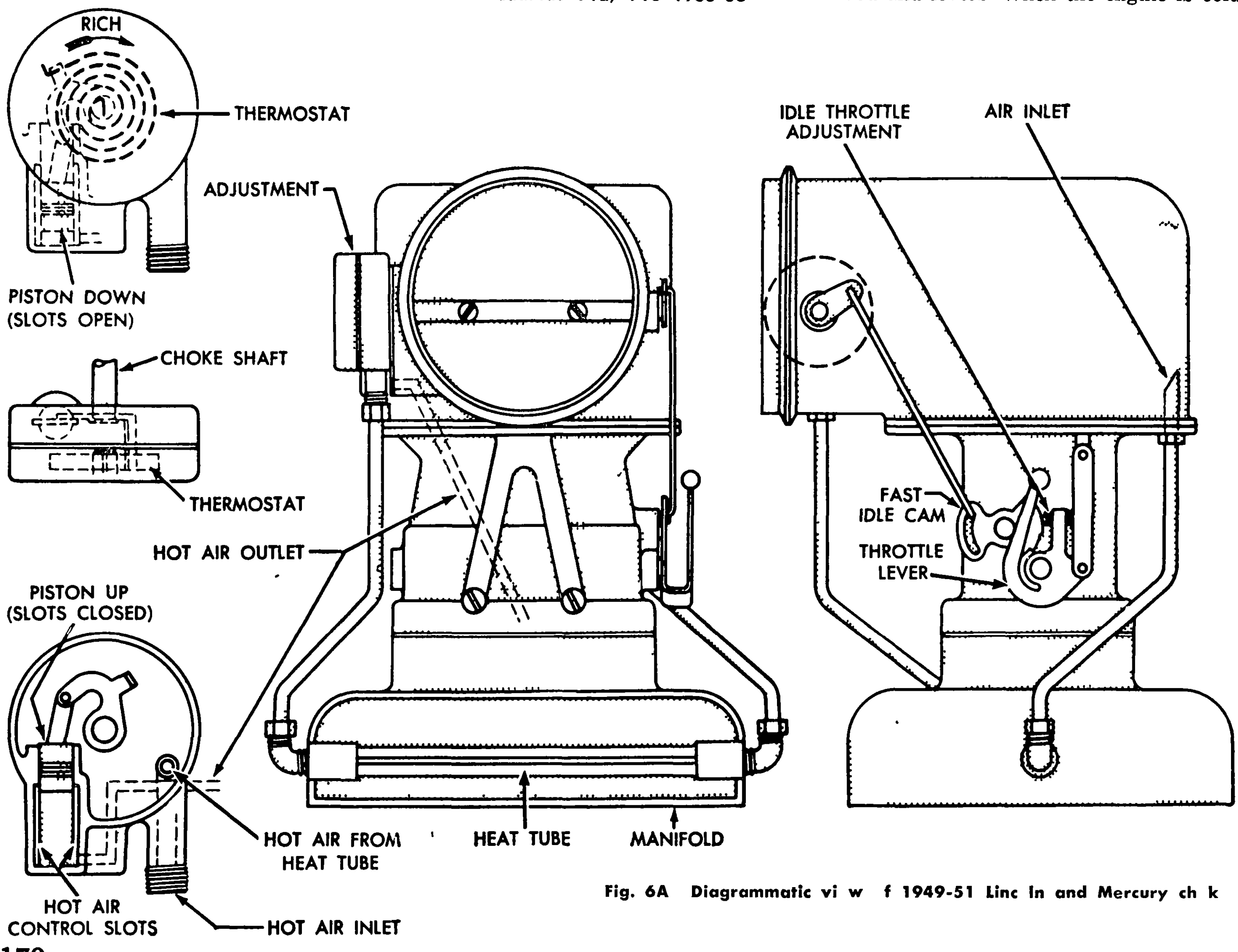


Fig. 6A Diagrammatic vi w f 1949-51 Linc ln and Mercury ch k

the thermostat contracts and holds the vane check against the carburetor vane so that it cannot expand. As the engine warms up the thermostat is heated and expands, raising the vane check until it is high enough so that it does not restrict the expanding of the vanes.

There is only one adjustment and ordinarily no adjustment is necessary unless the unit has been tampered with. The adjustment can be made by loosening the adjusting nut on the thermostat and sliding the thermostat stop until a pull of 12.9 ounces on Cadillac V-8 engines and 5.2 ounces on Cadillac V-12 and V-16 engines is required to hold the thermostat arm in a horizontal position.

LINCOLN-MERCURY 1949-51

Fig. 6A—This choke consists of a housing attached at the end of the choke shaft and containing a thermostatic coil and a vacuum piston and cylinder. The thermostat is assembled in a plastic case which can be rotated to effect choking action to suit differences in gasoline volatility. The vacuum piston cylinder is connected by internal passages in the carburetor to a point below the throttle plates where it is exposed to the vacuum existing in the intake manifold.

The vacuum cylinder is equipped with slots which permit a flow of air past the piston, this air being drawn through a tube in the intake manifold hot spot. The tube is piped up to the choke housing so that the heated air circulates around the thermostat and changes its tension for changes in temperature.

The air control slots in the cylinder are arranged so they are closed when the piston is in the up position (choke closed), and open to permit air flow when the piston is in the down position (choke open). The choke valve is offset so that the flow of air through the carburetor forces it toward the open position.

The choke mechanism includes several other features, such as an automatic unloading mechanism which makes it possible to hold the choke open slightly, regardless of temperature, by depressing the throttle wide open. This makes it possible to correct an engine that has been flooded due to some inadvertent operation, such as attempting to start with the ignition turned off or with wet spark plugs, etc.

There is also a linkage between the choke and the carburetor throttle mechanism to provide a fast idle for keeping the engine running without stalling when it is still quite cold. This gives a fairly fast idling speed while the engine is very cold and gradually reduces the idling speed to normal when the engine is fully warmed up.

To prevent dirt entering the choke mechanism, which is the usual cause for an inoperative choke, filtered air from the carburetor air inlet is piped through a heat tube, located in the heat riser in the manifold to the hot air inlet of the choke.

The automatic choke, fast idle and unloader are adjusted in production and no further attention is required. All air entering the choke mechanism is filtered through the carburetor air cleaner, hence no periodic cleaning of the choke mechanism is required.

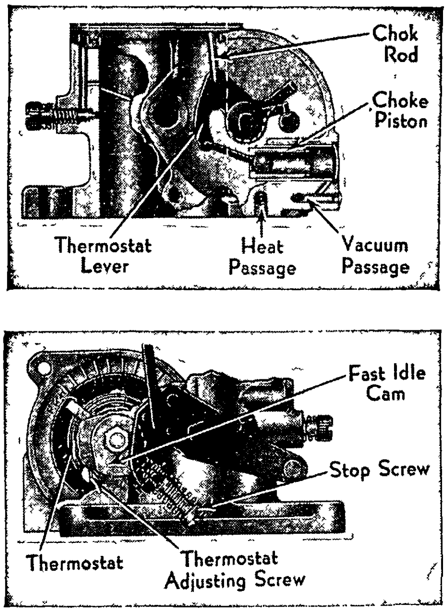


Fig. 7 HOLLEY (Chandler-Groves) Packard 1937-39 Six

HOLLEY

(Chandler-Groves)

Fig. 7—This automatic choke is of the mechanical type and completely contained within the carburetor. Its thermostat when cold tries to rotate the lever, raise the rod and close the choke valve for starting. As the fast idle cam is fastened to the lever, this closing cannot take place until the throttle is opened and the stop pin screw has pulled away from the fast idle cam. After the engine fires, the vacuum created in the intake manifold acts on the vacuum piston, opening the choke valve by turning the lever against the spring tension of the thermostat, which varies according to temperature. Hot air is drawn from a tube in the hot spot of the intake manifold, through an air passage to the thermostat case. This heats the thermostat, causing it to lose its tension and allowing the choke valve to reach its wide-open position.

If the mixture is not satisfactory during the warm-up period, the thermostat can be adjusted. To do this, remove the case by taking out the two screws. Do not remove the thermostat from the holder plate. The carburetor choke valve should open without lag. Clean the choke valve shaft and the choke rod if its action is sticky but do not oil any part of the assembly. Correct any bearing friction movement of the thermostat lever and vacuum piston. When the thermostat is heated to 100 degrees, the free end of the thermostat should be directly over the index mark in the holder plate. The standard setting is when this mark on the thermostat plate lines up with the punch mark on the thermostat case. If the punch marks are not aligned, loosen the screw and turn the index mark. Turning toward "RICH" tightens the tension of the thermostat and richens the choke. Be sure to tighten the screw after making an adjustment. On reassembling, be sure the end of the thermostat is hooked securely on the arm of the lever.

If the warm-up mixture is still unsatisfactory, again remove the thermostat and increase or decrease the thermostat spring tension one-half a graduation at a time. If the results are not satisfactory after changing the adjustment 5 graduations from the original setting, install a new thermostat.

It is very important that all the parts work freely. The choke valve should fall wide open from any position when the thermostat case is removed and the idle stop screw is not against the cam. It should close without any binding when the lever is rotated clockwise and the idle stop screw is clearing the cam.

SISSON

Figs. 8 and 9—This type of choke control regulates the position of the choke valve through an electro magnet and a thermostat. The choke unit is mounted on the exhaust manifold and a rod connects its lever to the carburetor choke valve lever. A wire connects the choke to the starter switch. When the starter is operated, current flows to the electro magnet in the choke unit and an armature lever is energized, moving the choke lever and closing the carburetor choke valve. As soon as the engine starts and the starter circuit is broken, the electro magnet is de-energized and the thermostat then automatically controls the position of the choke valve according to engine manifold temperature, until the engine is hot, when the automatic choke is inoperative. If the engine is hot when being started the thermostat holds the choke valve open, against the action of the electro magnet.

SERVICE—In case the choke unit is not operating properly, open the hand throttle and see that the rod from the auto-

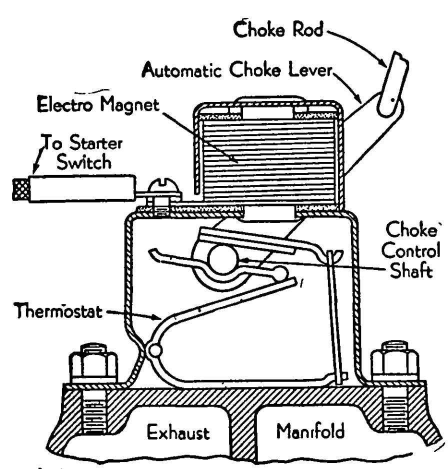


Fig. 8 Siss n ch k us d n 1935-52 Chrysler 6, D S t 6, D dg 6 and 1949-52 Plym uth

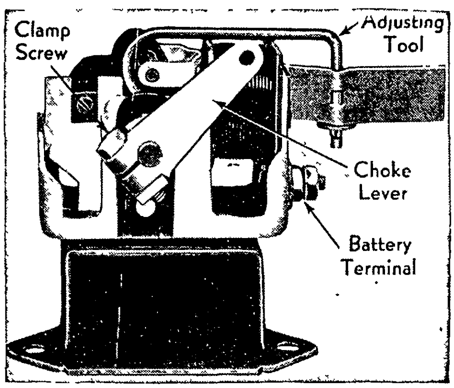


Fig. 9 Sisson choke used n Chrysler 8, 1935-50

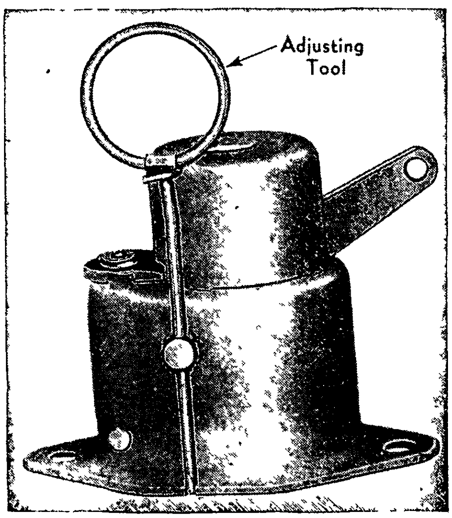


Fig. 10 SISSON Showing adjustment of Fig. 8

matic choke to the carburetor is not bent or binding. See that there is no binding in the choke valve. Check the fast idle rod and cam on carburetor for excess friction. Remove any paint, dirt or oil from external moving parts that might cause binding.

Check the wire from the starter switch to the automatic choke to be sure that the electrical circuit is complete. There must also be a good ground connection between the choke and the manifold. A lock washer between the mounting nut and the automatic choke makes this connection. Check to see that the circuit through the choke is complete by holding a screwdriver close to the magnet core while someone operates the starter. The screwdriver should be drawn against the magnet core.

Do not lubricate the automatic choke or any of its linkage. Be sure that there is an insulating gasket between the exhaust manifold and the automatic choke.

The choke should be checked for proper adjustment periodically and every time the engine is tuned.

ADJUSTMENT, Fig. 8—To make an adjustment open the hand throttle approximately one-fourth way. Remove the air cleaner from the carburetor so you can observe the position of the choke valve. Move the automatic choke lever until the hole in the brass shaft lines up with the slot in the bearings and insert an adjusting tool or rod, Fig. 10, through the hole in the shaft. Push the rod all the way down to the engine manifold so that it engages in the base of the automatic choke. Loosen the clamp screw on the automatic choke lever and push the lever upward until the carburetor choke valve is closed tight. Hold the lever in this position and tighten the clamp screw in the lever. Then remove the adjusting tool. Replace the air cleaner, checking to be sure that tightening of the air cleaner clamp does not bind the choke valve on the shaft. See that there is no binding in the fast idle or choke mechanism that would interfere with the free operation of the carburetor choke valve. Always be sure to check this with the carburetor throttle partly open.

The hairpin-shaped thermostat in the base of the choke is not a spring and should not be handled or bent. It has been set and heat-treated and any changes in its position or shape will throw the automatic choke out of adjustment. Never use a terminal screw on the automatic choke that is longer than the one furnished with the car.

ADJUSTMENT, Fig. 9—To make an adjustment, open the hand throttle one-fourth way. Remove the cover from the automatic choke by lifting with the hand and remove the air cleaner from the carburetor so that the position of the carburetor choke valve can be observed. Clamp a special adjusting tool in place, as illustrated, so that the end of the tool enters and lines up the hole in the armature and the hole in the magnet core. The end of the tool should enter these holes as far as it will go. Then move the flat bar of the adjusting tool so that it will lock the armature of the automatic choke tightly against the magnet core. Loosen the clamp screw on the automatic choke lever, and move the lever until the carburetor choke valve is closed tight. Hold the lever in this position and tighten the clamp screw. Remove the adjusting tool and replace the automatic choke cover. Replace the air cleaner on the carburetor, checking to be sure that tightening the air cleaner clamp did not bind the choke valve or shaft. See that there is no binding in the fast idle or choke mechanism that would interfere with free operation of carburetor choke valve. Check with carburetor throttle partly open.

STROMBERG

Fig. 11—Used on carburetor models EE-1 and EE-3. This automatic choke control is a separate unit from the carburetor and controls the position of the choke valve through a rod between the carburetor and the choke control. The operation of the choke unit is controlled by manifold vacuum and engine heat.

When the thermostat reaches a temperature of 70 degrees it returns the carburetor choke valve to its closed position. The choke valve is closed during the cranking of the engine and is held closed by the locking of the roller against the cam. When the engine fires and a manifold vacuum is created, the

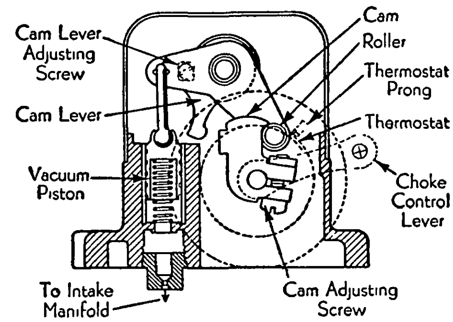


Fig.11 STROMBERG Used with EE-1 and EE-3 carburetors

vacuum piston is pulled partly down, unlocking the cam and roller. As soon as the engine fires steadily and an even vacuum is present, the piston travels the remaining distance. The cam lever then comes into contact with the cam, opening the choke a predetermined distance against the tension of the thermostat spring. When the engine has reached a temperature of 120 degrees the choke valve should be in its wide-open position.

ADJUSTMENTS—If the mixture is too rich or too lean during the warm-up period, check and adjust the automatic choke unit. To make an adjustment, remove the choke unit from the engine by disconnecting the control rod and choke attaching screws. Under any conditions, the thermostat should be allowed to cool or warm until it has reached a temperature of 70 degrees. This is very important. Remove the housing cover and see that all working parts operate freely. With the roller in its locked position against the first notch in the cam the distance from the center line of the hole in the control arm to the case of the automatic choke housing should be the dimension shown in following the table.

Car Make	Year	Control Lever Setting	Cam Setting Inches	Thermostat Position
Packard 12	1935-1939	1 15/16	.188-.198	16
Pierce Arrow 8	1935-1938	1 1/32	.169-.175	10
Pierce Arrow 12	1935-1938	41/64	.169-.175	12
Studebaker Com 8	1935	1 1/16	.158-.164	12
Studebaker Pres 8	1935,1936	1 1/16	.158-.164	12
Studebaker Pres 8	1937	1 1/16	.158-.164	8

If not correct, loosen the cam adjusting screw and correct the position of the arm.

The distance the cam lever travels before contacting the cam when the cam is in its locked position should be as shown in table. A drill or some other type of rod can be used to check this distance and an adjustment can be made after the cam lever adjusting screw is loosened.

Now unhook the thermostat from its prong and loosen the thermostat clamp screw. Revolve the thermostat case so that the zero marking is under the pointer. When in this position, the hook of the thermostat should be flush with the prong. Place the hook on the prong and revolve the case the number of graduations shown in the table toward rich and then tighten the thermostat clamp screw. The vacuum piston should operate freely and show no signs of sticking in any position.

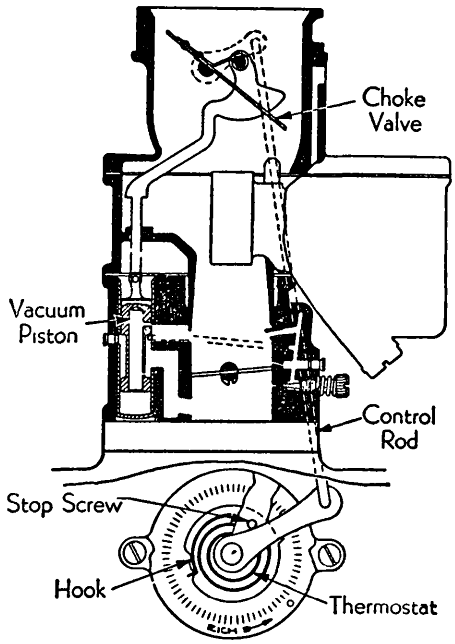


Fig. 12 STROMBERG Used with EE-14, EE-23 EX-23 carburetors

STROMBERG, Fig. 12—Used on carburetor models EE-14, EE-23, EX-23 This automatic choke with the exception of the thermostat unit is built into the carburetor The thermostat is attached to the manifold riser where it can absorb heat from the exhaust gases which governs its tension With this type, it does not require that the choke control be locked in its closed position while cranking the engine A vacuum piston is fitted which opens the choke valve when the engine begins to fire

The only linkage adjustments are changing the length of the rod which connects the vacuum piston and throttle linkage to the carburetor choke valve and the rod which connects the thermostat to the carburetor valve On Packard 120 and Graham cars using this type of choke control the vacuum piston, built into the carburetor, is connected to the carburetor choke valve by a link inside the carburetor which is not adjustable

With the choke valve in its closed position the length of the thermostat rod should be adjusted so that there is $\frac{1}{32}$' clearance between the thermostat lever and the lever stop

The length of the external vacuum piston rod on Packard Super 8, Studebaker and Cord cars can be checked as follows Remove the screw from the top of the vacuum chamber and push the piston to the bottom, using a small rod Push lightly against the short side of the carburetor choke valve to eliminate play in the linkage A $\frac{29}{64}$" drill or rod should fit between the long side of the choke valve and the carburetor body If it does not, adjust the length of the rod.

ADJUST THERMOSTAT—To adjust the thermostat it is necessary to remove the complete thermostat unit from the manifold, then allow the thermostat to cool or warm up until it has reached the temperature of 70 degrees When it has reached this temperature, unhook the thermostat from the prong on the housing and revolve the indicator pointer to the zero marking on the thermostat plate In this position the hook of the thermostat should come flush with the prong of the indicator The thermostat pointer should then be revolved to the prick punch marking which is the number of graduations rich shown in the table below and is the original factory setting

Car Make	*Year*	*Thermostat Setting*
Cord	1937	17
Graham	1935	15
Packard 120	1935-1938	11
Packard Super 8...	1935-1939	11
Studebaker Dict 6	1935-1937	7

If the thermostat hook does not come against the prong when the pointer is at zero marking, it will be necessary to recalibrate the thermostat To do this, hold the thermostat lever against the stop screw and revolve the pointer so that the hook of the thermostat comes flush with the thermostat prong This will place the pointer at a different position and will be the new zero location This should be stamped on the plate and the old marking obliterated From this point, hook the spring onto its prong and revolve the pointer the specified number of notches rich Fasten the lock screw securely Reinstall the thermostat unit on the manifold and with the choke valve in its closed position, attach the connecting rod to the thermostat lever, holding the thermostat lever against the stop screw.

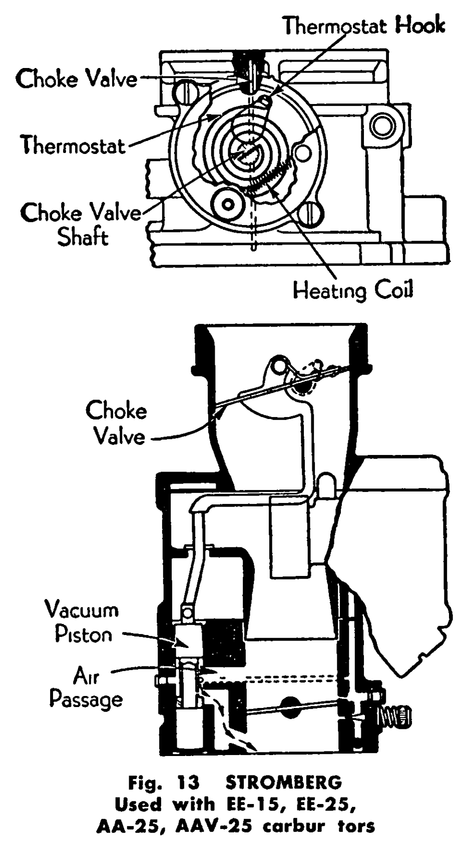


Fig. 13 STROMBERG Used with EE-15, EE-25, AA-25, AAV-25 carbur tors

STROMBERG, Fig 13—Used on carburetor models EE-15, EE-25, AA-25 and AAV-25 This choke is controlled by manifold vacuum, heat on a thermostat spring and an offset choke in the carburetor The vacuum piston which is used to open the choke valve when the engine begins to fire is connected to the choke valve, while the thermostat spring is connected to the choke stem

The thermostat is heated by an electric coil mounted in the thermostat housing Engine temperature also affects the thermostat When the ignition is turned on, current flows through the coil, heating the thermostat at the correct speed to provide proper choking during the warm-up period Current flows through the coil as long as the ignition is turned on so that once the engine is warm, the choke will not be applied again while the engine is running If the automatic choke mechanism should stick or fail to operate, a choke button on the dash can choke the engine or remove the choking action

ADJUSTMENT—To adjust the thermostat, remove the thermostat case, allowing the thermostat to cool or warm until it has reached the temperature of 70 degrees When the thermostat reaches this temperature, the inside of the hook of the thermostat should coincide with the zero marking on the thermostat case, which is the original setting When installing a new thermostat or other new parts, check the zero location very carefully at 70 degrees temperature and change the location if necessary If it is not possible for the thermostat to reach 70 degrees, provide for the difference by allowing one graduation on the thermostat case for every 5 degrees

To adjust the thermostat, reassemble the case onto the air horn so that the hook comes into contact with the pin on the lever without any tension and with the choke valve in its wide open position The zero marking on the case will then coincide with the notch on the air horn Revolve the thermostat case in the rich direction the number of notches shown in the following table

Car Make	*Year*	*Thermostat Setting*
Cadillac	1936	16
Cadillac	1937	17
Cadillac	1938	15
Cord	1936	17
La Salle	1935-1937	17

MANUAL CHOKE CONTROL—The choke may also be operated manually, independently of the automatic system, by a choke button on the instrument panel In its normal position, with the button flush with the throttle button, full action of the automatic choke control is permitted Pulling the choke button out its entire length of travel, the carburetor is choked manually independently of the automatic control When the button is pushed in past its normal position the automatic choke control is prevented from closing the choke valve

To adjust the manual control, have the control lever against the stop screw In this position the choke valve should be open sufficiently to allow a No 26 drill to be placed between the upper

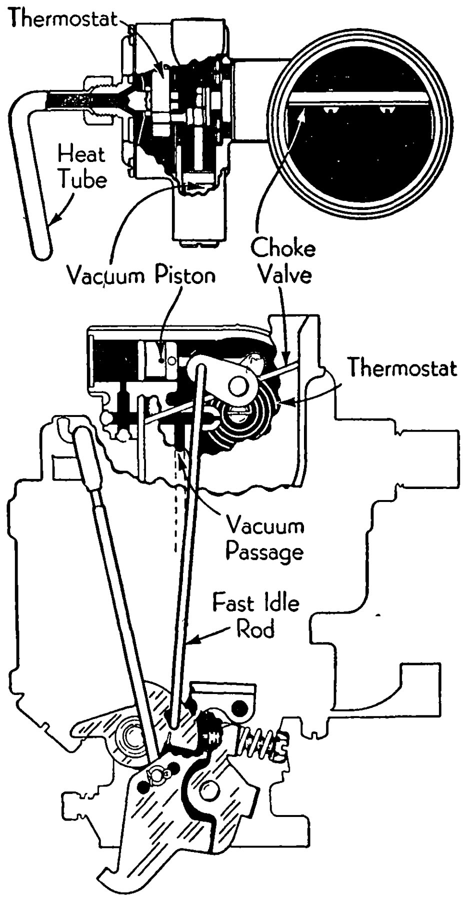


Fig. 14 STROMBERG
Used with AAV-16, AAV-26, BXOV-26, EE-16 Carburetors

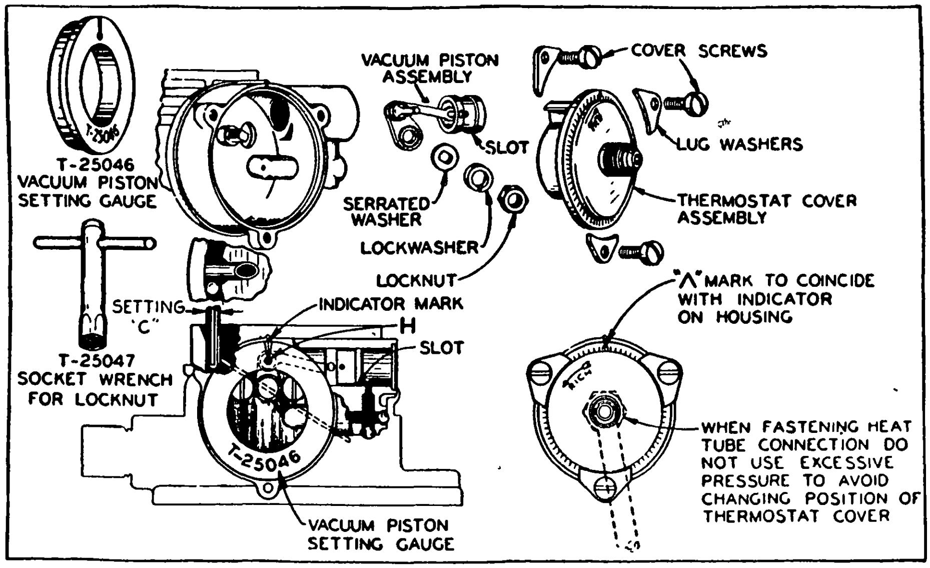


Fig. 15 STROMBERG. Used with AAV-16, AAV-26

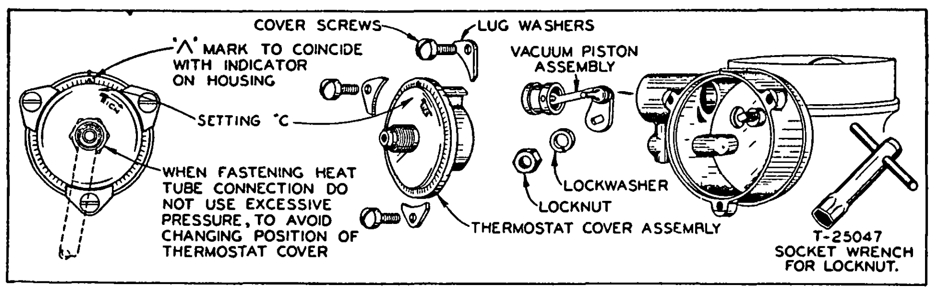


Fig. 16 STROMBERG. Used with BXOV-26

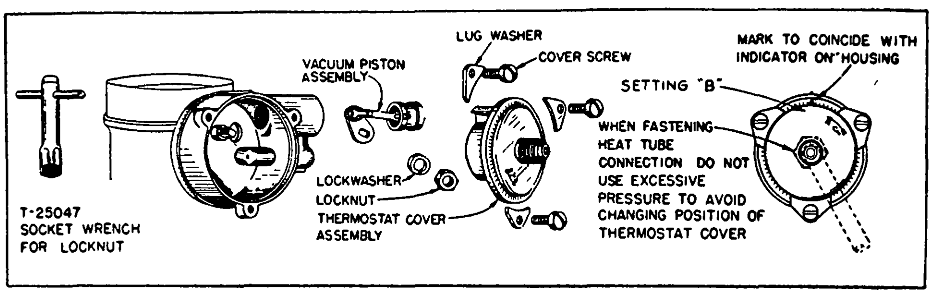


Fig. 17 STROMBERG. Used with EE-16

edge of the choke valve and the air horn. If necessary, adjust the stop screw to provide this opening.

STROMBERG, Fig. 14—This type choke, which is used on AAV-16, AAV-26, BXOV-26 and EE-16 carburetors, is built into a housing integral with the carburetor. Manifold vacuum, thermostat spring and an offset choke valve control the operation of the choke. The vacuum piston and thermostat are directly connected to the carburetor choke valve and control the opening and closing of the choke valve under varying operating temperatures and at various throttle positions. A tube leading from the exhaust manifold to the thermostat chamber transmits heat to govern the tension of the thermostat spring. A fast idle cam operating in conjunction with the choke provides the proper throttle opening for a cold engine and thereby prevents the engine from stalling during warm-up period.

When the engine becomes cold, the thermostat also cools and gradually gains tension. The thermostat is unable to close the choke valve until the throttle is opened. *It is therefore necessary to depress the accelerator pedal slightly and then allow it to return to its normal position before making a start.* When the engine begins to fire, the manifold vacuum pulls the piston, opening the choke valve against the tension of the thermostat. While the engine continues to run, the amount that the choke valve is opened against the tension of the thermostat spring is governed by the quantity of inrushing air past the off-center choke valve and the travel of the vacuum piston. Heat is transmitted into the thermostat chamber by hot air being drawn from the stove on the exhaust manifold. The thermostat gradually absorbs sufficient heat until it offers no further resistance to the choke valve.

SERVICE — To disassemble, disconnect the heat tube from the thermostat housing. Remove the carburetor from the manifold. Remove the thermostat cover screws and lug washers. The thermostat cover assembly can then be taken off the choke housing. Remove the thermostat cork insulator and baffle plate, if one is used. With a socket wrench, loosen the lock nut on the choke valve shaft and then remove the nut, lock washer and serrated washer, if one is used. Loosen the housing attaching screws slightly which will make it easier to remove the vacuum piston assembly from the housing. Remove the vacuum piston assembly from the housing. With a clean rag saturated with acetone or alcohol, thoroughly clean the cylinder walls of any dirt or any other foreign material which may have accumulated in regular service. Use compressed air to blow out all channels. The surface of the piston should be thoroughly cleaned. Do not use any abrasive materials for cleaning the piston or cylinder. Thoroughly clean the screen on the inside

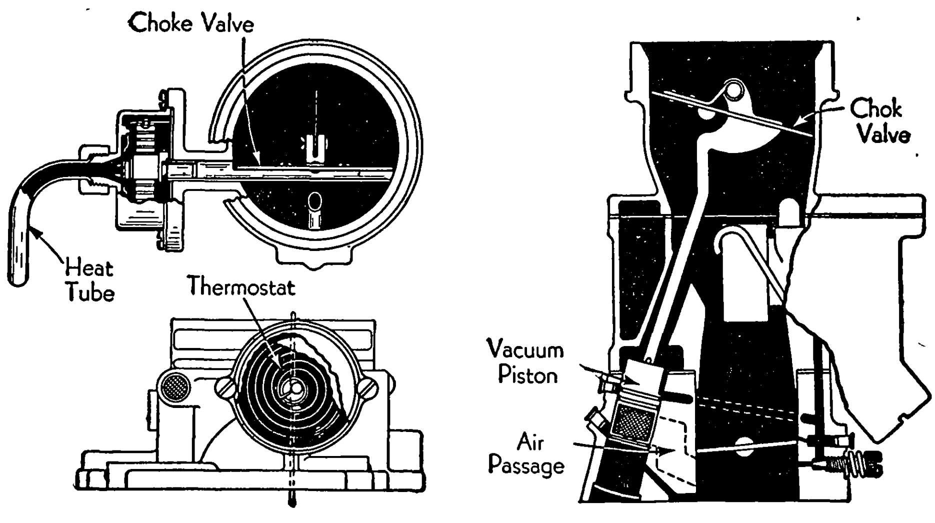


Fig. 18 STROMBERG. Used with AAO-161 carburetor

cover, if it is used, by blowing compressed air into the heat tube connection and also between the screen and the cover, using precaution in order not to distort the screen.

An AAV-16 and AAV-26 carburetors, refer to Fig. 15 and proceed as follows: To assemble, place the vacuum piston in the cylinder with the slot of the piston pointed down. This is very important. Also do not use any type of lubricant on the piston or in the cylinder. Assemble the lever on the choke stem. Next assemble the serrated washer, lock washer and lock nut, fastening the nut only by hand. Place a special tool, No. T-25046, in the choke housing with the small hole fitting over the pin of the choke lever. The indication line at the outer diameter of the tool should be set to line up with the projection of the choke housing. The tool should be held in this position by hand or two of the cover screws and lug washers can be used to do this. Place a drill of the diameter given in *Stromberg Adjustment* table in the *Carburetor* chapter between the choke valve and the air horn and hold the choke valve against the drill. With the valve in this position, tighten the piston lock nut lightly with a socket wrench. Remove the drill. Hold the choke valve in its closed position and tighten the lock nut securely. Check the choke valve opening to be certain that the setting was not disturbed. Do not change the position of the serrated washer or the piston lever without loosening the lock nut.

On BXOV-26 and EE-16 carburetors, refer to Figs. 16 and 17 and proceed as follows: To assemble, place vacuum piston in cylinder. Do not lubricate. Assemble lever onto choke housing stem and tighten screws. Assemble lock washer and nut, tightening nut securely. Check to see that choke valve can drop open freely without the slightest lag.

ADJUSTMENT—The thermostat is calibrated and properly set at the factory to give satisfactory performance with the regular blends of gasoline. When placing the thermostat cover assembly on the housing, use precaution that the edge of the screen, when one is fitted, is not crimped or creased to cause a leak. Locate the thermostat hook at the bottom of the housing and then rotate the cover in the RICH direction until the mark on cover coincides with the projection of the housing. This procedure is recommended to make certain that the thermostat hook contacts the pin on the choke lever. Place the lugs in position and fasten the cover screws securely.

If extremely high volatile fuel is used continuously or if some exceptional condition is encountered, it may be desirable to vary the adjustment slightly to obtain the best possible performance. Do not, however, vary the adjustment more than two graduations in either direction. The thermostat need not be changed unless some part of the assembly has been tampered with or is damaged. In such cases it is necessary to replace the entire assembly. A number may be found stamped on the cover and it is for identification. When assembling the heat tube connection nut into the thermostat cover, do not use much pressure because it will change the position of the cover.

STROMBERG, Fig. 18—This automatic choke control is built integral with the carburetor and its principles of operation are manifold vacuum, heat on a thermostat spring and an offset choke valve in the carburetor. The vacuum piston which opens the choke valve when the engine begins to fire is connected to the choke valve while the thermostat spring is connected to the choke stem.

When servicing the carburetor it is necessary that the vacuum piston is assembled in the throttle valve body with the slot in the side of the piston coinciding with the channel for the idle system.

The thermostat spring is set at the factory to give satisfactory performance under normal conditions. To compensate for the wide range in volatility of the various brands of gasoline, three markings are incorporated on the outside of the thermostat cover, namely: H, M and R. The standard setting is with R coinciding with the highest projection of the thermostat housing flange and is for use with regular or commercial brands of gasoline. If by having the cover set at R the engine tends to load up or overchoke, the cover should be moved to M, which provides a leaner setting. Where high volatile fuels are used continuously, it may be desirable to set the cover plate on H. The thermostat that was originally installed need not be changed unless it is tampered with. In such cases the entire assembly should be replaced.

The thermostat can be checked by submerging the assembly in water of 70 degrees temperature for approximately 10 minutes so that it can assume a natural position. The air horn should be cooled or warmed to as near 70 degrees as possible. Place the thermostat assembly onto the housing and rotate it until the choke valve just closes. In this position, R on the cover should approximately coincide with the projection on the housing flange.

FUEL PUMPS

Make, Year and Model	Pump No. Note A	Pump Pressure, Lbs. Note B
AUBURN		
1935-36 Six	1814	1½—4
1935-36 Eight	2146	1½—4
BUICK		
1935 Ser. 40	1765	2½—3½
1935 Ser. 40	1794	2½—3½
1935-38 Ser. 40	1854	2½—3½
1935 Ser. 50	1538★	2¾—4
1935 Ser. 50	1804★	2¾—4
1935 Ser. 60, 90	6138★	3—4½
1935 Ser. 60, 90	1805★	3—4½
1936-38 Ser. 60, 80, 90	1838★	3—4½
1938-39 Ser. 40	3703	2—3½
1939 Ser. 60, 80, 90	3868★	3—4½
1940 Ser. 40, 50	7100★	4—4¾
1940 Ser. 60, 70, 80, 90	3992★	4—4¾
1940-52 Ser. 40, 50	7337★	4—4¾
1940-52 Ser. 60, 70, 80, 90	7338★	4—4¾
CADILLAC		
1935 V8	6062	3—4¼
1935 V12, V16	6263	3—4¼
1936-37 V8	2119★	3—4½
1936-37 V8	3866★	3—4½
1936-37 V12, V16	2149	3—4¼
1938 V8	3694★	3—4½
1938-39 V8	3866★	3—4½
1938-40 V16	3695	3—4½
1938-40 V16	3696	3—4½
1940-46	7088★	4—4¾
1941-42	7083★	4—4¾
1946-48	9089★	3½—4¾
1949	9143★	4—5¼
1949	9488★	4—5¼
1950-52	9535★	4—5
CHEVROLET		
1935	1798	2½—3½
1935-36	1812	2—3½
1937-52	3429	3—3¾
CHRYSLER		
1935 C2	1803	3—4¼
1935 C1	1790	3—4¼
1935 C2, C3	1549★	3—4½
1935 C2, C3	3000★	3—4½
1935 C6	1788	1½—3½
1935 C6	2122	1½—3½
1936 C7	2237	1½—4
1936 C7	3137★	2½—3½
1936 C8	1803	3—4¼
1936-37	3023★	3—4½
1936 C9	1790	3—4¼
1936-37	1549★	3—4½
1936-37	3000★	3—4½
1937-39	1803	3—4¼
1937-40	2995	2½—4½
1937	3137★	2½—3½
1938-46	3647	3—4
1939-40	3913★	3—4
1939-40	3869	3—4
1939-50	7445	3—4
1940	3912	3—4
1948-50	9215	3½—5
1949-52 (Carter)	M639SL	3½—5
1949-52 (Carter)	M639SZ	3½—5
CORD		
1936-37	3340	3—4½
CROSLEY		
1939-42	7402	1½—2¾
1949-52	8923	2½—3
DE SOTO		
1935	1788	1½—3½
1935	2122	1½—3½
1936	2237	1½—4
1936-38	2995	2½—4½
1937	3137★	2½—3½
1938-46	3647	3—4
1939-41	3912	3—4
1939-41	3913★	3—4
1947-50	9042	3½—5½
1949-52 (Carter)	M639SL	3½—5
1949-52 (Carter)	M639SZ	3½—5
DODGE		
1935	1789	2½—4
1936	2237	1½—4
1936-39	2995	2½—4½
1938-46	3647	3—4
1939	3912	3—4
1947-49	9042	3½—5½
1949-52 (Auto-Lite)	FA-4001	3½—5½
FORD		
1935-37	1459	1½—2¾
1935-37	1764	1½—2¾
1935-37	3138	1½—2¾
1935-46 V8	7383	1½—3
1938-40	3307	1½—3
1941-46 V8	9047	1½—3
1941-47 Six	8523	1½—2¾
1941-47 Six	9422	1½—3
1941-51 Six	9350	4—5
1947-52 V8	9558	3½—4¼
FRAZER		
1947	9057	3—4½
1947	9073	2½—4½
1947-51	9549★	3½—4¼
GRAHAM		
1935	1674	2¾—3½
1935	1392	2—3
1936-37	3008	1½—3½
1936-37	3009	2½—3½
1938-41	3731	2½—3½
HENRY J		
1951-52 (Carter)	M807S	3½—5¼
1951-52 (Carter)	M809S	3½—5¼
HUDSON		
1935-36	1540	2½—3½
1937	3290★	3—4½
1937-47	3289	3—4½
1939-42	3753	2—3½
1948-49	9109	3—4½
1948-50	9108★	2—3½
1949-52 (Carter)	M729SL	3½—4½
1949-52 (Carter)	M729SZ	3½—4½
HUPMOBILE		
1935-40 Six	1811	2½—3½
1935 Eight	1811	2½—3½
1936-39	3014	3—4½
KAISER		
1947	9057	3—4½
1947	9073	2½—4½
1947-52	9571	3—4¼
1951-52	9549★	3—4¼
LAFAYETTE		
1935-36	2152	2½—3½
1937	3233	2½—3½
1937	3234	2½—3½
1938-40	3640	2½—3½
1938-40	3641	2½—3½
LA SALLE		
1935	1813★	3—4½
1936	2248★	3—4½
1937-38	2119★	3—4½
1937-39	3866★	3—4½
1939	3865★	3—4½
1940	7083★	4—4¾
1940	7088★	4—4¾
LINCOLN		
1935-40 Ser. K	1218★	3—4¼
1935-36 Zephyr	1764	1½—2¾
1935-42 Zephyr	7383	1½—3
1937-40 Zephyr	3307	1½—3
1940-47	7709	1½—3½
1942-48	9047	1½—3
1949-51	9142★	2—3½
MERCURY		
1939	3307	1½—3
1939-46	7383	1½—3
1941-48	9047	1½—3
1949	9268★	3½—4½
1949	9119	2—3
1949-52	9544★	3½—4½
1951-52	9601★	3½—4½
NASH		
1935 Ser. 20	1454	2½—3½
1935-36 Ser. 20	2153	2½—3½
1935 Ser. 80	1457	2½—3½
1935-36 Ser. 80	2154	2½—3½
1936 Ser. 40	1841	2½—3½
1936 Ser. 40	2152	2½—3½
1937 Ser. 20, 80	3237	2½—3½
1937-40 Ser. 20	3642	2½—3½
1937 Ser. 20	3238	2½—3½
1937 Ser. 20	3643	2½—3½
1937 Ser. 80	3236★	2½—3½
1937 Ser. 80	3644	2½—3½
1941-50 Ser. 40	7398	2½—3½
1941-51 Ser. 40, 80	9413	2½—3½
1941-51 Ser. 60	7389	2½—3½
1941-50 Ser. 60	9412	4—5¼
1946-50 Ser. 40	7406★	2½—4
1946-47 Ser. 60	8780★	2½—4
1947-50 Ser. 60	9216	4—5¼
1950-52 (Carter)	M774S	3½—5¼
1950-52 (Carter)	M797S	3½—5¼
1950-52 (Carter)	M798C	3½—5¼
1950-52 (Carter)	M816S	3½—5¼
OLDSMOBILE		
1935 Six	1792	3—4½
1935 Six	1785★	3—4½
1935 Six	2157★	3—4½
1935-36 Six	2189	2½—3½
1935-36 Six	2249★	3—4½
1935 Eight	1791	3—4½
1935 Eight	1784★	3—4½
1935 Eight	2158★	3—4½
1935-36 Eight	2188	2½—3½
1935-36 Eight	2250	3—4½
1937-38	3228	3—3¾
1937-39	3985	4—4¾
1937-38	3227★	3—4
1939 Six	3844	3—3¾
1939 Six	3845★	3—3¾
1939 Six	3986★	4—4¾
1939-40 Eight	3895★	4—4¾
1940 Six	7094★	4—4¾
1941-48 Six	7358★	4—4¾
1941-48 Eight	7330★	4—4¾
1949-50 Six	9297★	4—5
1949-52 Eight	9294★	4—5
PACKARD		
1935 Eight	1807	2½—3½
1935-36 Eight	1777★	3—4½
1935-36 Eight	1808★	2½—3½

Note A—Number stamped on mounting flange. All pumps are AC unless otherwise designated.

Note B—Minimum and maximum pounds static pressure when tested on engine.

★Combination fuel and vacuum pump.

Mak , Y ar and M del	Pump N . Note A	Pump Pressur , Lbs. N te B
1935 39 V12	1778★	3 —4½
1937	3202★	3 —3¾
1937 38	3196★	3 —4½
1938	3629★	3 —3¾
1938 50	3867★	4 —4¾
1939	3896★	3 —4
1940 Six	7060	3 —4
1940 47 Six	7403	3 —4
1940 47 Eight	7067★	4 —4¾
1941	7416★	4 —4¾
1942 47	7700	4 —4¾
1951 52	9590★	4 —4¾
PIERCE ARROW		
1935 38 Eight	2112	3 —4½
1935 V12	2113	3 —4½
1936 38 V12	3010	3 —4½
PLYMOUTH		
1935	1789	2½—4
1936	2237	1½—4
1936 38	2995	2½—4½
1937 38	3137★	2½—3½
1938 42	3648★	3 —4
1938 42	3913★	3 —4
1939 46	3647	3 —4
1947 49	9042★	3½—5½
1949 50	9418★	3½—5½
1949 52 (Carter)	M639SL	3½—5
1949 52 (Carter)	M639SZ	3½—5
1950 52	9421	3½—5½
PONTIAC		
1935	1783	2½—3½
1935 36	2221	2½—3½
1936	2237	1½—4
1937 38	3109	3 —3¾
1937 38	3110★	3 —3¾
1939	3844	3 —3¾
1939	3825★	3 —3¾
1939 48 Six	3985	4 —4¾

Mak , Year and M del	Pump N . N t A	Pump Pressur , Lbs. Not B
1939 42 Six	3986	4 —4¾
1940	7087★	4 —4¾
1940	3895★	4 —4¾
1941 52 Eight	7317★	4 —4¾
1949 Six	7342	3½—4¾
1949 52	9640★	4 —4¾
REO		
1935	1772	1½—3½
1936	1116	1½—3½
STUDEBAKER		
1935	1795	2½—3½
1935	1828	2½—3½
1935	1796	2½—3½
1935 37	1829	2½—3½
1935 39	1797★	1½—3½
1936 40	2227	2½—3½
1939 42	3926	1½—3½
1939 46	3957	2½—3½
1941 47	7378	1½—3½
1946 49	9092	3 —4½
1946 50	9416	3 —4½
1948 49	9217★	4 —5
1950	9496★	4 —5
1951 52	9560	4 —5
1951 52	9647	4 —5
TERRAPLANE		
1935 36	1540	2½—3½
1937 38	3289	3 —4½
1937 38	3290★	3 —4½
WILLYS		
1935 36	1390	1½—3
1937 40	3306	1½—2½
1941 42	7320	1½—2½
1946 48	7409★	2½—3½
1946 49	9306★	2½—4½
1948 52 Six	9245★	2½—4½
1949 Four	9353★	2½—3½
1950 52 Four	9562★	2½—3½

AC FUEL PUMPS

Using Fig 1 as an example, all AC mechanical fuel pumps operate as follows

1 The cam on the engine camshaft forces the rocker arm outward which, through the linkage and pull rod, moves the diaphragm on its down stroke

2 The downward movement of the diaphragm creates a vacuum in the fuel chamber of the pump which sucks fuel from the gasoline tank

3 The diaphragm spring then pushes the diaphragm upward on a pressure stroke, which forces the contents of the fuel chamber into the carburetor bowl

4 The flow of fuel from the pump is controlled by the carburetor float The float opens and closes the float needle valve which builds up or reduces pressure in the pump fuel chamber As pressure is built up in the fuel chamber, it prevents the diaphragm from taking a complete stroke, thus reducing fuel flow As pressure reduces in the fuel chamber, it allows the diaphragm to take longer strokes, thus increasing fuel flow

Fig 2 shows a typical combination fuel and vacuum pump, the vacuum section being used as a booster for windshield wiper operation The operation of the vacuum pump is as follows.

1 Rotation of the camshaft eccentric actuates the rocker arm This pushes the vacuum diaphragm downward, expelling the air in the chamber through the discharge valve and into the intake manifold of the engine

2 On the return stroke of the rocker arm, the diaphragm moves upward, creating a vacuum in the chamber which opens the inlet valve, drawing air from the windshield wiper

3 When the windshield wiper is not being used, manifold vacuum holds the diaphragm downward against spring pressure so that the diaphragm does not make a complete stroke for every stroke of the rocker arm

4 When manifold vacuum is greater than the vacuum created by the pump, the air will flow from the windshield wiper through both valves, and the operation of the wiper will be the same as if the vacuum pump were not installed

5 When manifold vacuum is low, that is, when the engine is accelerating or operating at high speed, the vacuum created by the pump will be greater and will operate the wiper

TROUBLE DIAGNOSIS — Fuel pump trouble is of only two kinds Either the pump is supplying too little fuel, or too much If the pump is supplying too little fuel, the engine will either not run at all, or it will cough or falter If the pump is supplying too much fuel, gasoline will drip from the carburetor, or the engine will not run smoothly when idling Too much fuel will also produce hard starting

Fuel pumps may be tested with an analyzer which discloses fuel pump pressure and rate of flow, or it may be tested for pressure by connecting a gauge of the type shown in Fig 3, the test being made while the engine is running In the absence of this equipment, do not remove the pump from the engine until the following points have been checked

If the engine is getting too little fuel, proceed as follows

1 Be sure there is gasoline in the tank

2 Disconnect the fuel line at the carburetor or at the pump, whichever is easier to reach Then, with the ignition shut off, crank the engine with the starter If gas spurts from the pump, trouble is not in pump, lines or tank

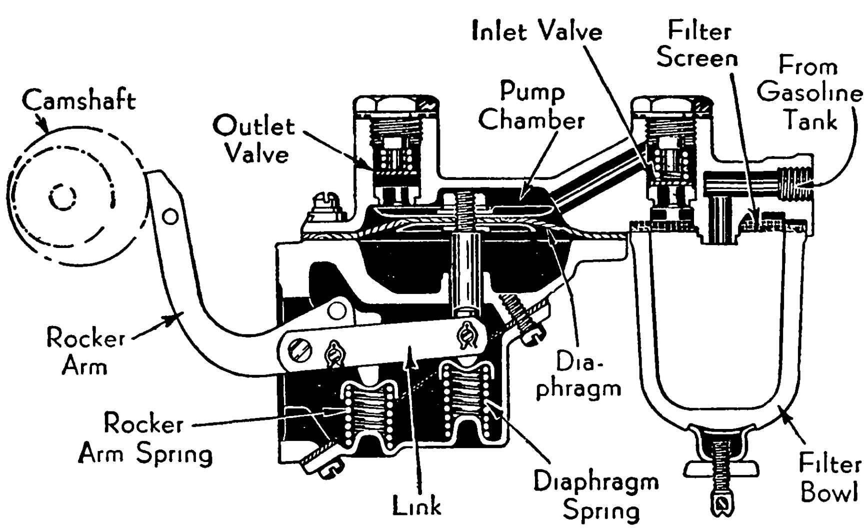


Fig. 1 AC FUEL PUMP. B series. D sign typical f D series

If no gas flows at all or if only a little gas flows, do the following:

1. Look for leaky bowl gasket. If not sure, replace gasket.
2. Remove and clean the strainer or screen which is inside the bowl.
3. Look for loose fuel line connections. Check all the way back to the tank. Tighten all connections.
4. Blow out all lines to remove any restrictions.
5. Make sure all pump cover screws are tight, and see that external plugs over pump valves are tight.
6. Inspect flexible line (if used) for breaks or porous condition.
7. Gasket between pump and engine too thick, causing low pump pressure.

If correction of the above items fail to restore the pump to operating condition, it should be removed for replacement or overhaul.

If the engine is getting too much fuel, the trouble is more than likely caused by one of the following: (a) defective automatic choke, (b) excessive use of hand choke, (c) punctured carburetor float, (d) defective carburetor needle valve, (e) loosely connected fuel line, or loose carburetor assembly screws, (f) improper carburetor adjustment, (g) gasket between pump and engine too thin, causing high pump pressure.

If none of the above items is the cause of flooding or poor gasoline mileage, then the pump needs overhauling.

VACUUM PUMP TROUBLES—If the windshield wiper is slow acting at high speed, it indicates an inoperative vacuum pump. Check the lines to the wiper. If the trouble is not in the lines, disassemble the vacuum pump and examine the valves and diaphragm.

If vacuum pump operation is noisy, it generally indicates either a worn or improperly installed oil seal or a worn vacuum pump link and rocker arm pin.

High gasoline pressure and noise indicates that the fuel pump is striking the vacuum pump diaphragm. This can be corrected by replacing the rocker arm pin and vacuum pump link.

If the vacuum pump diaphragm is punctured, oil is drawn from the crankcase, causing high oil consumption and ignition miss due to fouled plugs. A large hole will cause missing at low speed with throttle closed. In other words, this trouble will cause a very rough idle with a large puncture or broken diaphragm, and a somewhat rough idle with say a ⅛" puncture. This condition may be checked by the action of the windshield wiper upon acceleration, or by disconnecting the line on the manifold side of the vacuum pump to inspect for oil leakage.

Noisy operation or failure of the diaphragm may also indicate that it is either too taut, or too slack, which will be evident if the diaphragm is wrinkled.

SERVICE PROCEDURE—A good working knowledge of the three pumps described in the following paragraphs will furnish a good background for servicing all AC fuel and vacuum pumps.

Models B and R are representative of what is known as "single pumps"—which means that they pump nothing but fuel. The AJ pump, known as a "combination fuel and vacuum pump", not only pumps fuel but it also creates a vacuum which helps keep the windshield wiper operating.

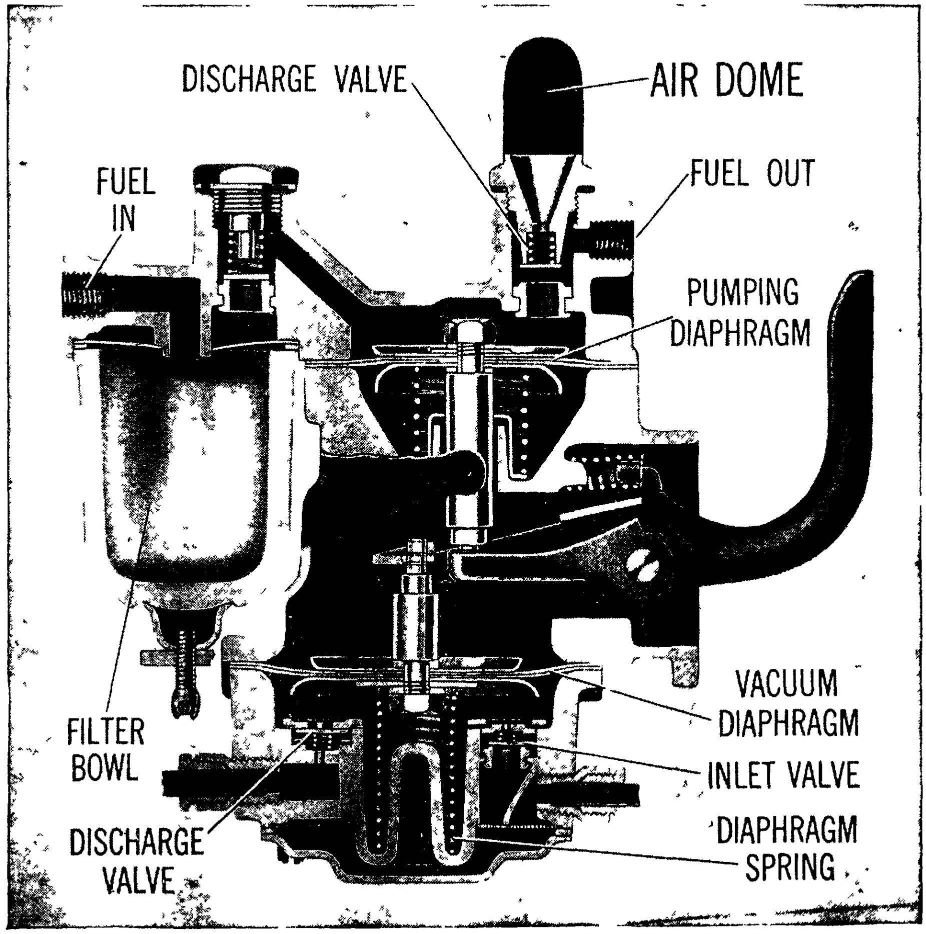


Fig. 2 AC COMBINATION PUMP. AB series Design typical of AD, AL, F, I, J, series

Fig. 4 is an exploded view of Model B, while Fig. 5 is that of Model AJ.

Do not attempt to overhaul fuel pumps unless you have a set of special tools designed for the purpose. If your equipment is not adequate, install a new or rebuilt pump, the latter being available on an exchange basis.

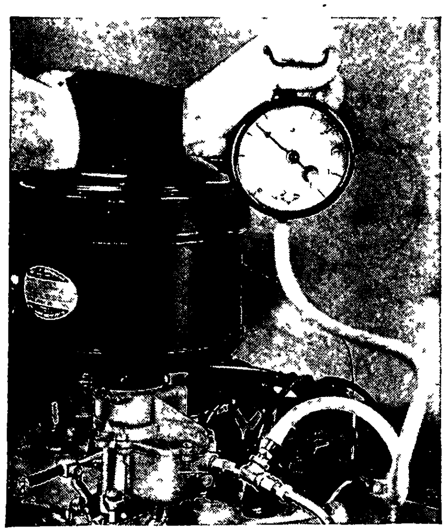


Fig. 3 Testing fuel pump pressure

Most pumps are identified by stamping the last four digits of the part number on the edge of the mounting flange. To identify the pump, convert these digits to the factory number by referring to the following key.

(152)1000 to (152)3999
(559)4000 to (559)4999
(85)5000 to (85)6999
(153)7000 to (153)9999

Some high production pumps are identified by the complete part number cast in the body, under the diaphragm flange.

SERVICE NOTE—B series pump repair procedure can also be used as a guide for series D and O. And insofar as the body section is concerned, it may also be used as a reference in servicing S, AC, AG and AR pumps, while the cover section is typical of series P, W, Y and AK.

R series pump repair procedure may be used as a guide in servicing E, G, T, AF, AH, AT, AU and AW pumps. It may also be used in servicing the body on series P, W, Y and AK, and the cover on S, AC, AG and AR pumps.

Use the AJ instructions as a guide in repairing all combination pumps.

PUMP REMOVAL—Disconnect the fuel line between the carburetor and pump, and the line between the pump and gaso-

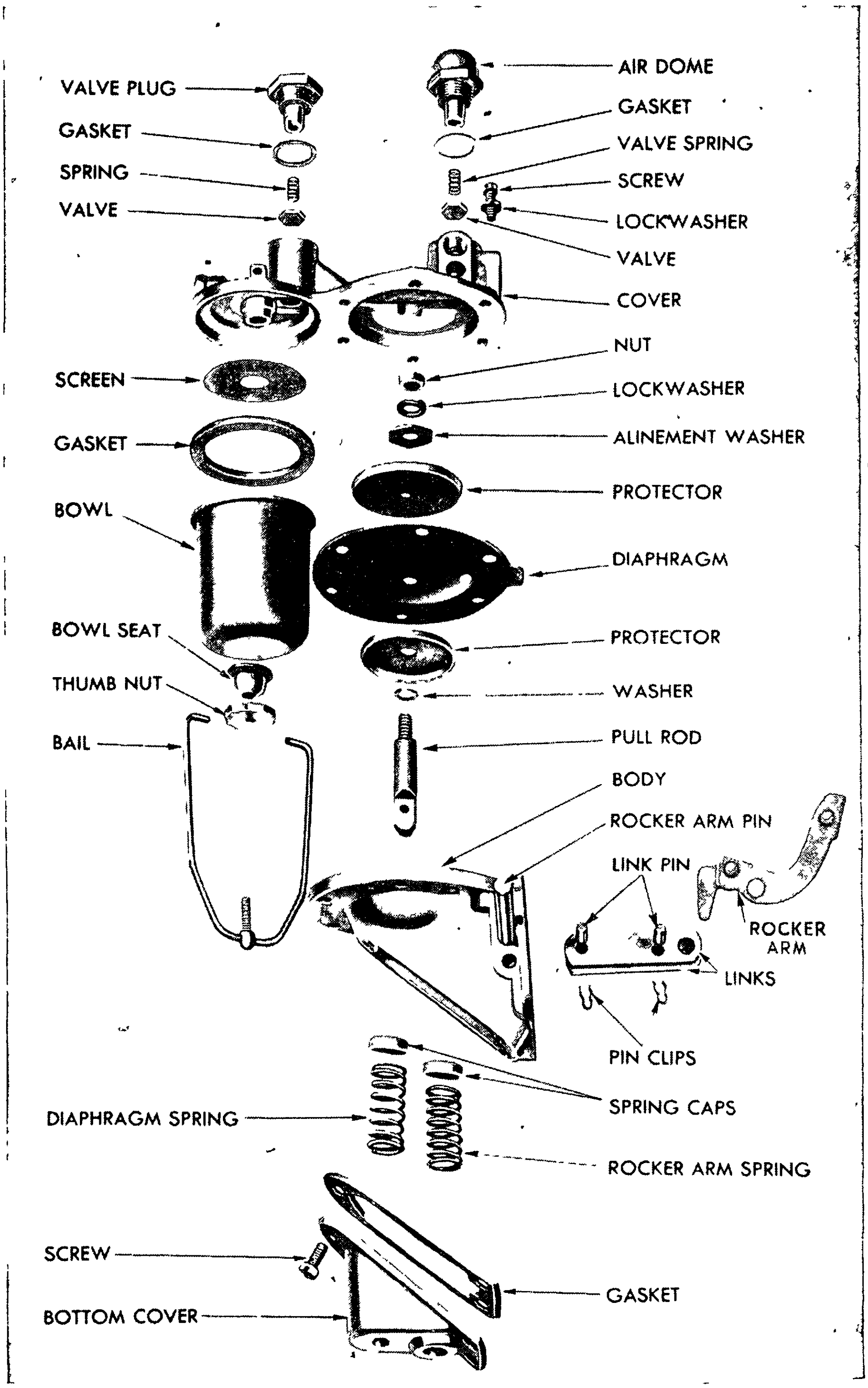


Fig. 4 Fuel pump exploded. Typical B series construction

line tank. If it is a combination pump, disconnect both vacuum lines. Remove bolts and washers which hold the pump to the engine. On some installations, the pump is mounted on a bracket which, in turn, is bolted to the engine. In these cases, it is easier to remove the pump and bracket as a unit. Lift off the pump and gasket. Clean the pump in gasoline or other suitable solvent.

PUMP DISASSEMBLY — Fuel pumps can be taken apart in any convenient manner but the following precautions should be observed.

Before taking a pump apart, always file a mark across the diaphragm flanges, Figs. 6 and 7. These file marks will serve as a guide when reassembling so that the inlet and outlet holes will match the position of the fuel lines. If a heat shield stud is used, the file mark should be made at the stud position.

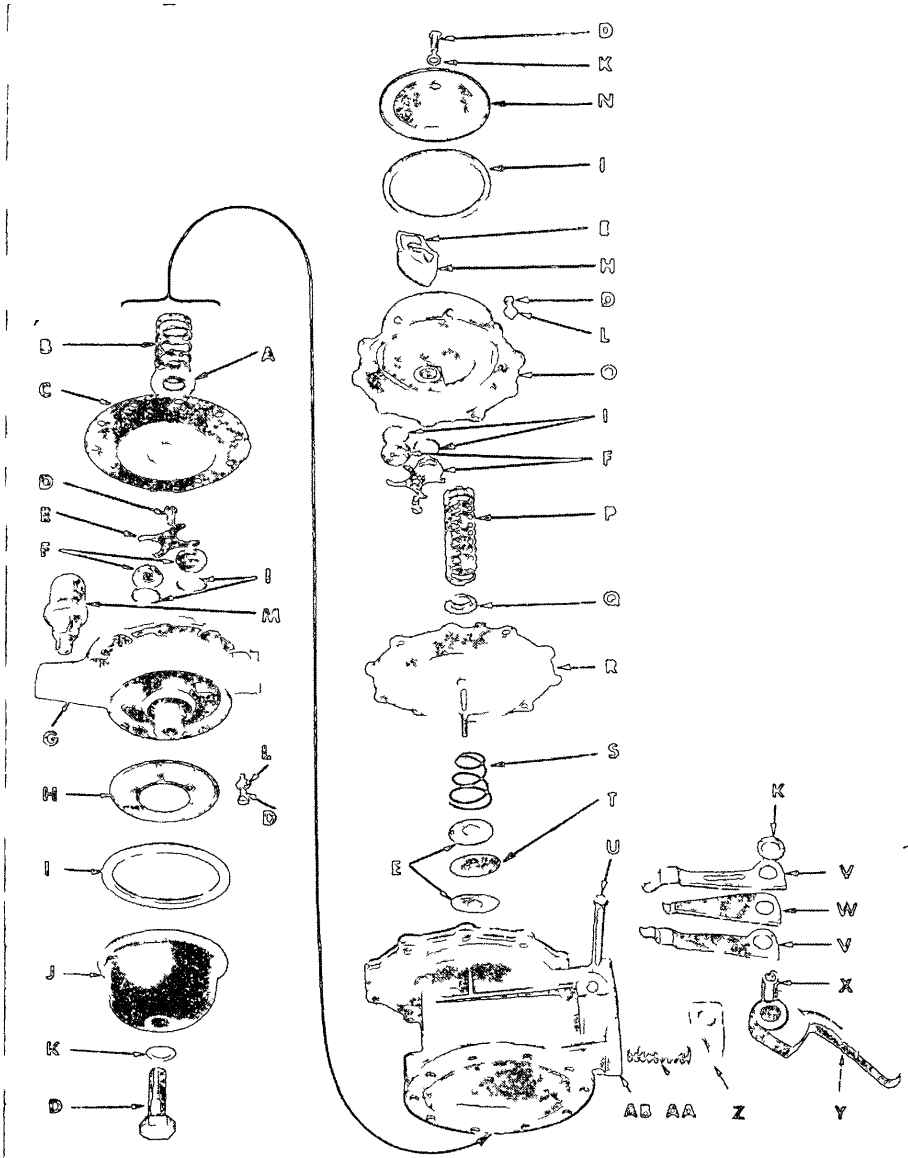
Fuel pumps with riveted diaphragm and pull rod assemblies, and the fuel section of combination pumps, usually have a tight fitting oil seal around the pull rod. The oils seal can be ruined by tipping the diaphragm while unhooking from the link. The safest method to follow is first to remove the rocker arm pin, 'rocker arm, and link. The diaphragm assembly can then be lifted straight out with no damage to the seal. This applies to pump series AH, AJ, AS, AT, AV and AW.

NOTE—B series pump diaphragm and rocker arm springs look alike but may have different pressures. Be sure to identify these springs for correct assembly. One method is to push a cover screw into the coils of the rocker arm spring.

Vacuum sections of combination pumps have a very strong diaphragm spring. Because of its strength, it is necessary to replace two opposite vacuum section diaphragm flange screws with two longer screws (1½ inches). Then remove the standard screws and alternately back off the long screws until spring pressure is no longer effective.

ASSEMBLING B TYPE PUMPS

1. Assemble the two links, Fig. 8, with one link pin and clips.
2. Attach the two links to the pull rod with the other link pin and clips. The cut off corner of each link should be nearest the diaphragm when the links are attached to the pull rod.
3. Install the assembly, Fig. 9, in the pump body, pushing the pull rod up through the hole provided for it. Be sure that the two links will swing to one side toward the rocker arm pin hole. This is necessary so that the rocker arm pin will pass through the holes at the ends of the links.
4. Hold the pull rod in position and slip the rocker arm through the slot. Be sure that it slides in between the two links and that the projecting hook on it goes *over* the link pin.
5. Insert the small end of assembly pin, Fig. 10, through the body, link and rocker arm. Push assembly pin through so that large end is retaining link and arm in position.
6. Maintain a slight pressure on the assembly pin while driving it out of the body with the permanent rocker arm pin.
7. Peen the edges of the pin hole over both ends of the pin. If the rocker arm pin is of the kind having rings to hold it, slip the two spring rings into the grooves at each end of the pin. If the pin has a head on one end and a tapered, hollow end on the other, install a washer over the taper and spread the hollow part to retain in position.
8. Install the parts of the diaphragm assembly over the threaded end of the pull rod in the order indicated in Fig. 11. The diaphragm should be dipped in kerosene to soften. It also acts as a lubricant between the layers of the diaphragm cloth. When installing the diaphragm fabric, be sure that the tab is in a position which will not interfere with the bowl.
9. Hold the hexagon alignment washer with the special wrench shown in Fig. 12 while tightening the pull rod nut. The alignment washer must be held stationary to avoid diaphragm distortion.



A—RETAINER
B—FUEL DIAPHRAGM SPRING
C—FUEL DIAPHRAGM
D—SCREW
E—RETAINER
F—VALVE AND CAGE
G—FUEL COVER
H—SCREEN
I—GASKET
J—BOWL
K—WASHER
L—LOCKWASHER
M—AIR DOME
N—PLATE
O—VACUUM COVER
P—VACUUM DIAPHRAGM SPRING
Q—SPRING RETAINER
R—VACUUM DIAPHRAGM
S—OIL SEAL SPRING
T—OIL SEAL
U—PIN
V—VACUUM LINK
W—FUEL LINK
X—BUSHING
Y—ROCKER ARM
Z—LINK SPACER
AA—SPRING
AB—BODY

Fig. 5 Combination pump exploded. Typical AJ series construction

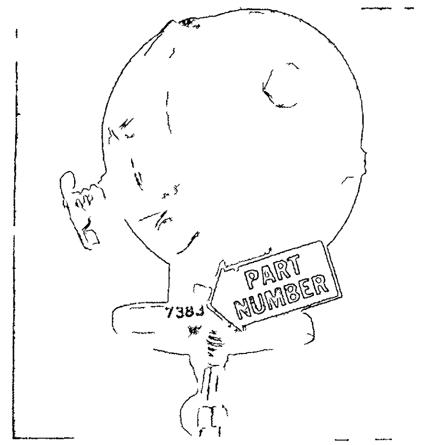


Fig. 6 Locati n f pump part numb r

Fig. 7 File mark acr ss flanges before disass mbly

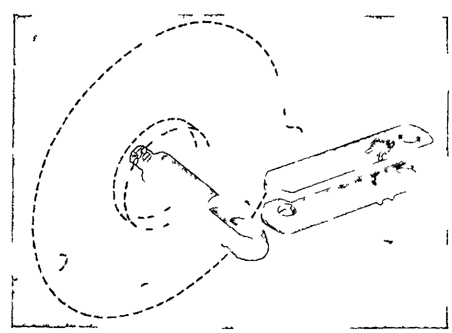


Fig. 8 B SERIES Link and pin assembly

Fig. 9 B SERIES Links placed in pump b dy

10 Holding the lower cover in your hand place the rocker arm spring and diaphragm spring over the bosses (hollow cones) on the inside of the cover Fig 13 Install the two spring caps over the ends of the springs with the rims down Replace gasket on cover flange

11 Bring the lower cover and pump body together, Fig 14, being sure that the cup of one cap fits around the end of the pull rod and the cup of the other fits around the end of the rocker arm Install the cover screws and tighten securely

NOTE—In assembling the top cover, if the brass valve seats are worn or damaged, new ones can be installed

12 Turn the top cover right side up Put a drop of light oil on a new inlet valve and place the valve in the well or recess over the bowl Be sure the valve lies flat Install a new outlet valve in its recess in the same manner

13 Place a new inlet valve coil spring, Fig 16, on top of the inlet valve

14 Install the inlet valve chamber plug and a new gasket Fig 17, starting it with your fingers to be sure the valve

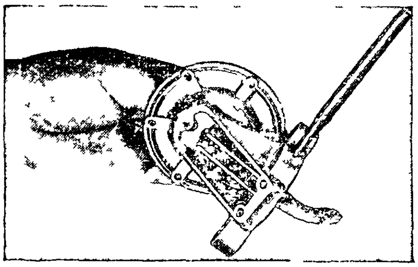


Fig. 10 B SERIES
Use f assembly pin

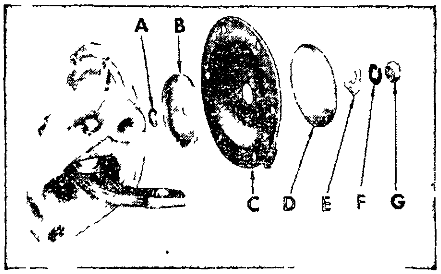


Fig. 11 B SERIES
Assembl diaphragm parts in fol- l wing s quence: A. Pull rod gasket. B. L wer diaphragm protector. C. Fabric diaphragm. D. Upper dia- p h r a g m protector. E. Diaphragm alignm nt washer (six-sided). F. L ck washer. G. Diaphragm nut.

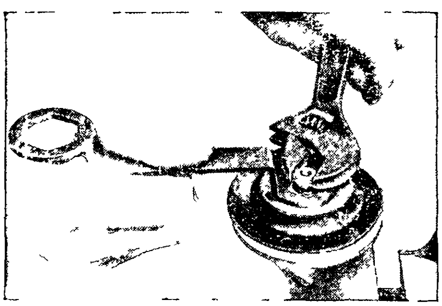


Fig. 12 B SERIES
H lding alignm nt washer with special wrench while tightening pull rod nut

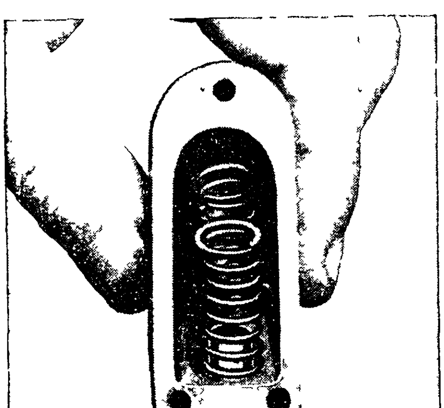


Fig. 13 B SERIES
Assembling springs in lower c v r

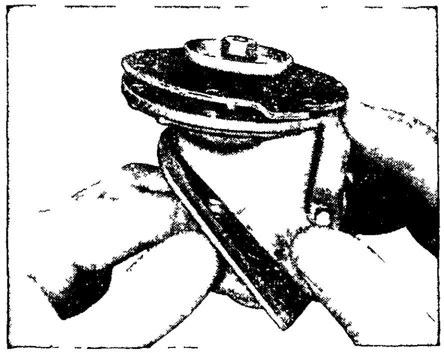


Fig. 14 B SERIES
Assembling lower cover to pump body

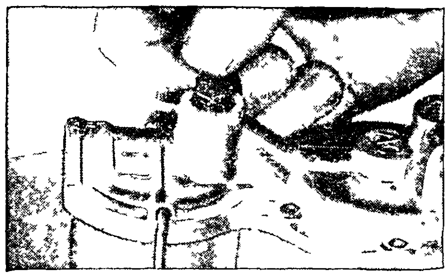


Fig. 15 B SERIES
Installing inlet valve

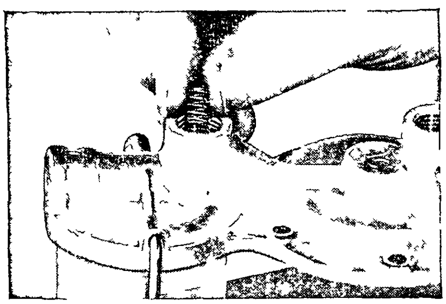


Fig. 16 B SERIES
Installing spring over inlet valve

spring fits up into the pocket in the plug.

15. Drop a new outlet valve coil spring down on top of the valve. Install the outlet valve chamber plug and a new gasket, in the same way you replaced the other plug. When an air dome is used, Fig. 18, it is always placed over the outlet valve.

16. Put the body in a vise and line up the file marks which were made before the pump was dismantled. Level the diaphragm by moving the rocker arm. Hold it while you install all screws and washers finger tight. Be sure they pass through the holes in the diaphragm easily without chewing the fabric. Tighten the screws only enough so that they just touch the lock washers.

17. Actuate the rocker arm several strokes, releasing with a snap. Then tighten the cover screws. Do this alternately, first a screw on one side, then a screw on the opposite side, repeating this until all screws are tightened securely.

NOTE—The most important single item in the repair of fuel pumps is to pull

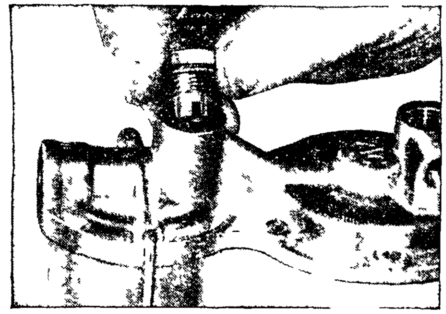


Fig. 17 B SERIES
Installing inlet valve chamber plug

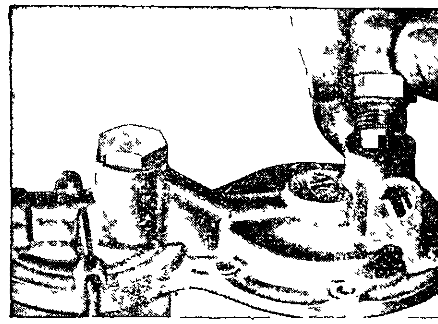


Fig. 18 B SERIES
Installing outlet v a l v chamber plug or air d me

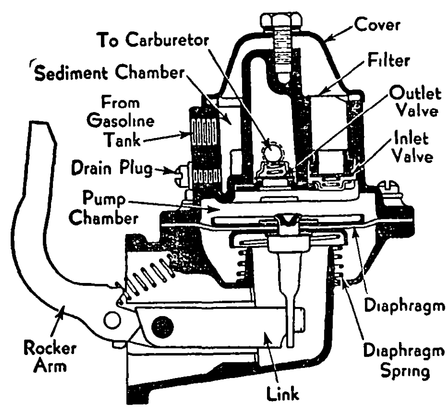


Fig 19 R SERIES Secti nal vi w

sufficient diaphragm cloth inside the pump to prevent stretching of the cloth when pump is placed in operation.

18. When assembling the strainer, hold the pump upside down and replace the screen in the bowl recess. The screen must fit tightly around the inlet shoulder and its outside edges must be flat on the screen recess. Spring the bail into position in its retaining holes.

19. Place a new bowl gasket in position. Clean the bowl thoroughly. Then put the bowl in place over the gasket and retain it with the bail.

ASSEMBLING R TYPE PUMPS

Fig. 19 is a sectional view of series R pump. Bodies on fuel pumps of this general construction may be classed ac-

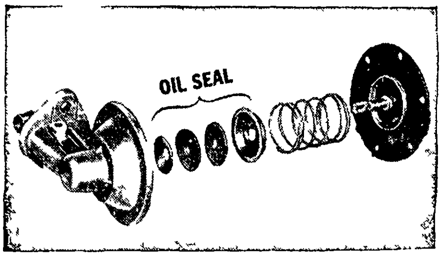


Fig. 20 R SERIES
Assembly sequence of oil s al wh n parts are separate

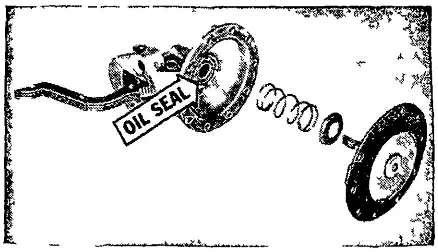


Fig. 21 R SERIES
Staked-in type oil seal

cording to the type of oil seal around the diaphragm pull rod

The oil seal shown in Fig 20 is made up of a compression spring and two leather washers sandwiched between metal discs, the latter being keyed for locking over the pull rod flat As a variant, you may find a cup-shaped rubber oil seal held in place by the diaphragm spring

The oil seal in Fig 21 is an integral part of the body It has an important function in preventing loss of crankcase oil The body and oil seal assembly must be replaced if the seal is dried out or the fine leather edge is torn On these bodies the diaphragm assembly *must* be installed correctly to avoid oil seal damage

The following procedure is based on the required procedure for bodies with staked-in oil seals, Fig 21

1 Make an assembly of rocker arm and link Retain with bushing, if one is used

2 Slide the rocker arm and link assembly into the body and retain in position with the thin end of the assembly pin shown in Fig 22

3 Replace the rocker arm spring, and large coil (diaphragm) spring, Fig 23, on the staked-in oil seal (or the body ledge around the pull rod hole) Lay diaphragm spring retainer on spring

4 Push the diaphragm pull rod straight through oil seal, against spring pressure Press on diaphragm to tilt rod slightly away from link Raise pump body until it is upside down so link will fall into engagement with pull rod Bring diaphragm back to level position to hook pull rod on link

5 Push the assembly pin through, Fig 24, so that thick portion is holding arm and link assembly in position

6 Maintain a slight pressure on assembly pin, Fig 25, and drive it out of body with permanent rocker arm pin

7 For bullet type pins, stake the edge of the pin hole over the end of the

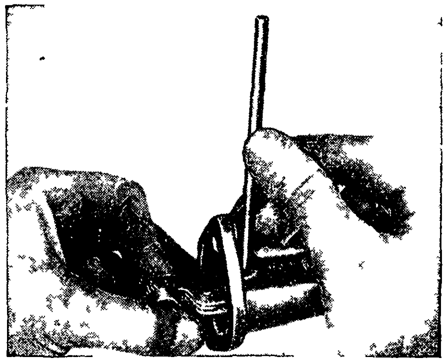


Fig. 22 R SERIES
Use of assembly pin to hold rocker arm and link in place

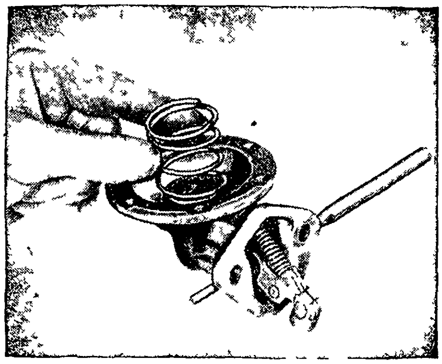


Fig. 23 R SERIES
Installing diaphragm spring arm and link in position

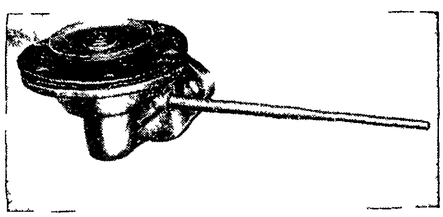


Fig. 24 R SERIES
Showing thick portion of assembly pin holding rocker

pin Do this at both ends of the pin If the pin has a head on one end and a tapered hollow end on the other, install a washer over the taper and spread the hollow part to retain in position

8 Stand the cover casting on the bench with the flange up Drop the fibre valve seat gaskets, Fig 26, down into the two valve pockets Drop the valves down into valve holes on top of paper gaskets Three legs up for inlet valve and legs down for outlet valve

9 Place valve cage retainer down on valves so that two pairs of arms rest on edges of valve assemblies and so the two small holes in the retainer line up with screw holes in casting The retainer is slightly curved and should be installed so the hump of the curve is toward you This will give the retainer some spring pressure when the screws are tightened down

10 If the pump being serviced is one in which the valves are not a unit, in-

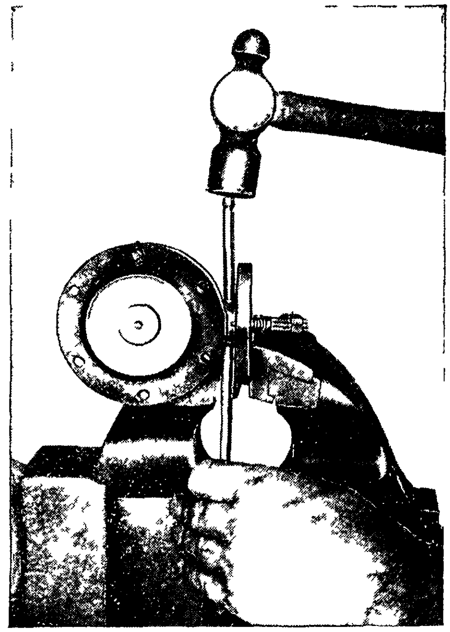


Fig. 25 R SERIES
Driving assembly pin out f body with permanent rocker arm pin

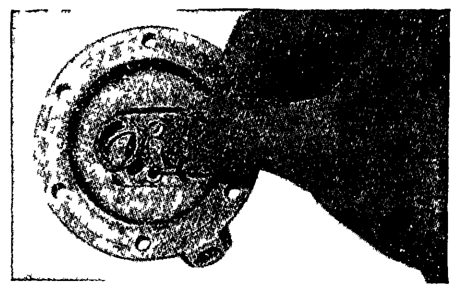


Fig. 26 R SERIES
Installing valve seat gaskets

stall the separate parts in the order shown in Fig. 27

11 Replace bowl cover gasket on edge of body casting Place screen, Fig 28, over gasket in such a way that rim of screen lies close against it The two small metal projections near the center of the screen should be on your side of the screen

12 Install bowl cover, Fig 29 Lay the cover over the casting and screen and install the cap screw through the hole in the center of the cover Tighten this screw securely Be sure fibre gasket is in place under a screw head

13 Clamp the body in a vise and line up the file marks which were made before the pump was dismantled Level the diaphragm by moving the rocker arm Hold it while installing all screws and lock washers Be sure screws pass through holes in diaphragm easily without chewing the fabric Tighten screws just enough so the heads touch lock washers

14 Push rocker arm back and forth several strokes, releasing with a snap Then tighten the cover screws Do this alternately, first a screw on one side, then a screw on the opposite side, re-

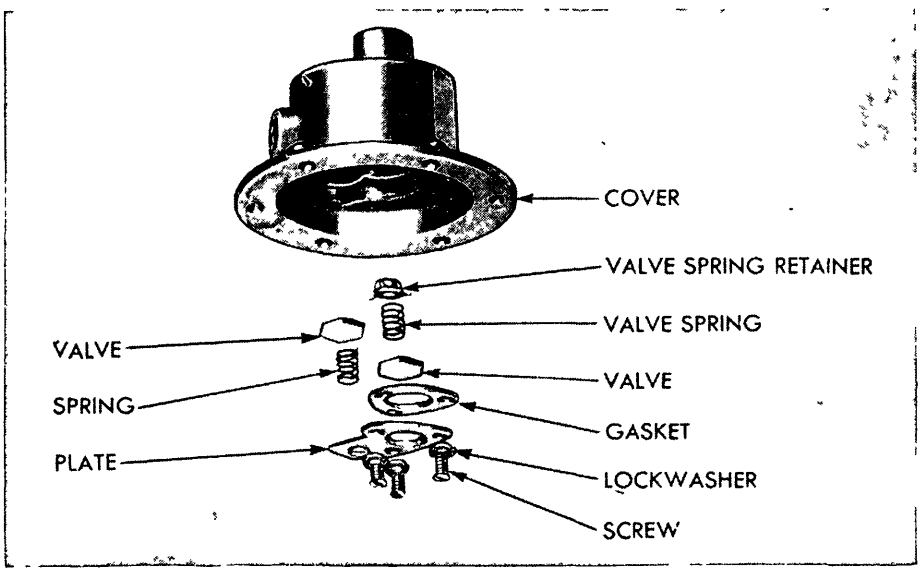


Fig. 27 R SERIES
If pump being serviced has separate valve parts, assemble sequence shown

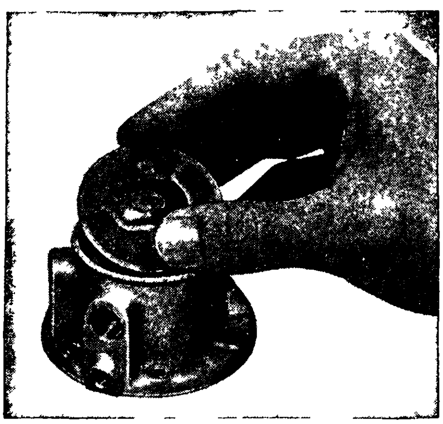


Fig. 28 R SERIES
Install screen with two metal projections facing you

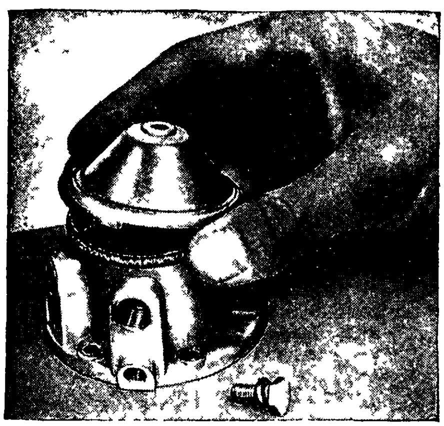


Fig. 29 R SERIES
Installing bowl cover

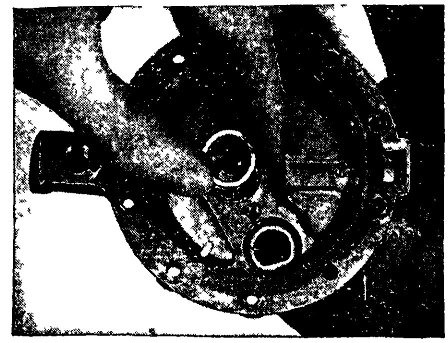


Fig. 30 AJ SERIES
Installing fibre valve gaskets

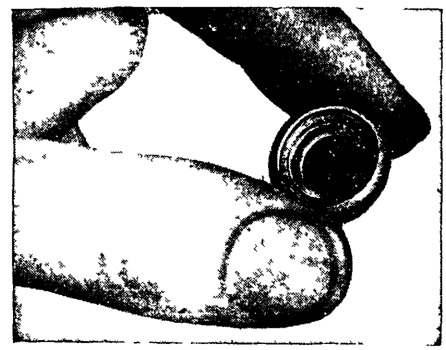


Fig. 31 AJ SERIES
Install valve with three-legged side down in valve seat nearest outlet hole

Fig. 32 AJ SERIES
Install other valve with legs up

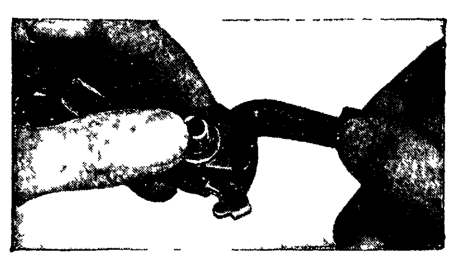


Fig. 33 AJ SERIES
Assembling bushing in rocker arm and link parts

peating this procedure until all are tightened securely.

15. If a drain cock and spring is used, install these parts.

ASSEMBLING AJ COMBINATION PUMP

The following repair procedure is generally applicable to all combination pumps.

1. Install the small fibre valve gaskets in the two valve seats, Fig. 30.

2. Place one valve assembly, Fig. 31, in the valve seat nearest the outlet hole in the center. Three legged side should go *down* into chamber.

3. Install the other valve assembly, Fig. 32, in the other seat, but keep the three legs *up*. If the pump being serviced is the type in which the valves are not a unit, replace the separate parts in the order shown in Fig. 27.

4. Set valve cage retainer in place over the valve cage assemblies. Hump in retainer should be *up*. Retain with one screw.

5. Thoroughly clean the screen and place in cover. Position a new bowl gasket. Clean the fuel bowl, install it, and retain with cap screw and gasket.

6. In assembling the pump body, the first step is to assemble the parts which combine to form the rocker arm and link assembly. Slide the spacer over the end of the short link so that the holes line up. The spacer should hang down from the link so it points in the opposite direction to the link hook. The projection on the spacer should point toward the hook end of the link.

7. Place one long link on each side of the spacer. Line up the holes. Be sure that the hook ends of the long links come together so that the long links surround the short link. Also be sure that the hooks on the two long links point in the same direction as the hook on the short link.

8. Place spacer washer (if required) on the outside of each long link, lining up all holes. Slide the whole assembly between the jaws of the rocker arm. The flat surface of the rocker arm pad should face the same way as the link hooks.

9. Slide the pin bushing, Fig. 33, through the holes in the rocker arm,

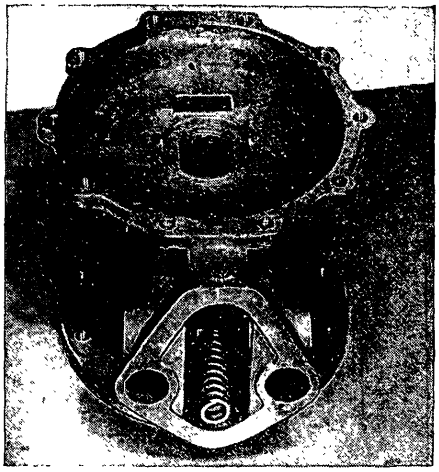


Fig. 34 AJ SERIES
Installing rocker arm spring in slot

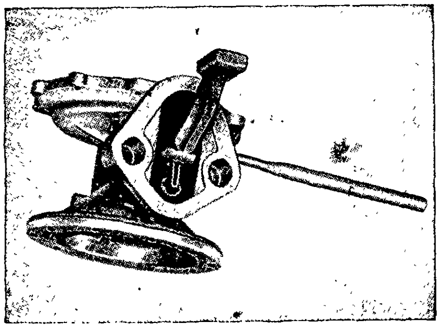


Fig. 35 AJ SERIES
Retain rocker arm and link in body with assembly pin shown

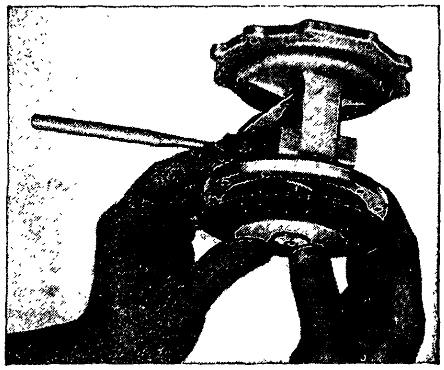


Fig. 36 AJ SERIES
Assembling diaphragm in b dy

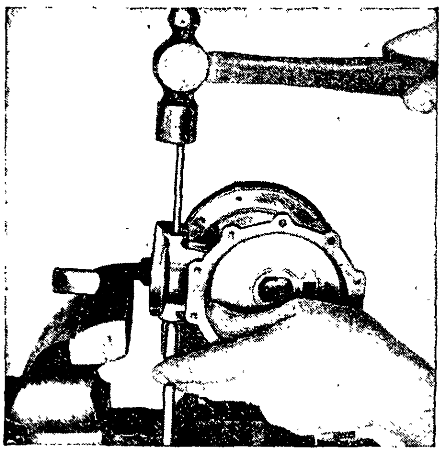


Fig. 37 AJ SERIES
Driving ut assembly pin by installing permanent rocker arm pin

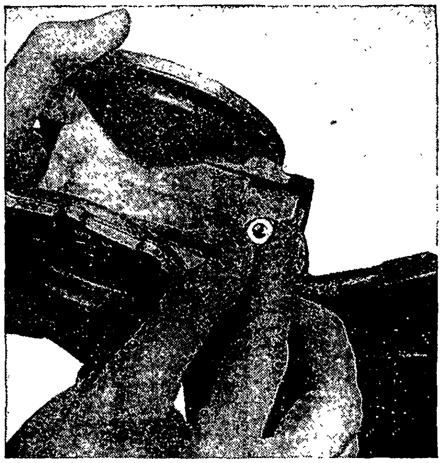


Fig. 38 AJ SERIES
Installing washer over small end of rocker arm pin. Turn washer until it lies flat

Fig. 39 AJ SERIES
Assembling body to c ver, matching previously made marks

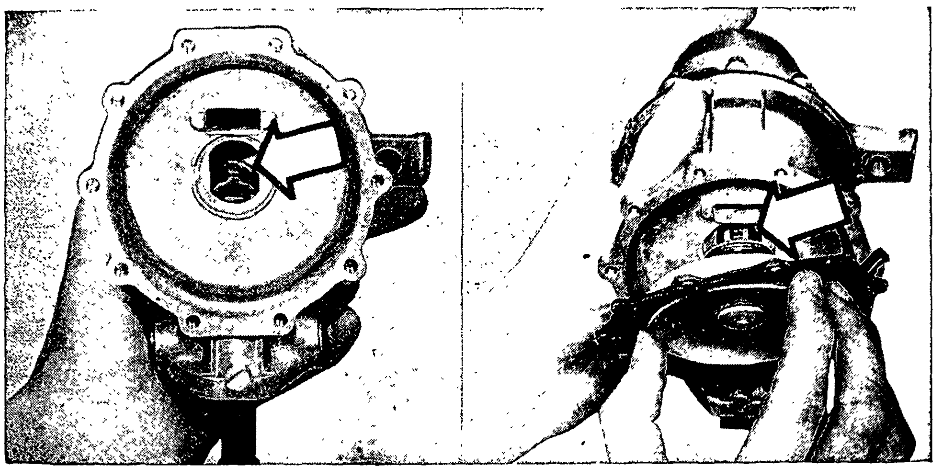


Fig. 40 AJ SERIES. Sighting through holes in body for pull r d installation (left). Assembling pull rod and diaphragm (right).

spacer washers, long links, spacer, and short link.

10. Stand the pump body on the bench, fuel flange *down.* Then place the rocker arm coil spring, Fig. 34, in the rocker arm slot and set the end of the spring over the cone (or stud) cast in the body. Slide the link and rocker arm assembly into this slot. The outer end of the rocker arm spring slips over the projection on the link spacer.

11. Push the link and arm assembly in until the pin bushing lines up with the pin holes in the pump body. With the assembly pin shown in Fig. 35, retain the rocker arm and link assembly in the body.

12. Place the diaphragm spring on the metal casing of the oil seal. Install the retainer (dish down) on top of spring.

13. Push diaphragm pull rod straight through oil seal, against spring pressure, Fig. 36. Push down on the diaphragm to tilt pull rod slightly away from the link. Raise pump body until it is upside down so link will fall into engagement with pull rod. Bring diaphragm back to level position to hook pull rod on link.

14. Push assembly pin, Fig. 37, through body so that large diameter is holding rocker arm. Drive assembly pin out with permanent rocker arm pin.

15. Turn the pump body on its side, large end of rocker arm pin down. Then slip the washer over the small end of the pin, Fig. 38. Turn the washer until it lies flat. Spread the end of the pin with a ball peen hammer or round-nosed punch.

16. Line up the file marks, Fig. 39, which were made before the pump was dismantled. Maintain pressure on the rocker arm so that diaphragm is level with flange. Install all screws and lock washers in the holes around the rim of the top cover. Be sure that they pass through the fabric diaphragm without

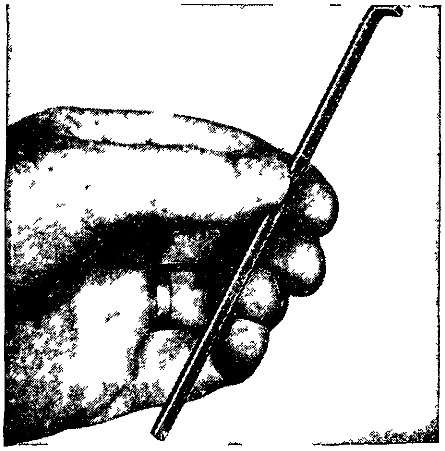


Fig 41 AJ SERIES
Diaphragm leveling tool

Fig. 42 AJ SERIES
Leveling tool in operation

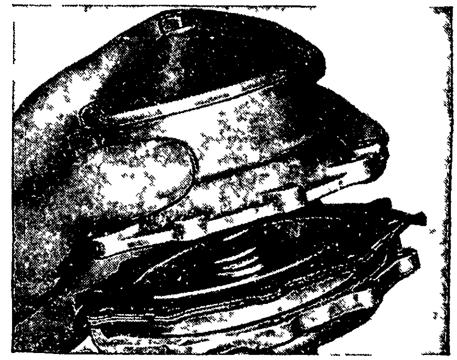


Fig. 43 AJ SERIES
Assembling vacuum c ver over diaphragm spring

Fig. 44 AJ SERIES
Lining up cover with b dy according to previously made marks

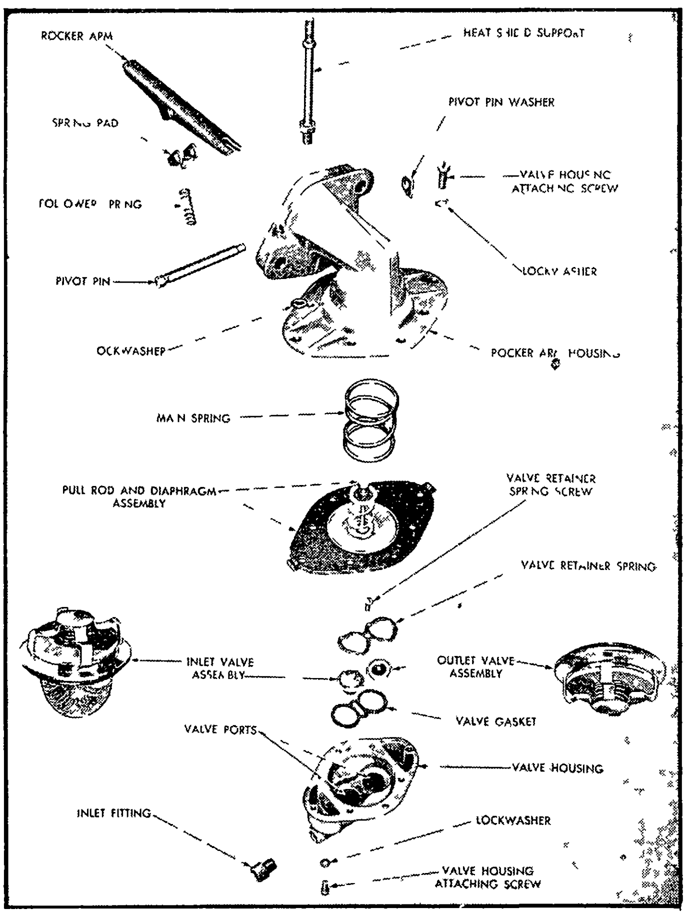


Fig. 45 Auto-Lite fuel pump. Inlet and outlet valves are shown exaggerated

chewing Tighten the screws only enough so that they just touch the lock washers

17 Pump the rocker arm two or three full strokes This assures that the diaphragm will not be stretched too tightly Then tighten all cover screws Do this alternately, a screw on one side, then the screw on the opposite side, repeating procedure until all are tightened securely

18 In assembling the vacuum cover, rinse the fine mesh wire screen thoroughly in gasoline or other solvent. Then dry it thoroughly, being careful not to bend it

19 Lay the cover casting on the bench with the diaphragm flange down and place screen over valve hole Install the screen retainer over screen

20 Place cover gasket in cover, set the cover on the casting and install the cap screw and washer, tightening securely

21 Turn the cover over and place the inlet and outlet gaskets in the valve recesses. Install one valve assembly in the valve seat nearest the outlet hole, with three legs facing down Place the other valve in the other chamber with the legs up If the pump being serviced is one in which the valves are not a unit, install the separate parts in the order shown in Fig 27

22 Install the valve cage plate with the hump upward Install valve retainer screw

23 Lift pump body above eye level, Fig 40, so you can see up inside through the center hole from the vacuum (lower) side Put the pull rod up through this hole and slip the pull rod slot over the hooks on the two long links Do not force vacuum links down by operating rocker arm The vacuum links should be left free so they rise naturally when the pull rod is engaged Applying force to the links will distort the pull rod

24 Hold the vacuum diaphragm assembly in place while you fasten the pump body in a vise, with the vacuum diaphragm up It is necessary to have the diaphragm held level with the body flange while attaching the cover Do this with the flexing tool shown in Fig 41

25 Push on the rocker arm until the diaphragm is level with the flange on which it rests Hold the rocker arm at this point Slip the hook of the flexing tool in between the rocker arm and the body casting, Fig. 42. Release the

rocker arm against leveling tool and the diaphragm will remain level.

26. Install circular spring seat on center of diaphragm retainer (over pull rod end).

27. Place the diaphragm spring on the seat. Then, Fig. 43, drop the vacuum cover over the spring. Do not try to press cover all the way down. Be sure spring seat stays down in place against diaphragm protector.

28. Line up the file marks, Fig. 44, which were made before the pump was taken apart. Insert two long (1½") screws in two opposite holes in the cover flange. Turn down these two screws as far as they will go without forcing. This will draw the lower cover toward the body far enough to allow the short screws to take hold.

29. Install screws with lock washers. Tighten screws only enough so that they press lightly against lock washers. Remove the two long screws and install short ones.

30. Remove the diaphragm leveling tool. The diaphragm will then flex the correct amount because of the pressure of the heavy spring. Tighten all cover screws. Do this alternately, first a screw on one side, then a screw on the opposite side, repeating the procedure until all screws are tightened securely.

INSTALLING PUMP—All series. 1. Insert the rocker arm through the opening in the engine. Make sure that the "pad", which is always the flat surface, rests against the cam on the engine camshaft.

2 Holding the pump in position against the engine, gasket in place, insert the bolts with lock washers in the mounting holes. Start the bolts with your fingers to prevent damage to the threads.

3 Tighten all bolts securely with a suitable wrench.

4 First check the fuel line to be sure it is properly aligned with the opening on the pump. Then start the nuts of both lines with the fingers before tightening them securely with a wrench.

5. On combination pumps, connect both vacuum lines.

AUTO-LITE FUEL PUMP

The operating principle of this type pump, Fig. 45, is similar to that described for AC. A rocker arm, actuated by a cam on the engine camshaft, moves the diaphragm up to admit fuel into the pump through the inlet valve. On the return stroke of the rocker arm, the diaphragm is forced down by the main spring. This action opens the outlet valve, allowing the fuel in the pump to be expelled to the carburetor.

TESTING PUMP ON CAR

If the pump fails to deliver sufficient fuel to the carburetor first check the fuel lines for leaks or clogging. Check flexible hose for cracks or deterioration. If none of these conditions is the cause of the trouble, check the pump breather hole for signs of gasoline or oil leakage. A gasoline leak indicates a defective diaphragm, whereas an oil leak points to a damaged oil seal in the diaphragm pull rod. In either case, the diaphragm must be replaced.

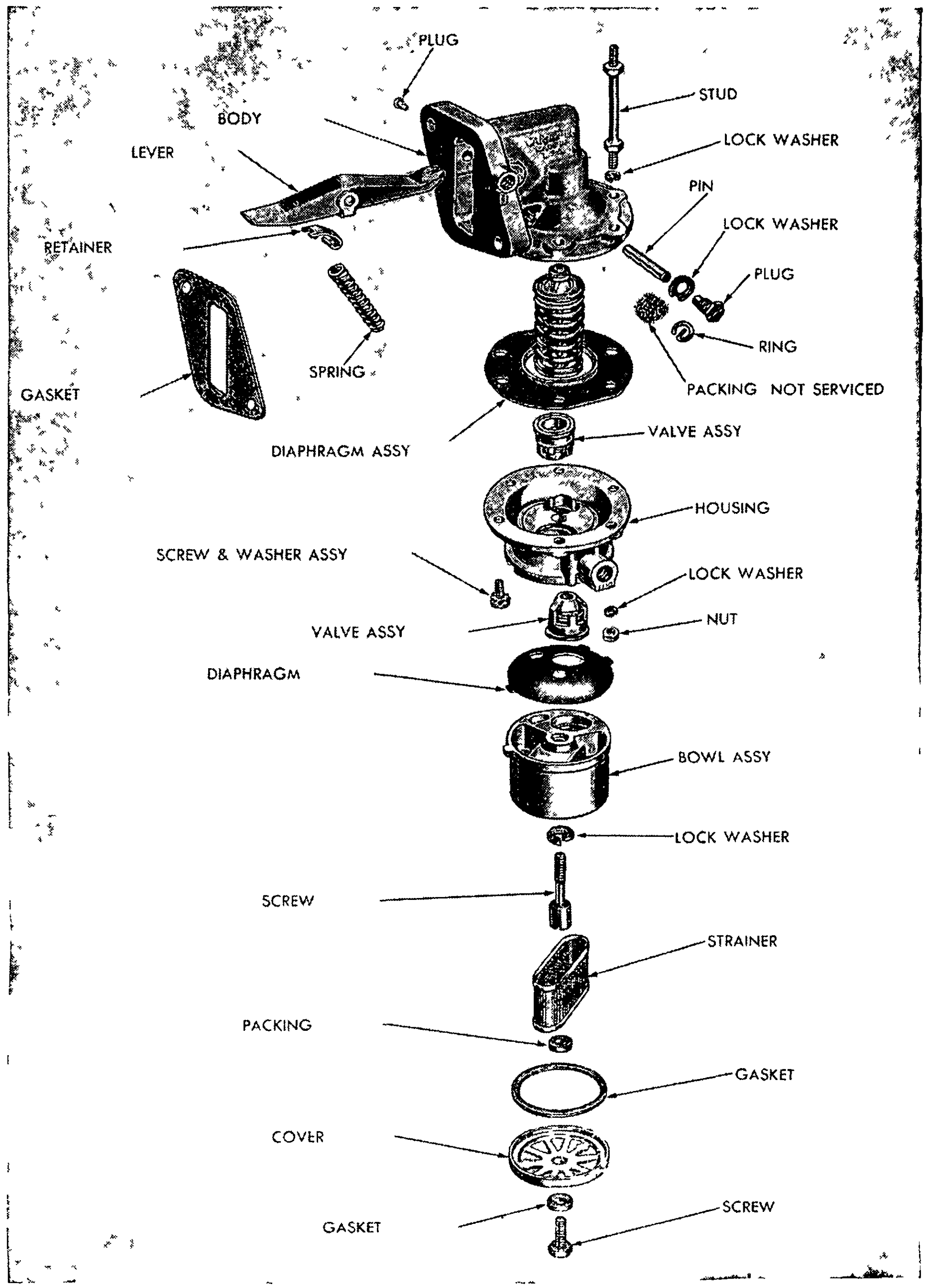


Fig. 46 CARTER MECHANICAL FUEL PUMP

If no leakage is evident, the next step is test the pump pressure. To do this, insert a "T" fitting into the fuel line at the carburetor (see Fig. 3). Connect a pressure gauge to the "T" and take the pump pressure with the engine running.

Pump pressure should be between 3½ and 5½ lbs., and should either remain constant or return to zero very slowly when the engine is stopped. If the pressure drops to zero instantly, the outlet valve is leaking and must be replaced.

Low pump pressure indicates a weak diaphragm main spring, or improper assembly of the diaphragm.

High pump pressure signifies that the main spring is too strong.

To test the inlet valve, disconnect the inlet line and, while the engine is running, hold a finger over the inlet fitting. There should be a noticeable suction, not alternated by blow-back. If blow-back is apparent, the inlet valve is not seating properly and must be replaced.

SERVICING THE PUMP

Before disassembling the pump, scribe a mark across the flanges of both housings so that when reassembled, the "Inlet" mark will be facing the inlet fuel line. Disassemble as follows:

1. Separate the lever housing from the valve housing by removing all of the attaching screws, including the heat

shield support screw and the screw under the valve housing.

2. If the diaphragm requires removal, remove the washer from the pivot pin. Drive out the pivot pin and pull the rocker arm, follower spring and spring pad directly away from the housing.

3. Remove diaphragm and main spring, and the screw holding the valve retainer in position.

4. Remove the inlet valve and strainer, outlet valve and gasket from the housing. Individual parts of valves are not available for service; they must be replaced as a unit.

Inspection—Examine the diaphragm for cracks, torn screw holes or ruptures. Check the rubber oil seal on the pull rod for deterioration. Check valves, valve seats and ports for gum deposits which would cause sticking. Gum deposits may be removed with denatured alcohol.

Inspect the rocker arm and pivot pin for wear. Test the tension of follower spring which should be 5 lbs. when compressed to $\frac{21}{32}$ in. The spring load on the main spring should be approximately 11½ lbs. when compressed to $1\frac{3}{32}$ in.

Assembly — Reverse the disassembly operations to assemble the pump, being sure to insert the inlet valve and strainer in the inlet port. And never use shellac or any other adhesive on the diaphragm.

CARTER FUEL PUMP

Referring to Fig. 46, the service procedure for this pump is as follows:

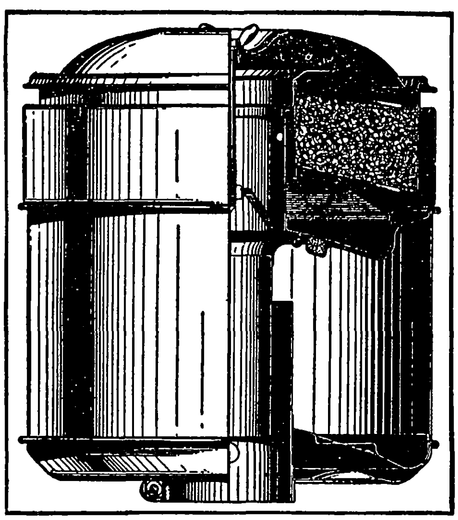
1. Mark pump body and valve nousing to assure correct reassembly.
2. Remove cam lever return spring.
3. Remove rivet plug, and cam lever pin plug and washer.
4. Remove cam lever pin, and take out cam lever and spring retainer.
5. Remove vent retainer ring and packing, and take off bowl cover, gasket and strainer.
6. Remove bowl retaining screw, bowl and outlet air dome diaphragm.
7. Remove pump valve housing by inserting a screwdriver at opposite sides between the valve housing and body at flats of diaphragm. By twisting the screw drivers in opposite direction, the valve housing will come off.
8. Lift out the diaphragm assembly, and remove both valve cages.

Clean all parts in gasoline or solvent and dry with compressed air. Replace all worn or damaged parts. To reassemble, proceed as follows:

1. Install new intake valve cage assembly, using tool T109-191. With the same tool, install new discharge valve cage assembly.
2. Install diaphragm with flats toward ports. Then install pump valve housing, starting all screws but do not tighten. Be sure marks previously made on body and valve housing are aligned.
3. Install cam lever and spring retainer, cam lever pin, cam lever pin plug and washer, and a new rivet plug, using tool T109-43 for the plug.
4. Flex the diaphragm to full downward position and hold in place while tightening valve housing attaching screws. Tool T109-192 may be used to flex diaphragm and hold in position.
5. Install outlet air dome diaphragm, bowl, and bowl retaining screw and washer.
6. Insert cap screw through gasket and bowl cover and install felt packing on screw. Then install strainer, bowl cover and ring gasket.
7. Install vent packing and retainer, and complete the assembly by installing the cam lever return spring.

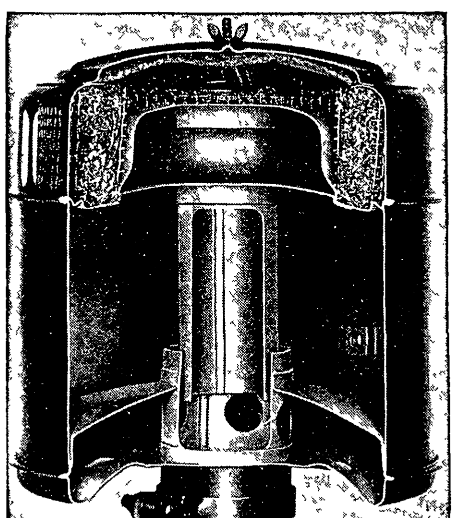
NOTE—When installing pump on engine, be sure slot and stud holes in gasket are aligned with those in face of pump body.

AIR CLEANERS



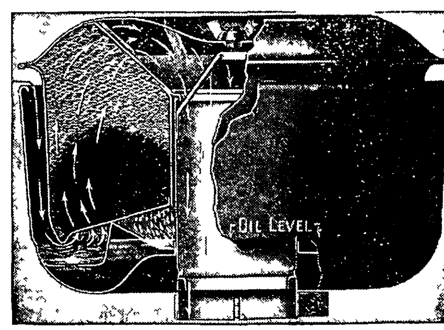
AC OIL BATH TYPE

Remove the wing nut from the top and remove the cover. Then remove the filter element by hand. Do not pry this part if it sticks for it may damage the filter element flange which must lie flat to insure a tight seat against the body to prevent air leaks when the cover is assembled. Empty the oil from the cleaner and remove all accumulated dirt. Wash the body with clean gasoline and wipe it dry. Wash the filter element thoroughly by slushing it up and down in clean gasoline and then let it stand until thoroughly dry. Pour one pint of engine oil, SAE 50 in summer and SAE 20 in winter, into the reservoir. Do not oil the filter element as this is done automatically when the car is driven. Reassemble the filter element to the cleaner and then replace the cover and tighten it in place with the wing nut.



AC STANDARD TYPE

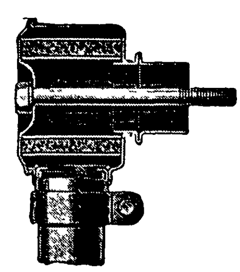
Unscrew wing nut and remove cover and felt pad. Remove cleaner element and wash it in clean gasoline r kerosene. Dip cleaner element in SAE 50 oil and let excess drain off. The felt pad must be fre f oil and have its hard side d wn. Th cleaner lement must always be moist.



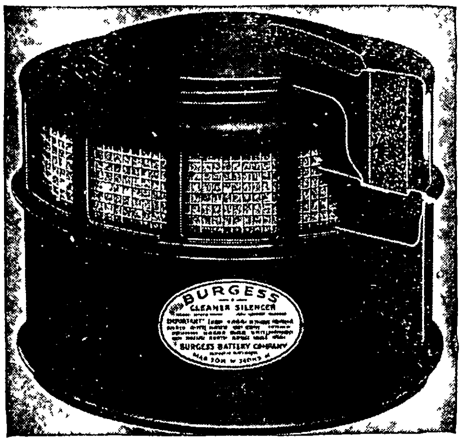
HANDY

Remove complete unit from carburetor and detach the upper half of cleaner from the sump. Remove oil from sump and refill with clean il. Type 800 holds one pint and typ 200 h lds ne quart of oil.

CRANKCASE BREATHER AIR CLEANER

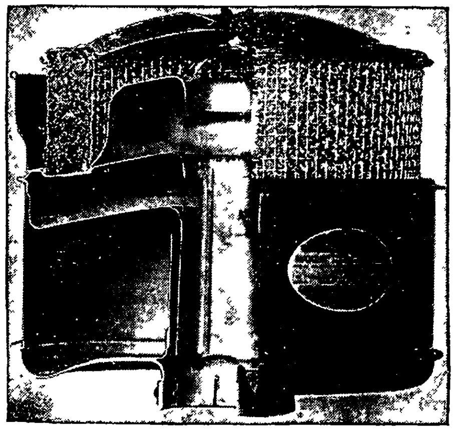


When an air cleaner is fitted to the crankcase ventilator outlet pipe it should be serviced when the carburetor air cleaner is serviced. T do this, rem v the filter, wash it in kerosene and dry it thoroughly. Then dip it in SAE 50 engine oil and replace it.



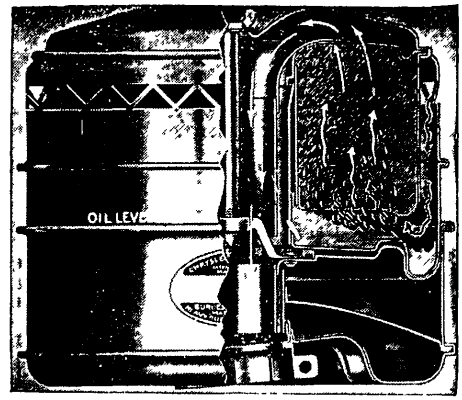
BURGESS

Remove complete unit from the car. Invert the assembly and dip it in clean gasoline just the depth of the cleaner element. Shake it until clean. When dry dip the complete unit in oil the depth of the cleaner element.



BURGESS

Unscrew the wing nut and remove the cleaner element. Wash the element in gasoline and when dry dip it in oil and let the excess drain off. The cleaner element must always be moist.



BURGESS OIL BATH TYPE

Unscrew the wing nut and remove the top and the cleaner element from silencer. Wash the cleaner element in kerosene but d not oil it. Empty the oil from the sump and wash it with kerosene. Refill the reservoir with ne pint of SAE 50 oil in summer and SAE 20 il in winter.

HYDRAULIC VALVE LIFTERS

Hydraulic valve lifters provide a means of automatically maintaining zero clearance in the valve mechanism. The device adjusts its own length automatically during each revolution of the camshaft to compensate for the expansion or contraction in the valve mechanism. The adjustment takes place in a column of oil that is incorporated in the valve train.

The basic part of the lifter is the hydraulic unit. The hydraulic unit consists of the cylinder, plunger, plunger spring, and ball check valve. The supply chamber in the hydraulic unit receives oil under pressure from the engine's lubricating system through a port in the lifter body each time it moves past a hole in the lifter guide.

GM & JOHNSON TYPES

BUICK 1948-52
CADILLAC 1949-52
CHEVROLET 1950-52 (Partial)
LINCOLN 1952 (Johnson)
OLDSMOBILE V8, 1949-52

Figs. 1, 2, 2A. In describing its operation, let us assume that the engine has been shut off for some time. Selecting a valve that is open, it will be found that the lifter is collapsed to its shortest condition. As the engine starts, the valve closes, removing the valve spring load from the lifter. At this instant, the spring in the lifter is strong enough to expand the lifter and prevent clearance from developing in the valve mechanism. As the lifter body rides on the base circle of the camshaft, and the plunger is held extended to maintain zero clearance in the mechanism, oil flows down through the ball check valve to completely fill the lower chamber.

As the cam starts to raise the lifter for the next cycle, the very first movement forces oil in the lower reservoir against the ball, closing the check valve and trapping the oil. This trapped oil, acting as a solid link, raises the plunger with the body, which, in turn, moves the valve train to open the valve.

During the movement of the valve, a predetermined amount of oil leaks from the lower reservoir past the plunger. When the lifter body again approaches

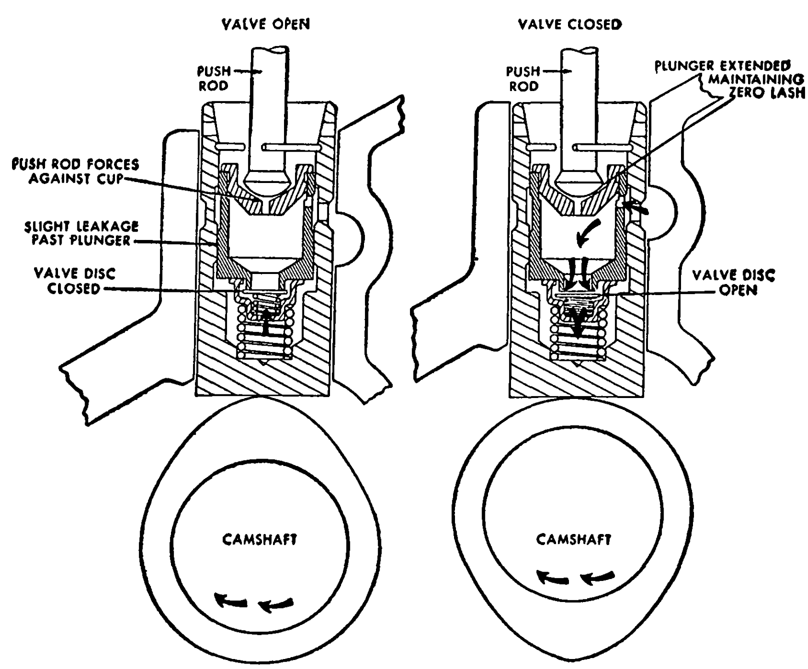


Fig. 2A Johns n typ hydraulic valv lifter used on 1952 Linc ln

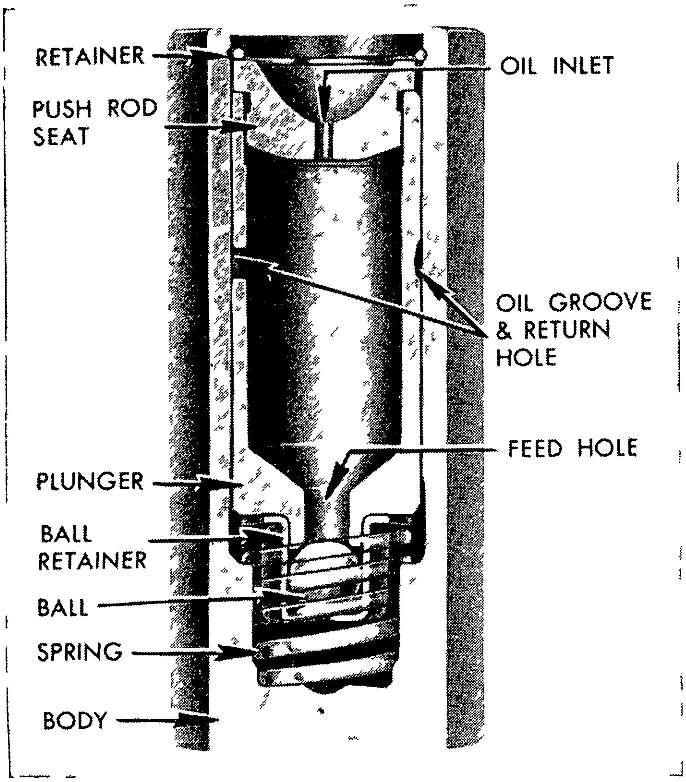


Fig. 1 General Motors type hydraulic valve lifter

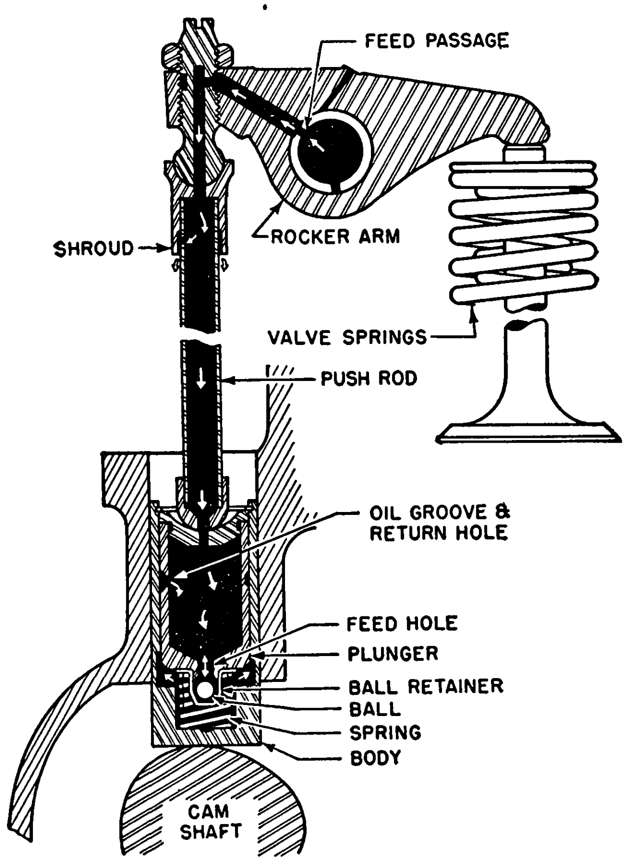


Fig. 2 Hydraulic operation of G neral M t rs type valve lifter as applied t Buick. In Cadillac, Chevr let and Oldsmobile engines, il is supplied thr ugh a line l cated in the engine bl ck

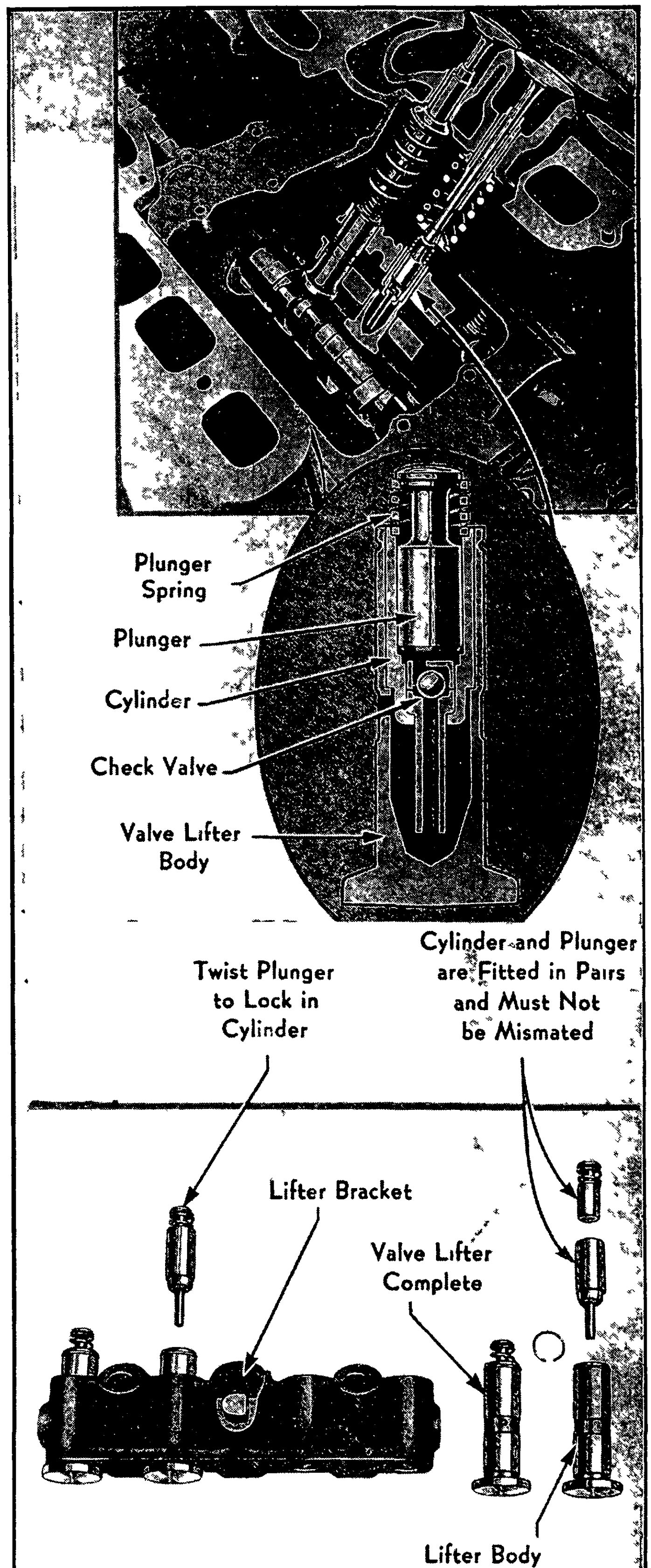


Fig. 3 Eaton (Wilc x-Rich) type hydraulic valve lift r as applied t Cadillac and La Salle pri r t 1949. Chrysler 8, Linc ln prior to 1952 and Packard us s this type

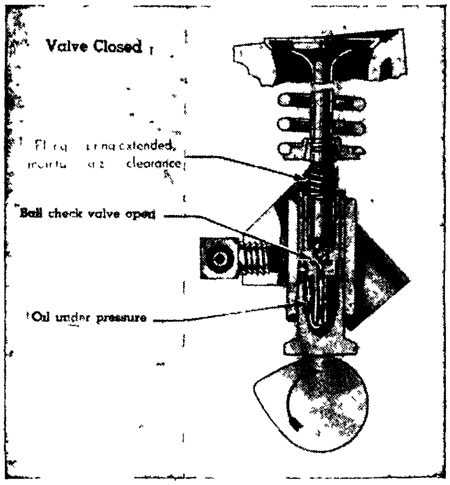


Fig. 3A Action of hydraulic valv lifter with valve closed

the cam base circle, the valve finally seats, removing the load from the plunger which then stops and is supported on the spring. The body continues the small remaining travel to the cam base circle, during which time the check valve opens and refills the lower reservoir ready for the next cycle.

As can readily be seen, at no time is the lifter dependent on the length of the valve train for the maintenance of zero clearance. As the valve mechanism expands or contracts due to temperature changes or wear, the lifter accommodates itself during each cycle of the valve mechanism.

HYDRAULIC LIFTER NOISE DIAGNOSIS

When an engine equipped with hydraulic valve lifters has been standing for considerable time (such as overnight) some valve noise will occur when the engine is first started. This is because oil escapes from the lifters that are holding valves open against valve spring pressure. These lifters will fill with oil after a few seconds of running if they are functioning properly.

If the noise persists, a noisy lifter can be detected by removing the rocker arm cover and, with engine idling, place a finger on each valve cap in succession. A distinct shock will be felt when the valve returns to its seat if a valve lifter is not functioning properly. The valve will return to its seat with no shock whatever if valve lifter is functioning properly.

There are four general types of hydraulic valve lifter noise that may be encountered and these are as follows:

Loud, Hard Rapping Noise—This may be caused by insufficient supply of oil to the valve mechanism due to low oil level in the crankcase, defective oil pump, clogged oil passages or dented oil pipes. If oil supply is satisfactory, this condition is caused by the valve lifter plunger sticking in the bore of the lifter body so that the spring cannot push the plunger back to its normal working position. The remedy is to clean or replace the valve lifter.

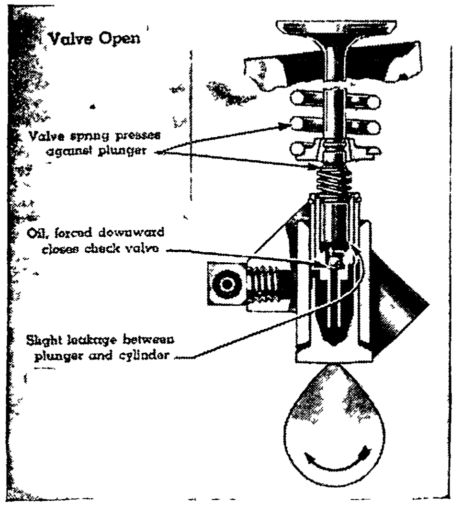


Fig. 4 Action of hydraulic valve lifter with valve open

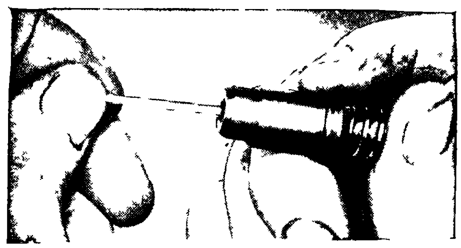


Fig. 5 Unseating check valve with wooden stick to release plunger

Moderate Rapping or Clicking Noise—This can be caused by an excessively worn valve stem guide, eccentricity of valve and seat, or warped valve. It also can be caused by excessive clearance of valve lifter in crankcase, or by a worn or scored cam. Moderate rapping or clicking also can be caused by too rapid leakage of oil between lifter body and plunger.

Intermittent Clicking—This is the most difficult condition to locate. It can be located only by listening carefully or feeling with a finger on each valve spring cap or rocker arm in succession until the click appears. This type of click is almost always caused by a microscopic piece of dirt which keeps circulating through the lifter and momentarily is caught between the check valve ball and seat. In rare cases the ball itself may be out of round or have a flat spot which, upon contacting the seat, permits leakage of oil. The remedy is to clean or replace the lifter.

General Noise Throughout the Valve Train—In almost all cases, this condition will be a definite indication of an insufficient supply of oil to the valve mechanism caused by low oil level in the crankcase, defective oil pump, clogged oil passages or dented oil pipes.

HYDRAULIC LIFTER SERVICE

If it becomes necessary to clean a hydraulic lifter because of dirt or varnish, it is advisable to clean all other lifters at the same time because it is likely that they may successively become faulty from the same cause.

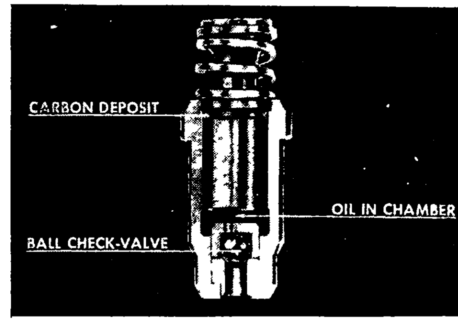


Fig. 6 Showing how plunger is held in cylinder by carbon deposit

Fig. 7 Separating plunger from cylind r

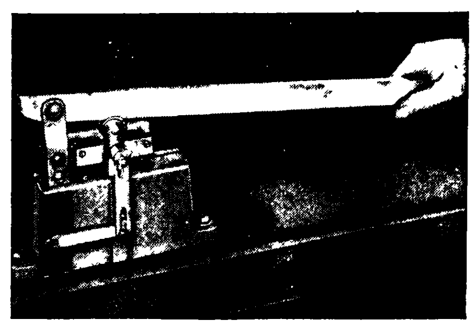


Fig. 8 Machine for checking leak-d wn rate of hydraulic valve lifter. Instructions for use of this equipment if furnish d by manufactur r

A hydraulic lifter may be lifted out of the crankcase by inserting the slightly bent end of a stiff wire into the oil hole in the push rod seat. If carbon formation in the bore above the lifter prevents removal, remove the formation with a clean cloth moistened with suitable solvent, using extreme care to avoid getting solvent or dirt into the lifter.

To disassemble a hydraulic lifter, remove the plunger retainer with a screwdriver, then remove the other parts from the body.

When a valve lifter has been in service for a long time, the body bore above the plunger may be caked with hard carbon so that the plunger cannot be removed easily. When this condition exists, submerge the valve lifter in a suitable carbon softener for a time and then remove the carbon with a stiff bristle brush.

Fig. 9 Checking leak-down rate without fixture. D press plunger with finger and rel as quickly. Plunger should kick back up n release

When the lifter is disassembled, use extreme care to avoid nicking or otherwise damaging the body and plunger through contact with other parts. Keep the parts of one lifter separate from all others so that parts will not be interchanged during assembly. Plungers are not interchangeable because they are selectively fitted to the bodies at the factory.

If plunger or body appear satisfactory, blow off with air to remove all particles of dirt. Install plunger in body without other parts and check for free movement. A simple test is to be sure that the plunger will drop of its own weight in the body.

Assemble the valve lifter parts as shown in Fig. 1. Fill lifters with correct seasonal grade of *clean* engine oil before installation in engine.

EATON HYDRAULIC LIFTERS

CADILLAC 1936-48

CHRYSLER 8, 1949-52

LA SALLE 1937-40

LINCOLN 1936-51

PACKARD (Senior Models) 1935-52

Fig. 3 illustrates the Eaton type hydraulic valve lifter used on the above cars. As can be seen, the plunger is located at the top of the unit instead of at the bottom. Figs. 3A explains its operation.

TROUBLE DIAGNOSIS—Noisy valve operation is caused by dirty, scored or worn parts, or by incorrect oil level or pressure. The oil level should never be above the "Full" mark on the dipstick, nor should it be more than one quart below the required amount.

Incorrect oil pressure usually results from a leak in the oiling system, a stuck or improperly operating pressure relief valve, worn engine bearings, worn oil pump gears, or faulty operation of the oil pump.

Fig. 11 Testing for faulty check valve. Block oil inlet with finger, press plunger down and release quickly; if it kicks back properly, check valve is at fault

If the plunger springs are weak, they can cause noisy valve operation by permitting excessive plunger movement and wear. If the lifter parts are dirty, scored or worn, noisy operation of the lifters will result.

A recurring tap or click, synchronized with valve action, indicates trouble in single hydraulic units, which should be disassembled and checked for dirt or other foreign matter. Whenever dirt is responsible for the trouble, the engine oil pan should be removed and cleaned thoroughly to prevent recurrence. The oil passages in the lifter guides should also be thoroughly cleaned.

SERVICE—Cleanliness is the most important factor in servicing hydraulic lifters. This means that the working surface should be cleared of all material and tools not needed for the job, and it should be thoroughly cleaned of all traces of dirt, metallic particles, or other foreign matter.

To do a complete job, all that is needed in addition to cleaning solvent, a pan and clean cloths are: (a) a pair of ordinary pliers with taped jaws to prevent metal-to-metal contact with the surfaces of the plunger; (b) wooden sticks about the size of matches to be used for unseating the ball check valve; (c) feeler gauges; (d) two racks.

One rack should be provided with compartments to hold the complete lifters as they are removed from the engine. The compartments should be numbered by cylinders so that each lifter can be returned to the cylinder from which it was removed.

The second rack should be provided with holes. The separate parts of the hydraulic units should be placed in these holes so that no interchange between plungers and cylinders will take place. It is important that the parts of one unit do not get mixed with the parts of another as they are precision-machined and mated with each other at the factory.

Fig. 3. Remove the body from the hydraulic unit and wash them thoroughly in clean solvent. Disengage the plunger spring by twisting the plunger and spring, then pull out the plunger. If it is difficult to remove the plunger, insert a wooden stick, Fig. 5, in the oil inlet at the bottom of the cylinder to unseat the ball check valve and allow any trapped oil to be drained out. After doing this, if the plunger can be pressed down but cannot be removed, it is probably being held in the cylinder by a carbon deposit, Fig. 6, around the shoulder of the cylinder. Soak the unit in solvent and use taped pliers, Fig. 7, to separate the plunger from the cylinder.

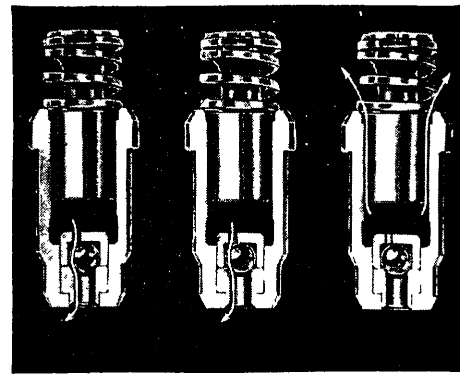


Fig. 10 If plunger fails to kick back when tested as in Fig. 9, look f r dirt und r check valve (left); damaged check valve (center); too much clearanc b t w e n plunger and cylind r (right)

NOTE—The plunger and the cylinder are selectively fitted at the factory, and the plunger from one cylinder cannot be used in other cylinders. Therefore, when necessary to discard a faulty plunger or cylinder, its mate must also be scrapped, regardless of its condition. Be sure to use the rack already described to keep the parts of each unit together. After separating the parts, clean each one thoroughly to remove all traces of foreign matter.

CHECKING LEAK-DOWN RATE—Leak-down rate is the rate at which oil escapes between the cylinder and plunger. This rate is determined at the factory but it may increase due to wear. There are special fixtures available, Fig. 8, for checking the leak-down rate and, when used, the instructions which accompany them should be followed exactly. Without this equipment, however, the unit may be checked as follows:

First make sure there is no oil on the cylinder wall and plunger. Then, with the plunger held upright in one hand, start the plunger into the cylinder with the other. Depress the plunger with the finger, Fig. 9, and *release quickly*.

It should be remembered that the plunger is now operating against air instead of oil. This air is sealed in by the ball check valve, and by the close fit of the plunger to the cylinder. The air should yield slightly to the pressure of the finger on the plunger, but the plunger should kick back upon release of the pressure.

If no kick-back occurs, it is due to: (a) air escaping past the check valve because of the presence of dirt which prevents the ball from seating properly; (b) air escaping past the check valve because of damage to the ball seat; (c) air escaping because the clearance between the plunger and cylinder is too great, indicating excessive leak-down rate. (Fig. 10 pictures the effect of these conditions.)

To determine whether the check valve

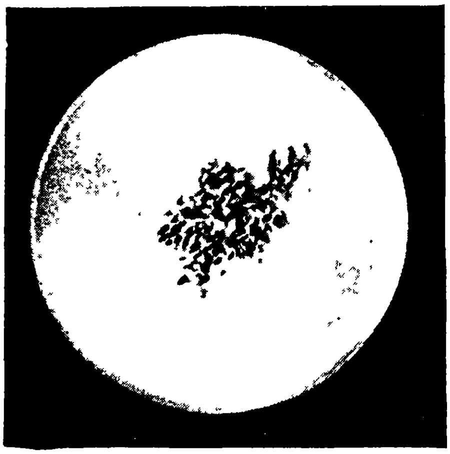


Fig. 12 Pitted lifter face

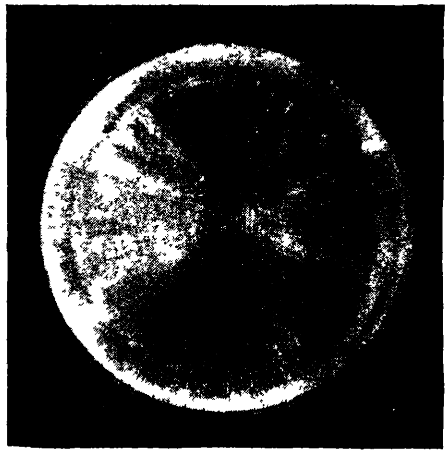


Fig. 13 Scored lifter face

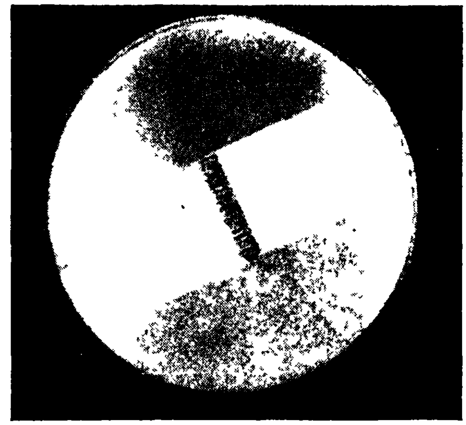


Fig. 14 Worn lifter fac

is leaking, place a finger over the oil inlet, Fig. 11, press down on the plunger and release quickly. If it kicks back properly, the fault lies with the check valve.

If the unit kicks back properly when the inlet hole is covered, rewash the unit to get rid of any dirt that may be fouling the check valve. Then repeat the test without blocking the inlet hole. If there is still no kick back, the check valve is damaged and the cylinder and plunger should be discarded.

If there is no kick back when the inlet hole is blocked, there is too much clearance between the plunger and cylinder, in which case, the entire unit should be scrapped.

NOTE—With the above test, it is important that pressure be released immediately after depressing the plunger. If held down too long, the test wouldn't mean anything because all the air trapped under the plunger would leak out.

INSPECTION—In addition to an improper leak-down rate or damaged ball check valve, inspect the plunger and cylinder for any unusual worn places or cracks. Discard both parts if any damage is found.

Clean the face of the lifter body, wipe dry and check the face for scores, wear or pitting. If the face of the lifter shows small nicks or indentations, Fig. 12, near the center of the face, it is pitted. The area covered by the pitting will vary with different lifters but regardless of the degree, the lifter must be scrapped.

A scored lifter face, Fig. 13, may be identified by small, scratch-like lines usually found near the outer edge of the face and appear to radiate from the center. Other score marks may be present and extend to the center. If the lifter face is in this condition, it should be replaced.

The wear that takes place on a lifter face that does not rotate will show up as a path formed by the wiping action of the cam, Fig. 14. In addition to this path, there will usually be extra wear at the center. If the wear is excessive, it will be noticeable to the touch if a finger nail is rubbed across the lifter face. Worn lifters should be discarded.

ASSEMBLING HYDRAULIC UNIT—If the unit is to be installed in the engine immediately, it must be free of lubricating oil. If not, a light film of oil may be applied to the parts to prevent rusting.

Insert the plunger into the cylinder, pushing the plunger down and, at the same time, twisting it to engage the spring in the counterbore of the cylinder. Then to make sure the unit will operate properly, check the following: (a) ball check should rattle when unit is shaken; (b) plunger should bounce back when pressed into cylinder and quickly released; (c) cylinder should slide smoothly into lifter body when free of oil.

INSTALLING LIFTERS—Install the lifters in the reverse order from which they were removed from the engine. Connect the oil feed pipes at the supply end only and crank the engine to expel the air from the lines. When a full stream of oil emerges from the lines, attach them at the lifter connections.

Check the clearance between the valve stem and the top of the plunger—which should be from .030 to .070 inch. This clearance is necessary because the hydraulic unit has been installed without oil but will be taken up automatically when the engine is started.

If the clearance is less than .030 inch, grind the necessary amount off the valve stem. If more than .070 inch the valve seat will have to be ground.

NOTE—Cadillac recommends that the lifter body be filled with oil before inserting the hydraulic unit. Then when installing the lifters in the engine, special tool No. J-827 be used to hold the lifters down during installation. When checking the clearance of lifters that are filled with oil, force the oil out of the lifter by pushing down the plunger and fully depressing the spring.

A **MEMO** FROM...

CLAYTON RESTORATIONS LTD.
For Fine Motorcars

CAD & LA Salle V-8 Flat head.
Hydraulic Valve Lifters.

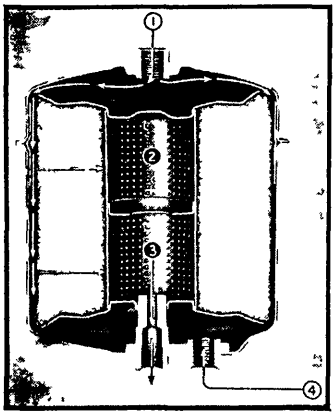
You dont have to Remove the valves or springs to Remove Lifter Blocks, But you do have to Remove the heads, Put strips of Leather ~~under the~~ Between the valves & seat, Leather About 1/16" thick. You might have to Bleed oil out of certain Lifters. Do this Before inserting the Leather strips,

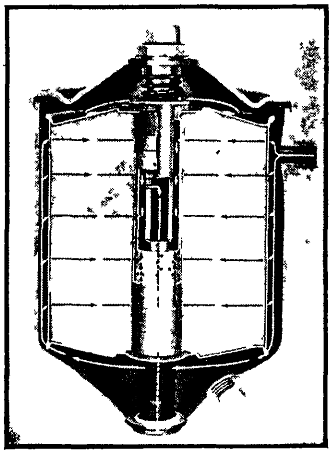
To use Kent Moore Lifter Tester, Clean-up old Lifters - Read Article on Hydraulic valve Lifters in Blue Motor Repair Manual (page 188-192)

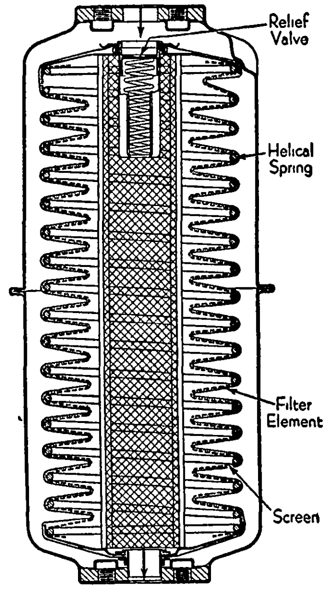
1, use new solvent in a small tin can, install Lifter in cam follower & Pump-up.
2, Put in Tester & Adjust to start-set point
3. Release Handle
4. old worn Lifters (most of them) fell Right to finish point - in Less than 1 or 2 sec. New Lifters Dropped to .094 Right Away

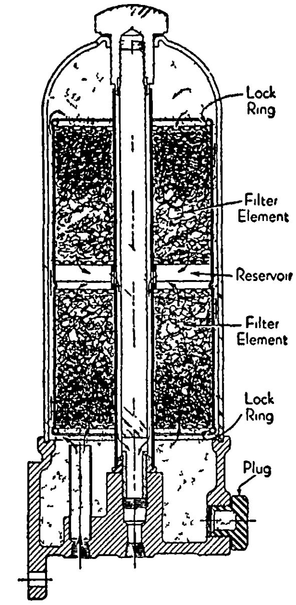
1751 W. Wolfensbergoer Road • Castle Rock, CO 80104 • 303/688-4035

Then Took 5 seconds to end AT .156









AC Sealed Container Type

Oil enters sealed container at "1" and passes through the filtering element. The perforated metal center tube "2" collects the filtered oil. Filtered oil enters the metered orifice at "3", maintaining full engine oil pressure. Optional inlet shown at "4". Oil passes through the filter element until it is clogged, at which time it flows down directly to the sump and through the outlet without being filtered. When replacement becomes necessary, as indicated by the engine oil being very dirty, the complete filter should be replaced with a new one.

AC Replaceable Element Type

Part of the oil from the oil pump enters near the top of the filter and is forced through the filter element into the perforated collector tube in the center of the filter. Solid matter and water settle in the sump at the bottom of the filter and should be removed from the unit at frequent intervals by removing the drain plug. When the filter element becomes clogged, the cover can be removed and the filter element replaced without disconnecting the oil lines. If the filter element is drained completely, as when an element is renewed, add sufficient oil to the crankcase to bring the oil to its correct level.

Purolator E

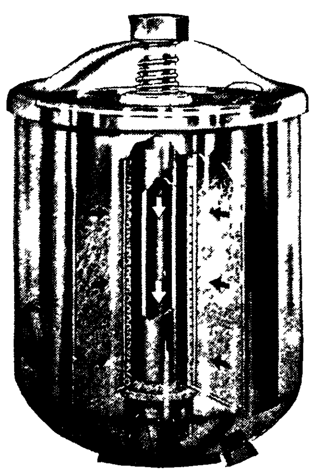
Oil enters the end of the filter and passes through the filter element to the inside of the filter. In the Full Flow type (shown) a relief valve permits an uninterrupted flow of unfiltered oil in case the filter element is clogged so that oil cannot pass through it.

When the filter element becomes clogged the complete unit should be replaced.

Michiana (14)

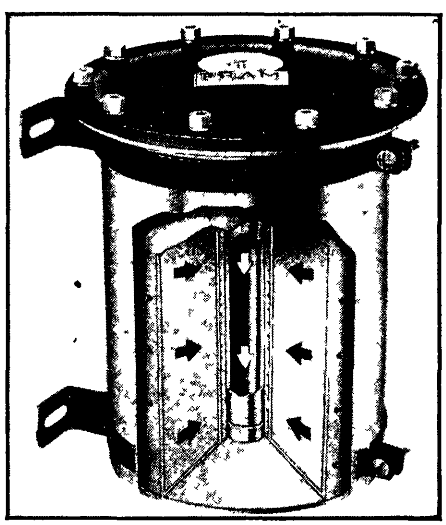
Some of the oil flowing into the filter is forced up through the lower filter element to the reservoir at the center while the balance of the oil passes up past the outside of the filter element container and down through the upper filter element to the reservoir at the center.

On some models the complete filter element is replaced when dirty. On others there is a wire ring at the t p and bottom of the filtering element. When these rings are used they can be removed and the filter material replaced.



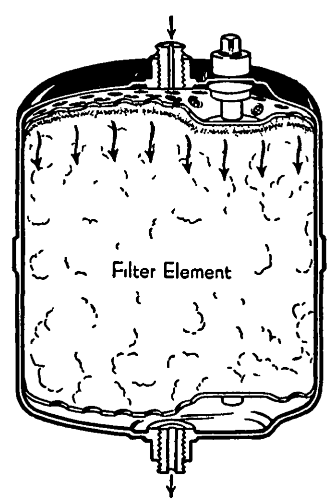
Fram F 35

This is a by-pass type of filter. Oil enters the side of the filter and is forced through the filter element to the collector tube in the center of the filter from where it returns to the crankcase. When the filter element becomes clogged, remove the filter cover. The filter element can be lifted out and replaced without disconnecting the oil lines.



Fram F 40

This is a by-pass type of filter. Oil enters the side of the filter and is forced through the filter element to the collector tube in the center of the filter from where it is returned to the crankcase. When necessary the cover can be removed and the filter element replaced without disconnecting the oil lines.



Briggs & Stratton

Oil to the filter passes down through the filter element to the outlet at the bottom of the unit. When the filter element becomes clogged he complete unit should be replaced.

CLUTCHES

Car Make	Clutch Make
AUBURN	
1935-36	Long (2)
BUICK	
1935-38	Buick
1939-52 Models 40, 50	Inland (1)
1939-48 Models 60, 70, 80, 90	Buick
CADILLAC	
1936-52 Except V16	Long (1)
1938-40, V16	Long (4)
1940, V8 (Early)	Borg & Beck
CHEVROLET	
1935-37	Chevrolet
1938-52	Inland (2)
CHRYSLER	
1935-52	Borg & Beck
CORD	
1936-37	Long (1)
DE SOTO	
1935-52	Borg & Beck
DODGE	
1935-52	Borg & Beck
1951-52 (Partial)	Auburn
FORD	
1935-52	Long (1)
1937-39, 60 H. P.	Long (3)
FRAZER	
1947-51 Partial	Borg & Beck
1947-51 Partial	Auburn
GRAHAM	
1935-36	Long (2)
1937-41 Except 85	Long (1)
HUDSON	
1935-52	Hudson
HUPMOBILE	
1935-39 Six	Borg & Beck
1935 Eight	Long (2)
1936-39 Eight	Long (1)
KAISER	
1947-52 Partial	Borg & Beck
1947-52 Partial	Auburn
LA SALLE	
1935-36	Borg & Beck
1937-40	Long (1)
1940 Early	Borg & Beck

Car Make	Clutch Make
LINCOLN	
1936-52	Long (1)
1935-40 Series K	Long (4)
MERCURY	
1939-48	Long (1)
1949-52	Borg & Beck
NASH	
1935-52	Borg & Beck
OLDSMOBILE	
1935-49 All and 1950 Six	Borg & Beck
1950-52 V8	Long (1)
PACKARD	
1935-47, 120	Long (1)
1935-38, Super 8	Long (1)
1937-47, 110	Long (1)
1939 Super & Custom	Long (1)
1940 All (Early)	Borg & Beck
1941-50 Super & Custom	Long (1)
1951-52, 200, 250, 300	Long (1)
PIERCE ARROW	
1935-38	Long (4)
PLYMOUTH	
1935-47	Borg & Beck
1948-52 Partial	Borg & Beck
1948-52 Partial	Auburn
PONTIAC	
1935-38	Pontiac
1939-52	Inland (2)
REO	
1935-36 Models 6A, 6D	Borg & Beck
1935-36 Model 7S	Long (2)
STUDEBAKER	
1935-37 Dictator	Borg & Beck
1935-38 Eight	Long (2)
1938-39 Commander	Borg & Beck
1939-52 Champion	Borg & Beck
1939-42 President	Inland (2)
1940-52 Commander	Borg & Beck
TERRAPLANE	
1935-38	Hudson
WILLYS	
1935-49	Rockford
1939 Overland	Long (3)
1950-52 Partial	Borg & Beck
1950-52 Partial	Auburn

CLUTCH TROUBLE DIAGNOSIS

SLIPPING—A clutch that slips may be caused by any of the following:
1. Insufficient pedal free play.
2. Oil or grease on facings.
3. Facings not installed properly
4. Worn or burned facings.
5. Installation of wrong type of facings.
6. Clutch cover parts improperly assembled.
7. Clutch levers improperly adjusted.
8. Clutch release shaft may be tight in housing.
9. Weak or broken pressure springs.

GRAB OR CHATTER—A clutch that grabs or chatters during engagement may be caused by any of the following:
1. Driven plate loose at hub.
2. Facings loose on plate.
3. Facings coated with gum.
4. Clutch release shaft tight in housing.
5. High spots on facings.
6. Wrong type of facings installed.
7. Weak clutch plate cushion springs.
8. Clutch plate too tight on clutch shaft.
9. Clutch cover not tightened to flywheel.
10. Cracked or broken pressure plate.
11. Cover parts not installed properly.
12. Excessive play in transmission gears.
13. Hill-Hold not properly adjusted (if used).

CLUTCH NOISE—If noise occurs when clutch is disengaged, the clutch release bearing may be damaged, dirty, worn or improperly lubricated, or it may be binding in the release shaft arms. The clutch shaft pilot bearing may be defective or not properly lubricated. Release levers not properly adjusted and bottoming against the driven plate hub may also cause this noise.

If the noise occurs when the clutch is engaged, it may be caused by improper alignment of the transmission with the engine. This noise is usually noticeable at idle or low speeds. A loose clutch driven plate on the clutch shaft splines will also produce noise. Likewise driven plate hub bolts may be loose, or the driven plate damper springs may be weak or broken.

ABNORMAL FACING WEAR — This condition may be caused by:
1. Facings improperly installed.
2. Wrong type of facings installed.
3. Badly warped pressure plate.
4. Weak or broken pressure springs.
5. Not enough clutch pedal free play.
6. Excessive clutch slippage during engagement.
7. "Riding" clutch pedal.
8. Unnecessary use of clutch.

CLUTCH DRAG WHEN DISENGAGED—This condition may be the result of any of the following:
1. Distorted, burred or rough clutch shaft splines.
2. Driven plate hub too tight on clutch shaft.
3. Facings loose or incorrectly installed.
4. Facing cushion springs distorted.
5. Warped clutch pressure plate.
6. Release levers not adjusted properly.
7. High spots on facings.
8. Incorrect pedal free play.

CLUTCH PEDAL PULSATION—Pedal pulsation is evident by a bounce of the pedal with every revolution of the engine. This condition may be caused by:
1. Broken or missing pedal pull-back spring.
2. Bent clutch release shaft.
3. Transmission not aligned with engine.
4. Release levers unevenly adjusted.
5. Release shaft arms not parallel.
6. Flywheel not seated properly on crankshaft flange.
7. Bent crankshaft flange.
8. Sprung clutch cover due to uneven installation.

BORG & BECK

This clutch, Fig. 1, is a single plate, dry disc type with no internal provision for adjustment for wear. However, each release lever is adjusted individually to the correct height, and no attempt should be made to adjust these levers unless the clutch is to be dismantled for overhaul.

As the clutch facings wear, the pressure plate moves closer to the flywheel face, and the outer ends of the release levers follows. This causes the inner ends of the levers to travel farther toward the transmission and decreases the clearance between the release levers and the release bearing. This will decrease the clutch pedal free travel, which must be maintained in order to prevent the clutch pedal from riding on the toe board, caus-

ing the clutch to slip. The clearance between the toe board and the point where the release levers contact the release bearing should be maintained according to the vehicle manufacturers' specifications.

CLUTCH, OVERHAUL

Remove the clutch assembly from the chassis, being sure that the flywheel and clutch cover are marked so that assembly may be made correctly and the original balance maintained.

NOTE—If the same pressure plate and clutch cover are to be re-installed, be sure to punch-mark these parts so that assembly may be made in the same relative position. When disassembling the unit, note carefully the position of the various parts so that assembly may be made correctly.

DISASSEMBLE: To disassemble the unit, place the cover assembly on the bed of a press with a block under the pressure plate, so arranged that the cover is left free to move down. Place a block across the top of the cover, resting on the spring bosses.

Compress the cover with the spindle of the press and, holding it under compression, remove the adjusting nuts and then slowly release the pressure to prevent the springs from flying out. The cover can then be lifted off and all the parts will be available for inspection.

To remove the release levers, Fig. 2, grasp the lever and eyebolt between the thumb and fingers so that the inner end of the lever and the upper end of the eyebolt are as near together as possible, keeping the eyebolt pin seated in its socket in the lever. The strut can then be lifted over the ridge on the end of the lever, making it possible to lift the lever and eyebolt off of the pressure plate.

INSPECTION: Inspect the pressure plate springs and replace if they show signs of overheating due to clutch slippage. If the springs have been overheated, they will show a pronounced blue color, indicating that the temper has been drawn, or else the paint will be burned off the springs.

NOTE—The following table may be used as a guide to test the spring compression pressure, and if the weight checks lower than indicated in the table, the springs should be replaced.

Color	Weight, Pounds	Height, Inches
No Color	150	$1\frac{11}{16}$
Black	160	$1\frac{11}{16}$
White	160	$1\frac{11}{16}$
Brown	140	$1\frac{11}{16}$
Red	180	$1\frac{11}{16}$
Light Blue	160	$1\frac{11}{16}$
Blue	180	$1\frac{11}{16}$
Pink	200	$1\frac{11}{16}$
Grey	200	$1\frac{11}{16}$
Purple	130	$1\frac{11}{16}$
Light Green	170	$1\frac{11}{16}$
Green	105	$1\frac{11}{16}$
Tan	155	$1\frac{1}{2}$
Orange	165	$1\frac{1}{2}$
Lavendar	145	$1\frac{1}{2}$
*Yellow	135	$1\frac{1}{2}$
**Yellow	140	$1\frac{11}{16}$

*Borg & Beck Spring No. 4331.
** Borg & Beck Spring No. 2994.

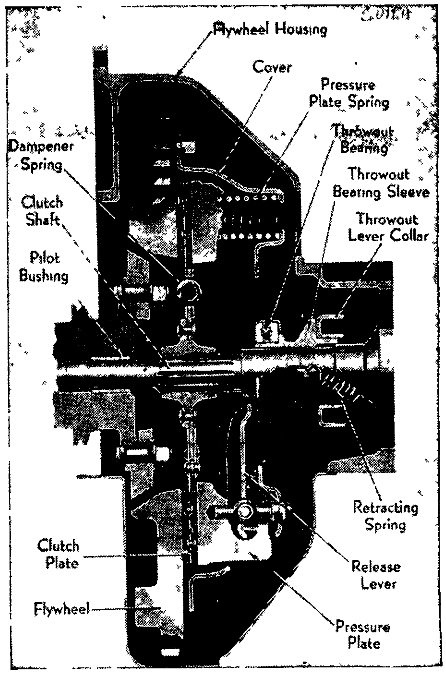


Fig. 1 Typical design of Borg & Beck clutch

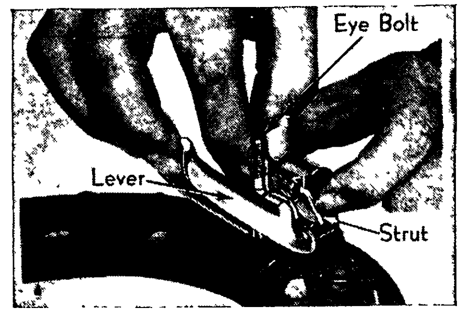


Fig. 2 Method of removing and installing release levers on Borg & Beck clutch

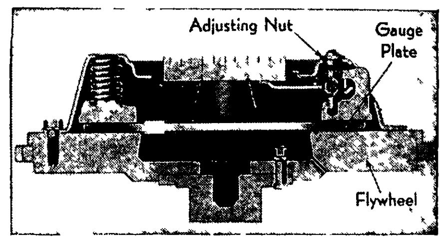


Fig. 4 Showing gauge plate in p siti n for adjusting release l vers

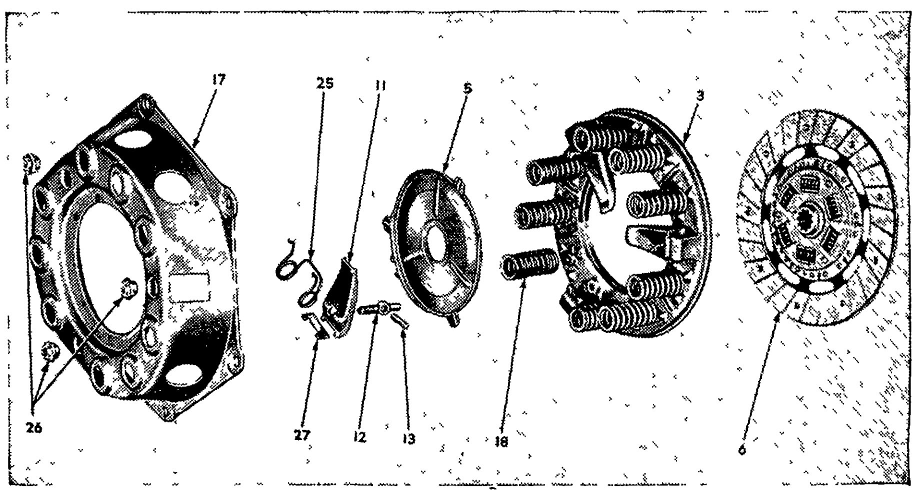


Fig. 3 Exploded view of Borg .& Beck clutch with baffle plate

3. Pressure plate
5. Pressure plate baffle
6. Clutch driven plate
11. Release lever
12. Release lever eye bolt
13. Release lever pin
17. Cover
18. Pressure spring
25. Release lever spring
26. Release lever ey b lt nut
27. Release lever strut

ASSEMBLE: When assembling the struts and release levers, apply a thin film of Lubriplate to the working edges of the struts, as well as to each side of the ears on the pressure plate where they extend through the clutch cover.

On clutches equipped with a baffle plate, Fig. 3, install the baffle before the levers are installed. When installing the baffle plate, note that adjacent to each hooked lug on the pressure plate, one of the spring seat lugs is lower than the others. The flanged edge of the baffle plate is formed to fit depressions in the pressure plate casting at the base of each lug, and ears are also formed, which rest on the low ribs already mentioned. Springs, which seat on these ears, hold the baffle plate in position.

NOTE—On the 9 and 10 inch size clutches, the ears must be located on the spring seats adjacent to the lugs, in a counter-clockwise direction. On the 11 inch size clutch, the ears must be located on the spring seats adjacent to the lugs in a clockwise direction. Particular attention must be paid to the correct assembly of these baffle plates as this is the only position in which the baffle plate will seat properly in the pressure plate. If the ears of the baffle plate have been bent in handling, be sure that they are straightened so that they will lie flat on the spring seat ribs and, at the same

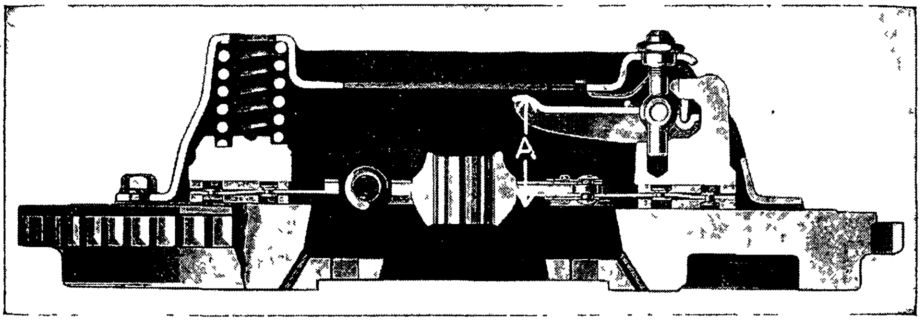


Fig. 5 B rg & Beck. Table below gives release lever height setting as indicated by dimensi n "A". All levers must be parallel within .005 inch. Cover number is stamped on flange inside cover

Cov r Number	Lever H ight, Inches	Cover Number	Lever Height, Inches	Cover Number	Lever Height, Inches	Cover Number	Lever Height, Inches
851	2 5/16	879	1⅞	908	2½	930	2 3/16
852	1⅞	880	2 5/16	910	2½	931	2¼
853	2 5/16	882	1⅞	911	2 5/16	932	2 5/16
854	2 5/16	883	2 5/16	912	2 5/32	933	2 3/16
855	2 5/16	884	1⅞	913	2⅜	934	2⅜
856	2 5/16	886	2 5/16	914	2⅜	936	2¼
859	1⅞	890	2 5/16	915	2½	937	2 5/16
860	2 5/16	892	2 5/32	916	2½	938	2 3/16
861	1⅞	894	2 5/16	917	2½	939	2 3/16
862	2 5/16	898	2 5/16	918	2⅜	940	2 3/16
863	1⅞	899	2 5/16	919	2⅜	941	2¼
869	2 5/16	900	1⅞	920	2⅜	943	2 3/16
870	2 5/16	901	2 5/16	921	2½	944	2¼
871	1⅞	902	2 5/16	922	2 5/16	945	2¼
872	1⅞	903	2 5/32	923	2 5/16	946	2¼
874	2 5/16	904	2 5/16	925	2⅛	948	2 5/16
876	2 5/16	905	2 5/16	926	2 3/16	949	2 3/16
877	2 5/16	906	2 5/16	928	2 3/16	950	2 3/16
878	2 5/16	907	2 5/16	929	2¼	951	2 3/16

time, the baffle plate must fit fully into the machined recess of the pressure plate.

LEVERS, ASSEMBLE: Assemble the lever, eyebolt and eyebolt pin, Fig. 2, holding the threaded end of the eyebolt between the thumb and index finger, allowing the end of the lever to rest on the second finger. Hold the end of the lever and the end of the eyebolt as close together as possible. Grasp the strut with the other hand, between the thumb and first finger, and insert the strut in the slots of the pressure plate lug. Drop the strut slightly and tilt its edge until it touches the vertical milled surface of the lug. Insert the lower end of the eyebolt in the hole in the pressure plate, which will place the short end of the lever under the hook of the pressure plate, and near the strut. Slide the strut upward in the slots of the lug, lift it over the ridge on the short end of the lever and drop it into its groove in the lever.

COVER, ASSEMBLE: Place the springs on the pressure plate, and the lever return springs, or anti-rattle springs, in the cover. Lay the clutch cover on top of the pressure plate and assembled parts, being sure that the punch marks on the pressure plate and cover are matched. Also make certain that the lever return springs, or anti-rattle springs, remain in the correct position and that the tops of the pressure springs are directly under the embossed seats in the cover.

With a wood block laid across the cover and the assembly placed on the bed of the press, compress the cover slowly, being sure that the eyebolt and pressure plate lugs are guided through the proper holes in the cover. Hold the clutch under compression and screw down the adjusting nuts until they are flush with the tops of the eyebolts. The spindle on the press can then be released. Release the clutch several times so that all moving parts will settle into their working positions. This can be done with the press by applying the spindle to the inner ends of the levers.

RELEASE LEVERS, ADJUST: Satisfactory operation of the clutch is absolutely dependent upon the accuracy of the lever adjustment, since the pressure plate must be parallel with the flywheel. The method of checking the position of the levers depends upon the equipment available. Regardless of how the levers are measured, they must be uniform within .005".

Using an extra flywheel as a dummy, and the proper gauge plate in the position normally occupied by the driven plate, mount the cover assembly to the dummy flywheel, turning the cover screws a turn or two at a time when pulling against the spring pressure, otherwise, the cover may be sprung. Before the cover is tightened down, be sure the gauge is centered.

NOTE—If an extra flywheel is not available, remove the flywheel from the engine being worked on. The gauge being used, Fig. 4, must be exactly the same thickness as the driven plate used in the unit being serviced.

Adjust the levers by screwing the adjusting nut on each lever until all levers are in the same plane within .005".

After the correct adjustment is obtained, engage and disengage the assembly several times to be sure all working parts are properly seated, and then recheck the adjustment. After the adjustment is completed, lock the nuts with a small chisel, peening portions of the nuts into the slots in the eyebolts.

When replacing the driven plate, be sure that the correct side is toward the flywheel, and, before tightening the clutch cover, insert an aligning tool, or a spare main drive gear, through the driven plate and into the crankshaft pilot bearing. Tighten the clutch cover to the flywheel gradually and evenly until all the bolts are secure before removing the aligning tool.

NOTE—If the correct gauge plate is not available, the dimensions given in the caption under Fig. 5 may be used as a guide to determine the lever height setting. The measurement is taken between the face of the flywheel and the contacting point of the lever. Cover assemblies are identified by the number which is stamped thereon. These measurements are to be used only for clutch rebuilding purposes. Lever settings on factory built covers should never be disturbed unless the levers are out of parallel more than .030".

LONG [1]

SEMI-CENTRIFUGAL TYPE

This clutch, Fig. 6, is a single plate, dry disc type which uses a pressure plate having centrifugal levers which add to the disc pressure as engine speeds are increased.

The unit is of the open and truss design allowing maximum ventilation and rigidity, and is attached directly to the flywheel surface by means of six pilot cap screws.

The release levers are made of forged steel, mounted on needle roller bearings which are centrifugally out of balance, due to weights at the outer end. The faster the clutch revolves, the more the levers try to throw out and the greater the pressure they exert on the pressure plate.

At zero speed, the load in the pressure plate is only that which is created by the pressure springs, but as the engine is started and the speed increased, the load increases slowly at first, but more rapidly as the speed increases to a higher range, until at high engine R.P.M., the total load is exerted.

The pedal operating pressure at normal speeds is lighter with this type clutch, and the amount of pedal travel which is necessary to release the clutch is less than on clutches of the non-centrifugal design. Failure to maintain correct clutch pedal free play may result in excessive wear of the release lever adjusting screws and premature failure of the release bearing.

Since the centrifugal clutch action reduces the play at high speed, very often a clutch which seems to have sufficient

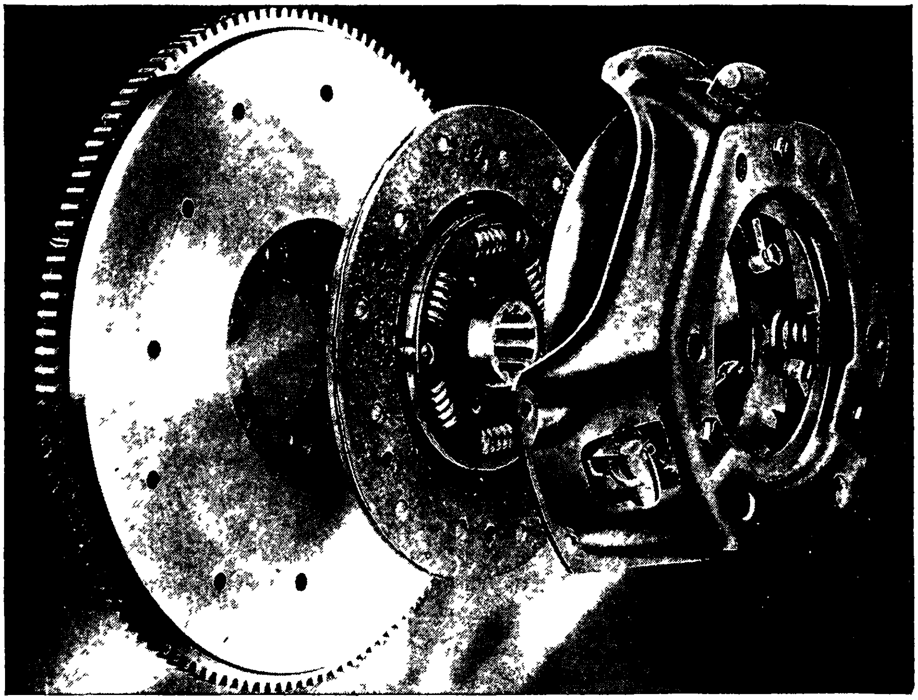


Fig. 6 Long semi-centrifugal clutch

pedal play with the engine idling, does not have any pedal play with the engine operating at higher speeds, which results in clutch slippage and excessive wear. Therefore, always check the clutch pedal free play with the engine operating at high speed.

DISASSEMBLE: Place the assembly on the bed of a press with a block under the pressure plate so arranged that the cover is free to move down. Place a block across the top of the cover, resting it on the spring bosses, and apply pressure to the assembly.

Mark the cover and pressure plate so that assembly may be made in the same relative position. Remove the screws from the assembly and release the pressure, after which, the cover may be lifted off.

NOTE—Before disturbing the position of any parts, note carefully their exact position so that assembly may be made accordingly.

INSPECTION: Examine all parts carefully and replace any that are doubtful. If the pressure springs have been overheated, they will show a pronounced blue color, indicating that the temper has been drawn, or else the paint will be burned off the springs. If the overheating has been continued long enough, the springs will show a dark grey color, indicating that the temper has been entirely drawn from them. If any of these conditions are evident, it is recommended that the complete set of springs be replaced.

NOTE—When disassembling the pressure plate, if washers are found between the clutch cover and the release lever yokes, be sure to replace them if the same pressure plate is used. If a new pressure plate is being installed, do not re-use these spacer washers.

With this type cover assembly, it is impossible to re-grind the pressure plate without throwing the levers out of adjustment. After the pressure plate has been ground or turned down, it is necessary that a spacer washer be used to compensate for the material removed. It is recommended that when .020″ is removed from the surface of the pressure plate spacer washers .015″ thick be used between the clutch cover and the release lever yokes. These washers should be approximately the same size as the top of the release lever yoke.

If the cover is bent or twisted, it is impossible to set the levers correctly. To check the cover, use a spare flywheel, lining up the cap screw holes in the cover with the corresponding holes in the flywheel. If the cover is bent or twisted, the holes will not line up properly and no amount of hammering will correct the trouble. Therefore, it will be necessary to replace the entire cover assembly.

ASSEMBLE: When mounting the lever on the yoke, make certain that the roller is placed on the correct side of the flat-sided pin. When assembling the lever to the pressure plate, use a pin which has been sawed off so that it is as long as the lever is wide. Use this pin as a guide to hold the needle bearings in position. Force the sawed-off pin out with the regular pin after the lever is in place and lock the pins in position with cotter pins. Screw the lever adjusting screw in position into the tip of the lever and turn it down all the way.

After the levers have been installed assemble the pressure springs and locators. Set the yokes so that they are vertical to the pressure plate. Mount the cover over the pressure springs, making certain that all parts are properly located. The marks which were previously

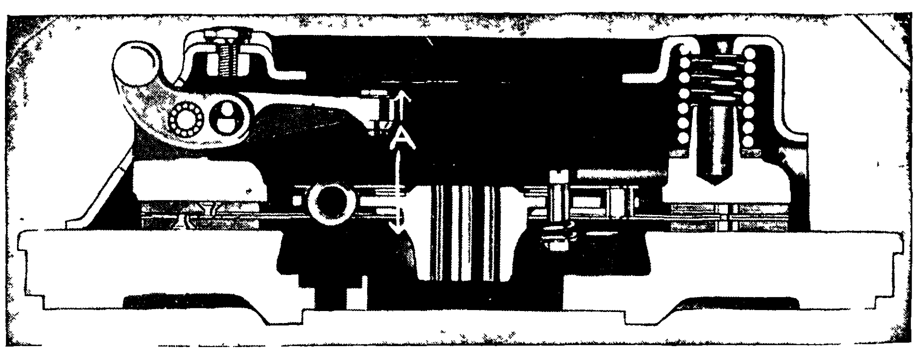


Fig. 7 Long semi-centrifugal clutch. Table below gives lever height setting as indicated by dimension "A". All levers must be parallel within .005 inch

Clutch Model	Cover Number	Lever Height, Inches	Clutch Model	Cover Number	Lever Height, Inches
9CF	BL3538	2 3/32	10CF	BL5470	1¾
9CF	BL4235	2 3/32	11CF	BL1440	2 7/32
9CF	BL5102	2 3/32	11CF	BL1478	2 7/32
9CF	BL5448	1 15/16	11CF	BL3607	2 7/32
9½CF	ALL	2	11CF	BL3800	2 7/32
10CF	BL3555	2⅛	11CF	BL3890	2 3/16
10CF	BL3817	2⅛	11CF	BL4525	2 7/32
10CF	BL4395	2⅛	11CF	BL5004	1⅞
10CF	BL4671	2⅛	11CF	BL5013	1⅞
10CF	BL4898	2	11CF	BL5143	1 15/16
10CF	BL5034	1 15/16	11CF	BL5152	1⅞
10CF	BL5078	2	11CF	BL5167	1⅞
10CF	BL5148	2⅛	11CF	BL5300	2 7/32
10CF	BL5222	1¾	11CF	BL5305	2 7/32
10CF	BL5389	2⅛	11CF	BL5391	2 7/32
10CF	BL5392	2⅛	11CF	BL5393	2 7/32

made on the cover and pressure plate should line up.

Compress the cover slowly, guiding the pressure plate lugs through the holes in the cover, making sure that the pressure springs are seated properly. After the assembly is completed, apply pressure to the levers, compressing and releasing the assembly several times to make sure that all moving parts are in their proper working positions, then, adjust the levers.

RELEASE LEVERS, ADJUST: Satisfactory operation of the clutch is absolutely dependent upon the accuracy of the lever adjustment, since the pressure plate must be parallel with the flywheel. The method of checking the position of the levers depends upon the equipment available. However, regardless of how the levers are measured, they must be uniform.

Using an extra flywheel as a dummy, and the correct lever height gauge plate in the position normally occupied by the driven plate, mount the assembly to the dummy flywheel, turning the cover screws a turn or two at a time to prevent springing the cover. Be sure the gauge is centered properly.

NOTE—If an extra flywheel is not available, remove the flywheel from the engine being worked on. The gauge being used must be exactly the same thickness as the driven plate used in the unit being serviced.

To make the adjustment, turn the adjusting screw in the end of the lever as far as it will go. Make sure that the yoke fastening screws are tight. Turn the adjusting screw in the end of the lever until the distance from the surface of the flywheel to the tip of the adjusting screw is as given in the LEVER SETTING table, Fig. 7.

NOTE—If the correct gauge plate is not available, the dimensions given in the table under Fig. 7 may be used as a guide to determine the lever height setting.

LONG [2]

Model 9AB

DISASSEMBLE: Fig. 8. Before disassembling the unit, a hacksaw should be used to break the seals of the release lever adjusting nuts. By removing the metal of the adjusting nut upset into the slot in the release bolt, the removal of the adjusting nuts will be greatly aided.

To disassemble the unit, use three hand "C" clamps, if a regular fixture is not available, to compress partially the entire unit. After the adjusting nuts have been removed, loosen the clamps and lift off the cover. Before disturbing any of the parts, note carefully their exact positions so as to assemble the unit correctly.

ASSEMBLE: After replacing any necessary parts, set the cover in the correct position, being sure that the pressure spring locators, pressure spring heat insulators and pressure springs are in their proper location.

Using the three "C" clamps, or the special fixture if available, compress the entire unit evenly until the release bolts can be pushed through the cover plate stamping and release levers sufficiently to allow the nuts to be assembled. Draw the nuts down flush with the top of the release bolts, but leave them unlocked. Make sure that the release bolt springs and washers are assembled between the pressure plate and the release levers, with the washers at the top of the springs next to the levers, before the release bolts are installed.

NOTE—If, when attempting to compress the entire unit with the hand clamps, the driving blocks do not quite enter the slots in the pressure plate, do not drive or pry on the driving blocks to bring them into position, but use a small diameter brass drift at one end of the pressure spring holes in the top of the cover and, with light hammer blows, shift the cover in the desired direction until the driving blocks are directly over the slots in the pressure plate.

After the adjusting nuts have been drawn down flush with the threaded end of the release bolts, install the entire assembly together with the driven plate to the flywheel.

NOTE—Before installing the cover assembly to the flywheel, compress the assembly and insert ¼" tapered wooden blocks between the inside edge of the cover and the top of the levers, which will prevent the cover flange from bending when installing the cover. When the cover is properly fastened to the flywheel, remove the blocks, and be sure the cover flange fits freely and evenly into the turned recess of the flywheel.

RELEASE LEVERS, ADJUST: If special equipment is not available to make the adjustment of the levers, use a straight edge across the top of the cover plate and adjust the release levers so that the dimension between the tips of the levers and the surface of the flywheel is as given in the following table:

Model	Cover	Setting, Inches
9AB	BL1523	$1\frac{19}{32}$
9AB	BL1524	$1\frac{5}{8}$
9AB	BL1578	$1\frac{5}{8}$
9AB	BL2122	$1\frac{17}{32}$
9AB	BL2132	$1\frac{17}{32}$
9AB	BL2224	$1\frac{17}{32}$
9AB	BL2483	$1\frac{17}{32}$
9AB	BL2495	$1\frac{17}{32}$
9AB	BL2984	$1\frac{17}{32}$
9AB	BL3343	$1\frac{17}{32}$

Make sure all levers are set uniformly, and when the adjustment is completed, lock the adjusting nuts with a staking chisel and re-check the adjustment. If possible, use a dial indicator for the final check.

LONG [3]

Ford V8-60

Before disassembling the unit, use a hacksaw to break the seals of the release lever adjusting nuts. By removing the metal of the adjusting nut upset into the slot of the release bolt, the removal of the adjusting nuts will be greatly aided.

To disassemble the unit, use three hand "C" clamps, if a regular fixture is not available, to compress partially the entire unit. After the adjusting nuts have been removed, loosen the clamps and lift off the cover. Before disturbing any of the parts, note carefully their exact positions so as to assemble the unit correctly.

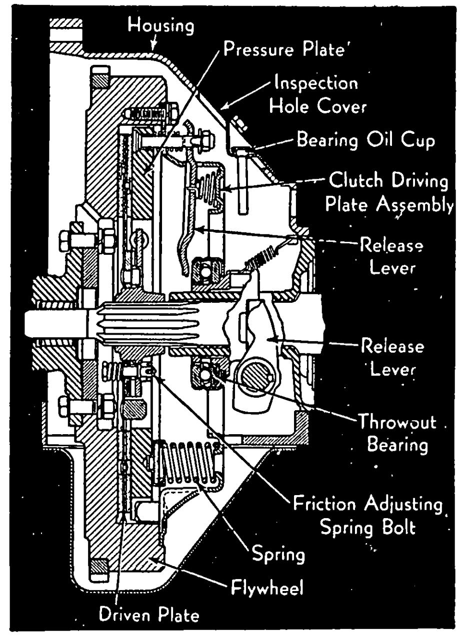


Fig. 8 Long Model 9AB clutch

CLUTCH, ASSEMBLE—After replacing any necessary parts, set the cover in the correct position. Using the three hand clamps, or the special fixture if available, compress the entire unit evenly until the release bolts can be pushed through the cover plate stamping and release levers sufficiently to allow the nuts to be assembled. Draw the nuts down flush with the top of the release bolts, but leave them unlocked.

RELEASE LEVERS, ADJUST—If special equipment is not available to make the lever adjustment, attach the assembly to the flywheel or a surface plate with a gauge which is exactly the same thickness as the driven disc which is to be used in th unit being serviced. Adjust the release levers so that their tips are 1¼" from the surface of the flywheel or surface plate. All levers must be uniform so as to maintain the correct parallelism between the pressure plate and the flywheel. Lock the adjusting nuts with a staking chisel and re-check the lever adjustment.

OVERLAND 39, 1939

Procedure for servicing this unit is the same as described for the Ford V8-60 described above except that this unit utilizes the model CF cover plate.

The levers should be set so that the distance between the surface of the flywheel and the lever tips is $1\frac{7}{16}$".

LONG [4]

Model 12 CB

Place the assembly on the bed of a press with a block under the pressure plate so arranged that the cover is free to move down. Place a block across the top of the cover, resting it on the spring bosses and apply pressure to the assembly.

Mark the cover and pressure plate so that assembly may be made in the same relative position. Remove the screws from the assembly and release the pressure, after which, the cover may be lifted off.

Before disturbing any of the parts, note carefully their exact position so that assembly may be made accordingly. Examine all parts carefully and replace any that are doubtful.

CLUTCH, ASSEMBLE—Mount the adjusting yoke on each lever and fasten it on by using a short lever pin. Use a lever pin which has been sawed off so that it is as long as the lever is wide. Use this pin as a guide to hold the needle rollers in place while assembling the yoke to the lever, and the lever to the pressure plate. Force this sawed off pin out with the regular pin after the yoke is in position. Repeat this operation to assemble the lever to the pressure plate, using long lever pins.

Assemble the pressure spring locators, buttons and pressure springs. Place the release lever tension washers over the yoke bolt and set so that the bolt part of the yoke is vertical to the pressure plate. Mount the clutch cover over the pressure springs, making certain that every part is properly located. The marks on the cover and pressure plate which were made before dismantling must line up during assembly.

With the assembly in position on the press, compress the cover slowly, guiding the pressure plate lugs through the holes in the cover, making sure that the pressure springs are properly located. After the assembly is completed, apply pressure to the levers, compressing and releasing the assembly several times to make sure that all moving parts are in their proper working positions. Assemble the release lever adjusting nuts, turning them down until their tops are flush with the tops of the bolts.

NOTE—Care must be exercised when assembling the levers to the pressure plate to see that all the needle roller bearings are in place correctly and the lever pins are locked with cotter pins.

If the unit being serviced is equipped with lever pins using a hairpin lock wire at either end to hold the pin in place, replace with the new type pin using a head on one end and a cotter pin on the other end.

RELEASE LEVERS, ADJUST—Using an extra flywheel as a dummy, and a gauge in the position normally occupied by the driven discs, mount the assembly on the dummy flywheel, turning the cover screws a turn or two at a time to avoid springing the cover. Be sure the gauge is seated properly.

NOTE—If an extra flywheel is not available, remove the flywheel from the engine being worked on. The gauge being used must be exactly the same thickness as the combined thickness of the two driven discs used in the unit being serviced.

To make the adjustment, set each lever by turning the adjusting bolt nut so as to bring each lever $2\frac{13}{32}''$ from the surface of the flywheel to the contacting portion of the lever. Lock the nut with a staking chisel and re-check the lever setting.

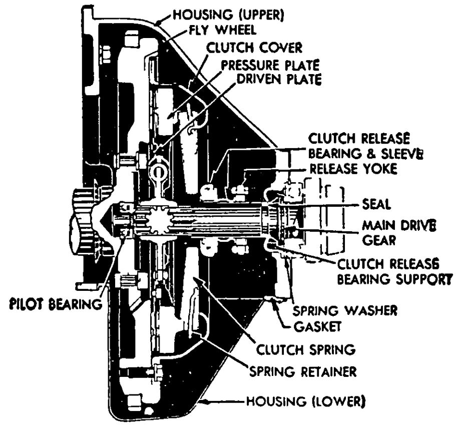


Fig. 9 Inland corrugated spring type clutch

INLAND [1]

Corrugated Spring Type

This clutch, Fig. 9, is a single plate dry disc type using a corrugated pressure spring instead of the coil pressure springs as used in the conventional design. The diaphragm spring serves the dual purpose of providing pressure and releasing means. The spring is held in place by a series of hairpin-shaped springs, which also hold together as an assembly the pressure plate, diaphragm spring and the clutch cover plate.

DISASSEMBLY — 1. Place pressure plate and cover assembly on a flat work surface and *mark cover, pressure plate, and clutch spring* with paint so that parts can be reassembled in the same relationship to each other in order to preserve engine balance.

2. Unhook spring retainers from ears on clutch cover, using Assistor Hook J-1039-2, Fig. 9A. Tool J-1039-1 shown in illustration is not used in this operation.

3. Lift off clutch cover, then unhook all spring retainers from clutch spring by working one leg of retainer toward center of spring and the other leg away from center, Fig. 9B.

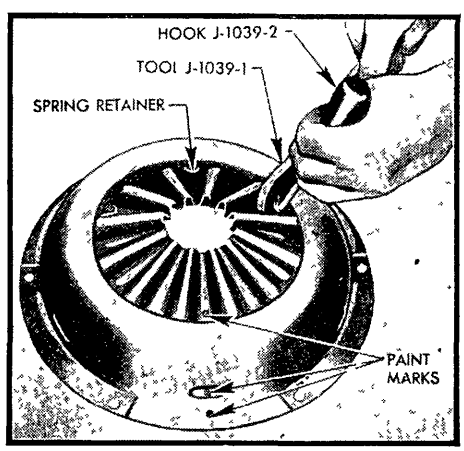


Fig. 9A Attaching spring r tainer to c v r

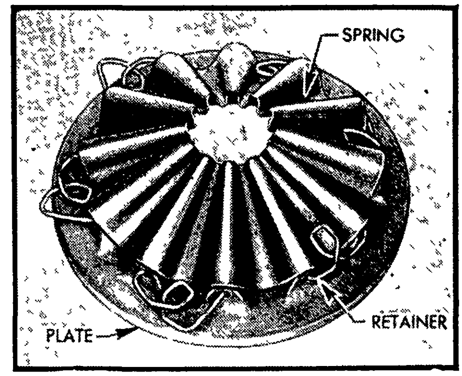


Fig. 9B Assembling pressure plat , clutch spring and r tain rs

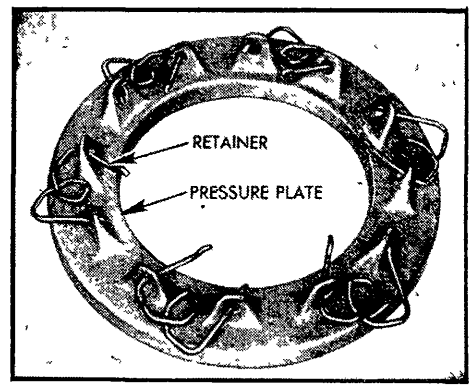


Fig. 9C Positioning spring retain rs

4. Lift off clutch spring and remove retainers from pressure plate, Fig. 9C.

INSPECTION—Wash all metal parts of clutch, except release bearing and driven plate, in suitable cleaning solution to remove dirt and grease. Soaking release bearing in cleaning solution may permit solution to seep in bearing and destroy the lubricant. Soaking driven plate in cleaning solution may damage the facings.

Examine friction surfaces of flywheel and pressure plate for scoring or roughness. Slight roughness may be smoothed with fine emery cloth, but if the surface is deeply scored or grooved the part should be replaced.

Inspect the clutch cover for cracks or distortion. Place cover on a flat surface and measure the setting of each of the six ears where spring retainers are attached. The dimension from flange surface of cover to top surface of each ear should be 1 ⅝ in., Fig. 9D. If dimension is not 1⅝ in., and cover is otherwise serviceable, the ears should be bent as required, using care to avoid cracking the metal.

Inspect the clutch spring for cracks, particularly at inner edge. Cracks weaken the spring and make replacement necessary.

It is a normal condition to have some wear at the inner edge of the spring, resulting from release bearing sliding radially on the clutch spring. This type of wear does not effect the operation or efficiency of the spring; therefore, the

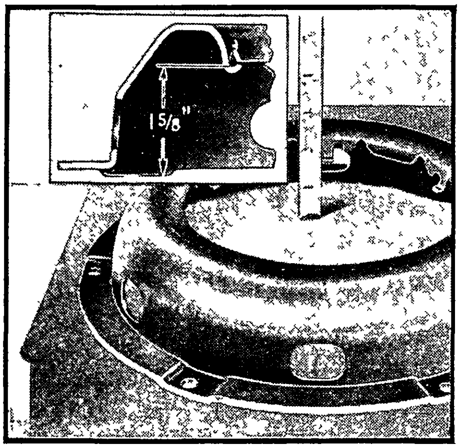


Fig. 9D Setting of spring retain r ars on clutch cover

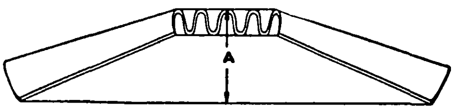


Fig. 9E Clutch spring height. N rmal h ight "A" 1 13/16"; minimum height 1 11/16"

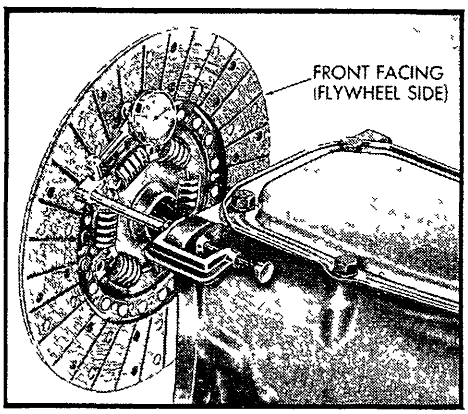


Fig. 9F Checking driven plate for run-out

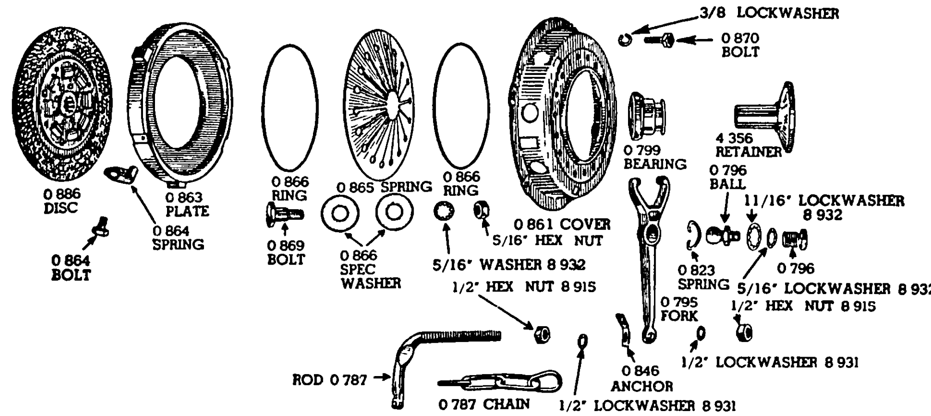


Fig. 10 Inland diaphragm spring type clutch. Chevrolet 1938 sh wn

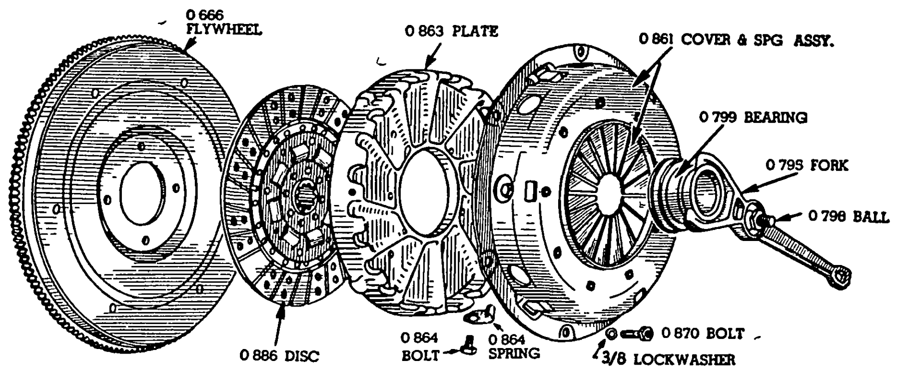


Fig. 11 Inland diaphragm spring type clutch. Chevrolet 1939-51 sh wn

spring should not be discarded unless the depression is worn deep enough to cut through the metal. Unless the metal is worn to a sharp knife edge, the spring will operate satisfactorily.

The clutch spring will flatten slightly due to the metal taking a permanent set, which is characteristic of any type spring after continued flexing. The normal height of a new spring is 1$\frac{13}{16}$ in., Fig. 9E. After only a short period of usage, this height will be reduced somewhat. However, if height is not less than 1$\frac{11}{16}$ in. the spring will retain sufficient pressure to prevent clutch slippage and will operate satisfactorily provided, of course, the spring is not cracked.

When oil is found on the driven plate facings, examine transmission drainback hole, pilot bearing, engine rear bearing and other points of oil leakage, and the lower flywheel housing gasket.

Test the fit of the driven plate hub on the transmission main drive gear; an easy sliding fit should exist. Regardless of whether the old plate or a new one is to be installed, the plate should be checked for run-out. This check can be made by sliding the driven plate (front side first), Fig. 9F., over the main drive gear until it is tight on the splines. Then set up a dial indicator to bear against the plate as shown in Fig. 9F. While holding firmly against the front end of the main drive gear to take up play in main drive gear bearing, slowly rotate driven plate and observe the amount of run-out shown on the indicator. If run-out of front facing exceeds .025 in. the plate should not be used since it is not practical to correct excessive run-out by bending.

Inspect clutch release bearing for scoring or excessive wear on front contact face. Test for roughness of balls and races by pressing and turning front face slowly.

ASSEMBLY—1. At points where clutch spring contacts clutch cover, pressure plate, and ends of spring retainers apply a light coating of Lubriplate or Delco Brake Lubricant (this is not brake fluid). Use sparingly as excessive lubrication will ruin driven plate facings.

2. Install spring retainers through holes in pressure plate, with curves on ends upward, one end in toward center of plate and the other end out from center as shown in Fig. 9C.

3. Place clutch spring on pressure plate *with marks made at time of disassembly in alignment,* then push spring retainers up over the spring, Fig. 9B.

4. Place clutch cover over spring and pressure plate *with marks made at disassembly in alignment.*

5. Use Assembly Tool J1039-1 and Assistor Hook J1039-2 to hook loop of each spring retainer over ear on clutch cover, Fig. 9F. Do not hammer on tools to get them into place because this will distort clutch cover. Do not stretch retainers any further than is necessary to hook loop over ear on cover. If retainers appear weak or distorted they should be replaced in complete sets to insure even tension.

INLAND [2]

Diaphragm Spring Type

This clutch, Figs. 10 and 11, is the single plate, dry disc type using a dished, or conical-shaped diaphragm spring in place of the coil pressure springs used in the conventional type units. The outer rim of the diaphragm spring acts as a spring, while, extending inward from it, are eighteen release fingers.

When the diaphragm spring is placed on the pressure plate, and the clutch cover is clamped tightly against it, the diaphragm spring forces the pressure plate firmly against the driven disc. The spring is fulcrumed on the clutch cover by two wire rings.

CLUTCH, OVERHAUL—Before dismantling the unit, note the position of the

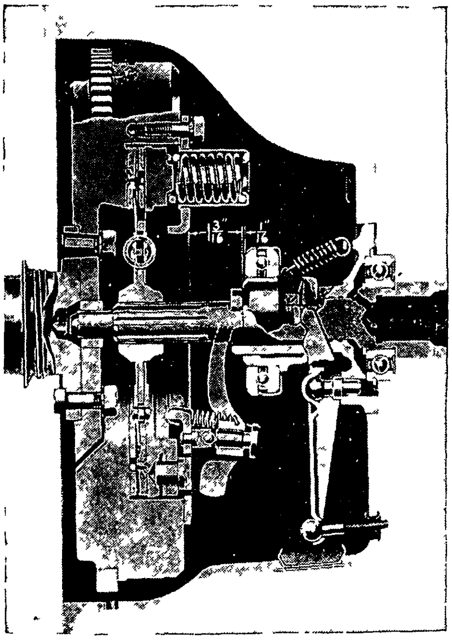


Fig. 12 Rockford clutch

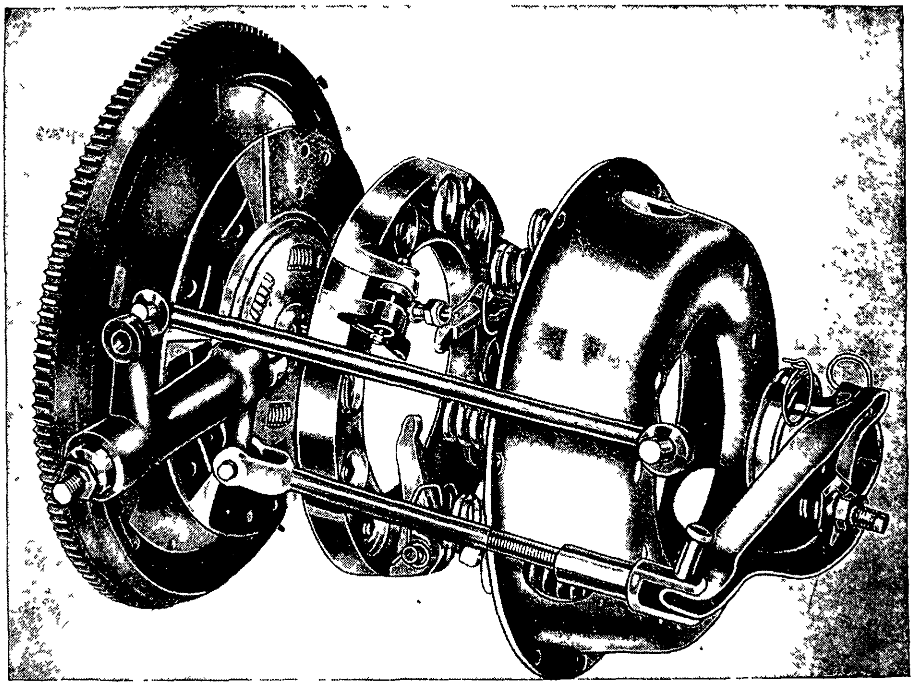


Fig. 13 Buick clutch. Typical of all models not using Inland

various parts. Punch mark the clutch cover and pressure plate so that assembly may be made in the same relative position, in order to preserve the original clutch balance.

Use a suitable wrench to remove the three pressure plate retracting spring bolts, after which, the springs can be removed, which will release the pressure plate from the balance of the assembly.

If it is necessary to replace the diaphragm spring, and the unit which is being serviced employs bolts and nuts to hold the diaphragm spring in position, remove the nuts and washers, and take out the bolts and complete the disassembly operation.

If the assembly being serviced employs rivets to hold the diaphragm spring in place, remove the rivets by grinding the rivet ends from the top of the cover plate, after which, the disassembly may be completed.

CLUTCH, ASSEMBLE—Place the cover plate upside down. Install the wire ring in position encircling the bolt or rivet holes. After coating the flat washers sparingly with graphite grease, place one washer over each bolt or rivet hole in the cover plate with one side resting on the wire ring. The projections on the wire ring should be adjacent to the bolt or rivet holes so that they will straddle the bolts.

Place the diaphragm spring in position with its convex side down, being careful not to disturb the ring and washers which are already in position. Coat the remaining flat washers lightly with graphite grease and place them on the diaphragm spring, one over each bolt or rivet hole, after which, the other wire ring should be placed on top of the washers with the projections located in the same straddling manner as the ring already in position.

Insert the bolts down through the assembly, making sure that they pass through both flat washers and both wire rings. Be sure that the three pairs of projections on the wire rings straddle the bolts. Turn the nuts and lock washers onto the bolts from underneath and tighten securely with suitable wrenches.

Place the cover and spring assembly on top of the pressure plate, lining up the drive slots in the cover plate with the drive lugs on the pressure plate. If the pressure plate has not been replaced, make sure that the punch marks, made before disassembling, are placed in the same relative position.

Install the pressure plate retractor springs through the holes in the top of the cover so that their hooked ends catch the top of the diaphragm spring. Fasten the retractor springs into position by means of the bolts through the holes in the side of the cover plate, being sure that lock washers are used.

ROCKFORD

The clutch, Fig. 12, is of the single plate dry disc type, consisting of a pressure plate assembly having six pressure springs, three release levers, and a spring-cushioned driving disc mounted on a hardened steel splined hub.

CLUTCH, OVERHAUL—Compress the assembly in a press and remove the lever pins and release levers. Release the pressure and lift off the cover.

Examine all parts and replace any that appear to be doubtful. Inspect the release levers for wear. Replace pressure springs that have seen considerable service and have lost their original tension. If the pressure plate is warped, grooved or heat checked, it must be replaced. Replace worn lever pins.

CLUTCH, ASSEMBLE — Position the pressure springs on the pressure plate, and the spring cups over the pressure springs. Install the cover over the spring cups, lining up the square holes in the cover with the lever or drive studs in the presure plate. Compress the cover and fasten it to the pressure plate.

With the adjusting screw partially turned down into the lever, insert the lever spring through the hole in the lever so that it extends upward against the head of the adjusting screw. Hook the curved end of the lever spring under the rim of the cover plate and force the rear end of the release lever into position in the slot of the lever stud to a point where the lever pin can be inserted through the stud and lever, after which, lock the lever pin with a cotter pin.

RELEASE LEVERS, ADJUST — If a special fixture is not available to make the adjustment, install the clutch assembly to the flywheel. The installation is made easier by placing a short nail or steel pin $\frac{1}{8}$" diameter in the lever stud slot directly under the rear end of the lever. Be sure to remove these pins after the assembly is bolted to the flywheel. To make the adjustment, turn the knurled screw in each of the release levers so that when the clutch pedal is released and the clutch engaged, there should be approximately $\frac{1}{16}$" clearance between the front face of the release bearing and the end of the release levers. The distance between the front face of the release bearing and the rear face of the clutch back plate should be $1\frac{3}{16}$" when the clutch pedal is depressed approximately $\frac{3}{4}$".

If a special fixture is being used, the lever should be set so that the distance between the surface of the pressure plate and the end of the levers is $\frac{17}{32}$".

BUICK

Fig. 13. Place the assembly on the bed of an arbor press with the pressure plate supported on blocking so that there is clearance under the flange of the cover. Then place a bar across the top of the cover plate on which to rest the ram of the press. Compress the cover sufficiently to relieve the pressure on the adjusting nuts. After removing the nuts the clutch cover can be lifted off for inspection and replacement of any necessary parts.

RELEASE LEVERS, ADJUST — Place the gauge plate in the flywheel in the position normally occupied by the driven disc, and mount the cover on the flywheel, turning the cover screws a turn or two at a time when pulling against spring pressure, to prevent springing the cover. Before the cover is tightened down securely, be sure that the gauge plate is properly centered. Also be sure that the three machined surfaces of the gauge plate are directly under the levers.

After the cover has been mounted, a short straight edge or scale can be laid across the center boss and the bearing surface of one lever. Then turn the adjusting nuts until the levers are the same height on the gauge boss within .005". After the adjustment is completed, lock the nuts by slightly burring the threads.

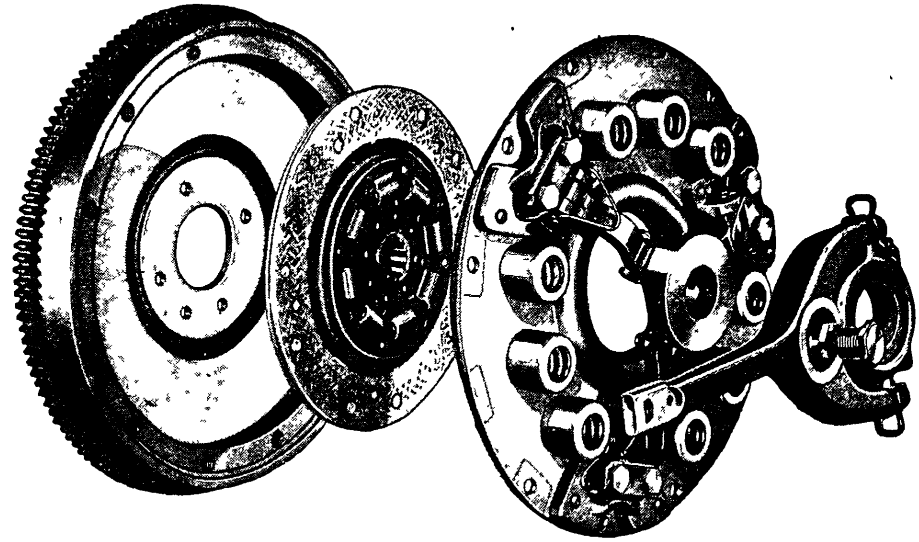


Fig. 14 Chevrolet 1935-37 clutch

CHEVROLET

Fig. 14. To remove the clutch assembly from the flywheel, remove every other screw and then relieve the spring tension by removing the other screws one turn at a time.

Mark the clutch cover and pressure plate so that assembly may be made in the same relative position, in order to maintain the original clutch balance. Remove the remaining cap screws which will permit the removal of the clutch cover from the pressure plate. Remove the clutch lever retaining springs and check the levers to see if they are binding, after which, the lever pins and levers may be removed.

Check the fit of the lever pin in the lever and, if either pins or levers are worn, they must be replaced. Inspect the slots in the throwout bearing sleeve for wear, and also, check the ends of the levers in the slots to make sure they are free. See that the bearing surfaces of both the pressure plate and the flywheel are free from scores, grooves or heat checks. Install the cover over the pressure plate and check to make sure that the pressure plate bosses are not binding on the guides in the cover. Remove any burrs which are found along the edges of the broached guides in the cover. Check the pressure springs for even height. Also check the run-out of the transmission pilot hole in the clutch housing, which should be within .008" as measured with a dial indicator.

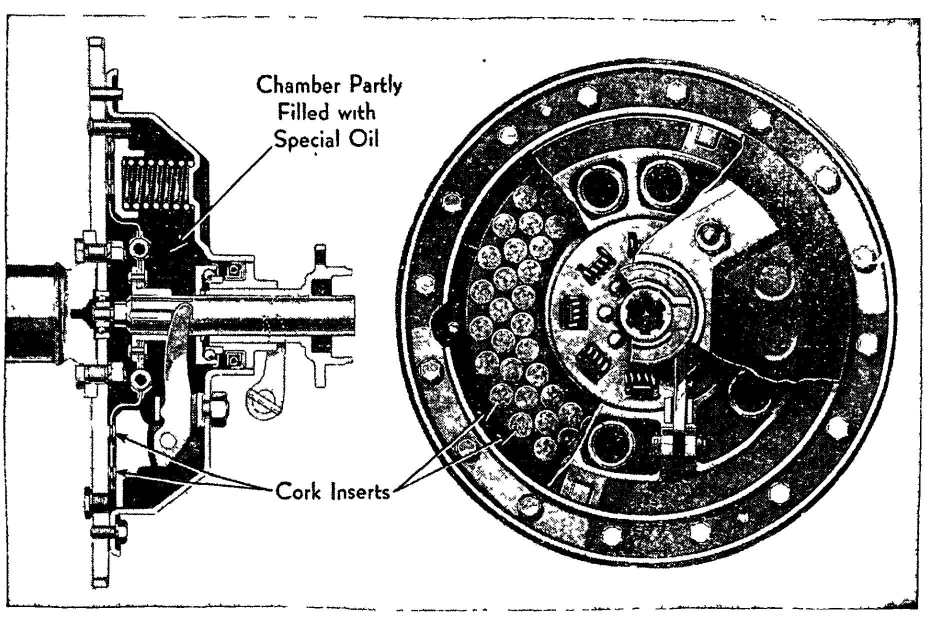


Fig. 15 Hudson clutch

CLUTCH, ASSEMBLE — Apply a light film of graphite grease to the lever pins and install the release levers, making sure that they operate freely. Install the pressure springs in the recesses of the pressure plate, and match the punch marks in the clutch cover and pressure plate. Assemble the lever plates, lock washers and bolts, tightening the bolts evenly and securely.

Assemble the clutch disc to the flywheel and place the clutch cover and pressure plate in position with the nine screw holes in the cover lining up with the corresponding holes in the flywheel.

NOTE: The "X" mark on the clutch cover should line up as near as possible with the "X" mark on the flywheel.

With a clutch pilot tool in position, assemble the cap screws which hold the cover to the flywheel, tightening each screw one turn at a time until all are secured, after which, remove the aligning tool.

To install the throwout bearing sleeve, turn the engine until the release levers form an inverted "Y". Place one hand through the lower opening in the clutch housing and raise all three levers. While one hand is holding the levers out, slightly compress the sleeve retaining springs and place the slots in the sleeve over the levers with the other hand. Then slowly drop the levers while following with the sleeve. Use a long-bladed screw driver through the hole in sleeve to push the retaining springs over the ends of the levers.

With a dial indicator mounted on the machined surface of the clutch housing, crank the engine and check the run-out of the sleeve, which should not exceed .020". If the run-out is in excess of this, chalk-mark the high point. Remove the clutch lever plate that is in line with the high point and place a shim between the plate and the guide to lower the high lever, and then re-check the run-out.

Install the clutch throwout fork, being sure to seat the bolt firmly in the housing, and tighten the ball seat on the screw.

HUDSON

Fig. 15. After the transmission is removed from the car the 16 cap screws around the clutch cover are removed and the clutch assembly removed from the car and taken to the bench. The entire assembly should be washed thoroughly. Inspect the driving plate to see that the corks are in good condition. A black glaze indicates the use of an improper lubricant. If the corks are not burned, soaking in Hudsonite and the use of Hudsonite in the clutch after reassembly, will clean up the cork surfaces. Clean cork surfaces are necessary for smooth engagement and "clean" disengagement.

Before disassembling, look for the punch marks near the outer edge of the pressure plate and a corresponding mark near it on the turn of the cover flange. These marks indicate the position of the parts when the assembly was balanced at the factory and the unit should be reassembled with the marks together to maintain the original balance. If the marks are not readily visible, make them so with a prick punch.

With the aid of an arbor press or special clutch fixture, remove the three nuts from the back of the cover. The cover can then be removed, exposing the springs, clutch fingers, and finger retainers.

The engaging springs are pre-set so that they will lose very little of their original strength in use, unless they become excessively hot. However, it is good practice to replace the engaging springs after long usage unless some means is available for testing their strength (Spring Tester U-15). The engaging springs in Hudsons have a minimum pressure of 120 pounds when compressed to a length of 1⅝" when new. If these springs, after being in service, show less than 110 pounds when compressed to 1⅝", they should be replaced. Terraplane inner engaging springs have a minimum pressure of 75 pounds when compressed to 1⅝" when new and should be replaced if a weight less than 60 pounds compresses it to 1⅝".

Shellac a new gasket to the clutch cover. Align the three clutch fingers so that they contact the throwout bearing evenly. If clutch finger adjusting gauge (J-774) is not available this may be done by resting the clutch fingers squarely on the throwout bearing and rotating the clutch assembly. If an uneven motion is produced, adjust the fingers by tapping the high finger with a soft hammer until an even motion is obtained.

Install clutch assembly with aligning arbor. Insert one-third pint of Hudsonite in the clutch housing through the hub cover. Install throwout bearing, being sure that the oil seal is in good condition, without any folds or tears in the leather as this will cause oil leakage.

PONTIAC

Fig. 16. Place the assembly in the bed of an arbor press with the pressure plate

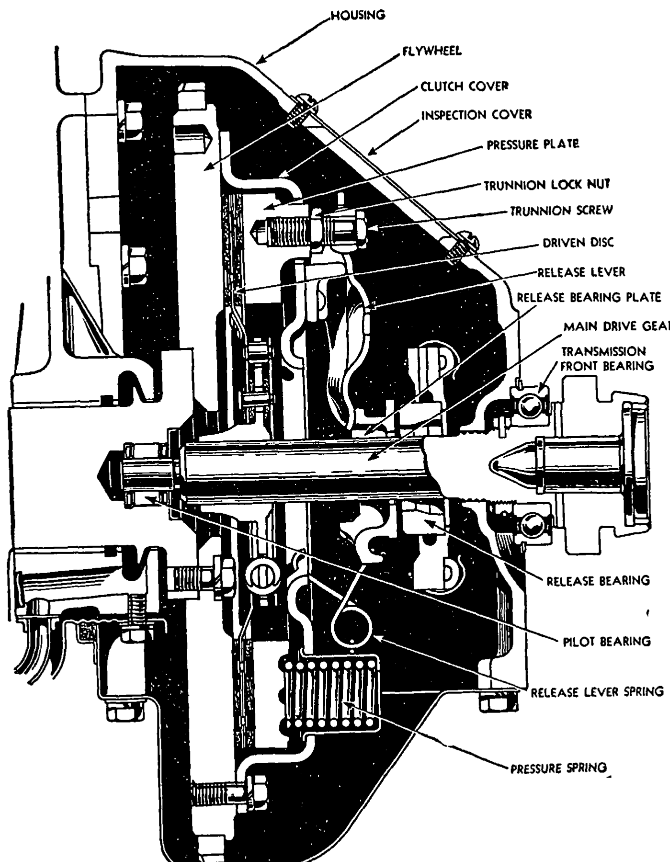


Fig. 16 Pontiac 1935-38 clutch

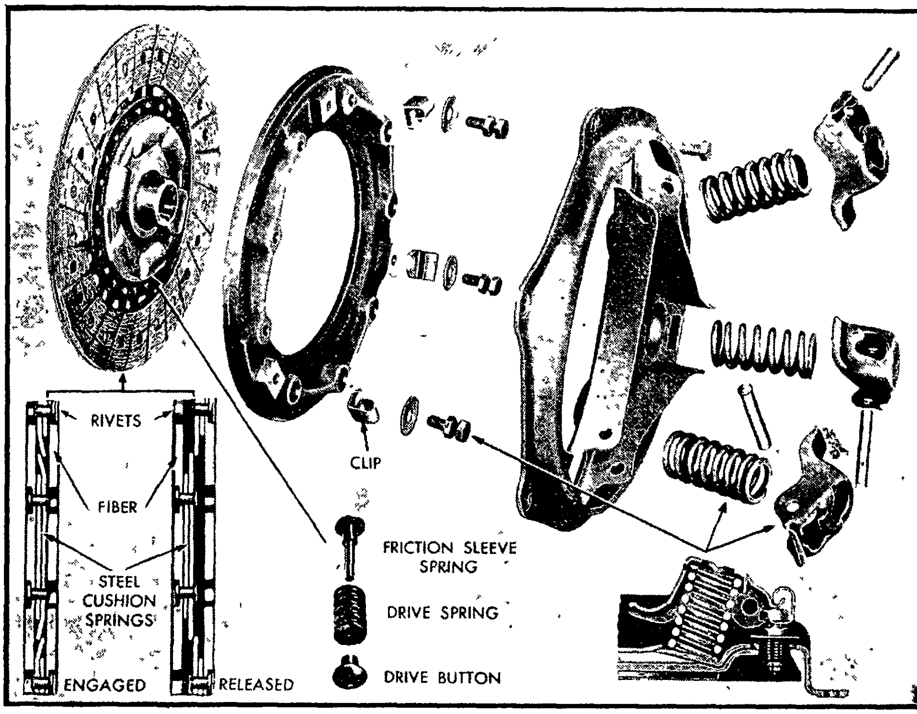


Fig. 17 Expl ded vi w f Auburn clutch

supported on blocking, so that there is clearance under the flange of the cover. Then place a bar across the top of the cover plate on which to rest the ram of the press. Compress the cover sufficiently to relieve the pressure on the adjusting nuts. After removing the nuts, the clutch cover can be lifted off for inspection and replacement of any necessary parts.

RELEASE LEVERS, ADJUST — Satisfactory operation of this type clutch is absolutely dependent on accurate adjustment of the release levers. Therefore, it is recommended that gauge plate No. J-285-B and an adapter be used to perform this operation in order to bring all the levers within .005" of parallelism with the flywheel.

Place the gauge plate in the flywheel in the position normally occupied by the driven disc and mount the cover on the flywheel, turning the cover screws only a turn or two at a time, when pulling against spring pressure, in order to avoid springing the cover. Before tightening the cover securely, make sure that the gauge plate is properly centered and see that the machined surfaces of the gauge plate are directly under the release levers.

After the cover has been mounted on a spare flywheel on the bench, insert the adapter screw and loosen the locknut. Turn the adjusting screw until a setting .010" for 1935-1936 models, and .040" for 1937-1938 models, is secured by placing a feeler gauge between the adapter plug and the bearing plate. Be sure that the adapter plug is held down securely when making the adjustment. After making the adjustment on each lever, tighten the lock nuts and re-check the clearances. Remove the gauge plate and assemble the clutch to the engine.

AUBURN

This clutch unit, Fig. 17, is a single plate, dry disc type with the clutch cover consisting of a three-legged spider in which the clutch springs and release levers are mounted. The release levers pivot on the pins riveted to the cover legs and actuate the pressure plate through adjustable screws in the pressure plate under the outer end of each lever. The pressure springs are mounted in cups which form part of the release levers. Hairpin type retracting springs are mounted on each adjustable screw and are retained by the adjusting screw lock nut.

OVERDRIVE

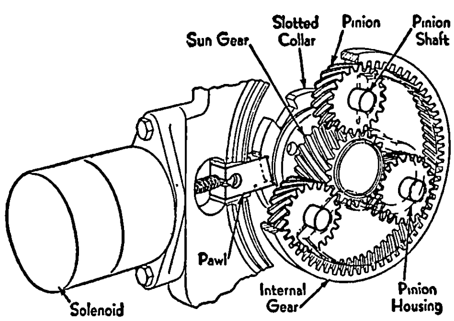


Fig. 1 Thr ugh the planetary unit shown, the overdrive pr vides a higher gear ratio, and wh n in peration, engine speed is approximat ly 30 per cent slower than when perating in convential high gear

OVERDRIVE UNITS are essentially automatic two-speed planetary transmissions attached to the rear of conventional three-speed transmissions. As shown in Fig. 1, the heart of the overdrive is the planetary unit consisting of sun gear, planetary pinions and internal (ring) gear. In overdrive, the pinions are connected to the mainshaft, and revolve around the sun gear which holds against rotation. The internal gear, connected to the tailshaft, is thus forced to rotate at a speed greater than the mainshaft. The engagement of the gearset may be controlled at either the pinions, internal gear or sun gear. In fact, all three methods have been used since the automatic overdrive was adopted in 1934. However, present types are controlled by coupling the internal gear to the tailshaft, or holding the sun gear stationary, or by a combination of the two methods.

The types fitted since 1939 are electrically controlled and allow the driver to shift down to conventional high gear by depressing the accelerator pedal down to the floor board a little harder than required merely for wide-open throttle. The shift-down provides greater acceleration so often needed when passing cars on the highway. The pre-1939 types shifted automatically to overdrive above a certain speed and it is not possible in an emergency to shift down to normal high gear before the car slowed down to a pre-set changing speed. A centrifugal clutch is the only control with these types.

TYPES OF OVERDRIVE

While the principle of obtaining a higher gear ratio through a planetary unit is used on all types of overdrive, there is some variation in the method of control and service requirements. Therefore, a brief description of the three types is as follows:

1. SEMI-ELECTRIC KICKDOWN TYPE WITH CENTRIFUGAL CLUTCH. In this design a solenoid, controlled through a relay and throttle (kickdown) switch, provides means of cutting out overdrive. It consists of three major as-

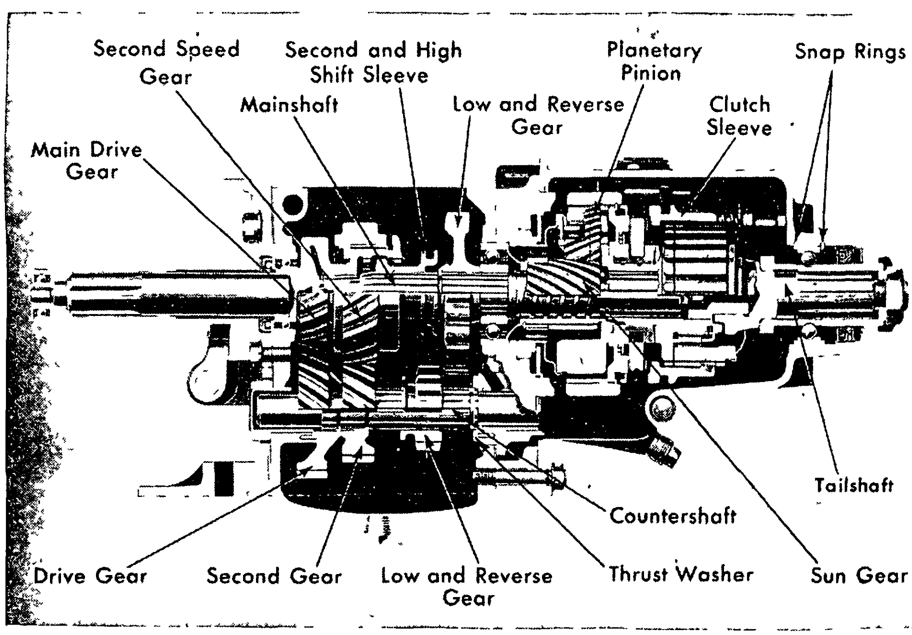


Fig. 2 Transmission with semi-electric type overdrive with centrifugal clutch. Hudson 1940 applicati n. Ov rdrive (nly) typical f Chrysler 1939-40 and 8-cyl. 1941; De S t 1939-40; Nash 1940-42 and early 1946; Packard 1939; Studebaker 1939-42 and early 1946 (exc pt 1941-42 Pr sident)

semblies (A) a sun gear and three planetary pinions, (B) centrifugal clutch, (C) free wheeling unit. Fig. 2 shows the 1940 Hudson application.

2. FULL-ELECTRIC KICKDOWN TYPE WITH CENTRIFUGAL GOVERNOR. This design is controlled by a speed-responsive governor switch for cutting the overdrive in or out; a kickdown (throttle) switch which cuts out overdrive temporarily; and a switch on the dash lockout control which opens the solenoid circuit when the hand control is pulled out, thus preventing operation of the overdrive automatic controls.

In the first version of this type, Fig. 3, the major mechanical assemblies are quite similar to those of the semi-electric type except that the centrifugal clutch is not used — its function now being taken over by the centrifugal governor. In the second version, Fig. 4, the controls are similar to the first version but the mechanical parts are simplified and made more compact.

3. TYPES WITHOUT ELECTRIC CONTROL. In Fig. 5, the mechanical parts are almost identical to the semi-electric type. Fig. 6 is also basically the same except that all overdrive and transmission parts are housed in a single case. Fig. 7 differs from the others chiefly in that there are five planet pinions and the overdrive mainshaft is splined to the transmission mainshaft.

In all types, the speeds at which the overdrive cuts in and out are pre-set and cannot be controlled by the driver.

MECHANICAL SERVICE

Although some overdrive units can be taken out of the chassis without removing the transmission, it is good practice to remove both because when repairs involving the complete disassembly of the overdrive become necessary, an inspection of the transmission is in order. To do otherwise may necessitate a second removal later on should trouble develop in the transmission as a direct result of a broken-down overdrive. In removing the transmission and overdrive, follow the procedure outlined in the car chapters.

SEMI-ELECTRIC TYPE

Fig. 8 is an exploded view of the Chrysler overdrive which may be used as a guide for the identification of parts and the sequence of their assembly. After disassembling the unit as shown by the Studebaker step-by-step procedure illustrated in Figs. 9 through 25, inspect all parts for evidences of wear or damage and replace as required. Special attention should be given to the following:

Wear on the pawl raceways or windows of the clutch sleeve, Fig. 26, will produce a rasping noise at certain speeds, which vanishes when overdrive is engaged. A worn sleeve should be replaced and when this is done, the centrifugal clutch should also be renewed.

Ordinarily it should not be necessary to dismantle the centrifugal clutch since it is usually supplied only as an assembly. Should the occasion arise, however, be sure to count the number of turns required to remove the adjusting screws so that when they are replaced, the original cut-in speed will be obtained.

The centrifugal clutch, Fig. 27, should be installed without end play. If end play exists, install a thicker snap ring. Rings are available in several sizes, and one should be selected which provides a snug fit.

Check the clearance between the end of the solenoid pawl and the balk ring, Fig. 28. The check should be made with

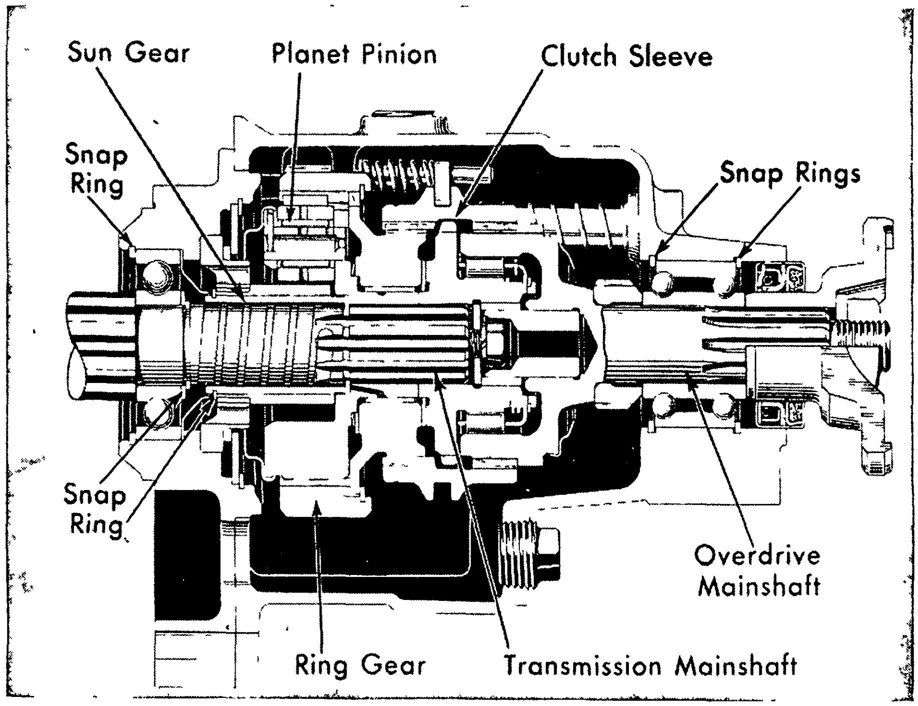


Fig. 3 First version of full-electric overdrive with centrifugal governor. Shown is Packard 1940-48 application but is typical of Hudson 1941-47, Studebaker late 1941 and 1942 Pr sid nt

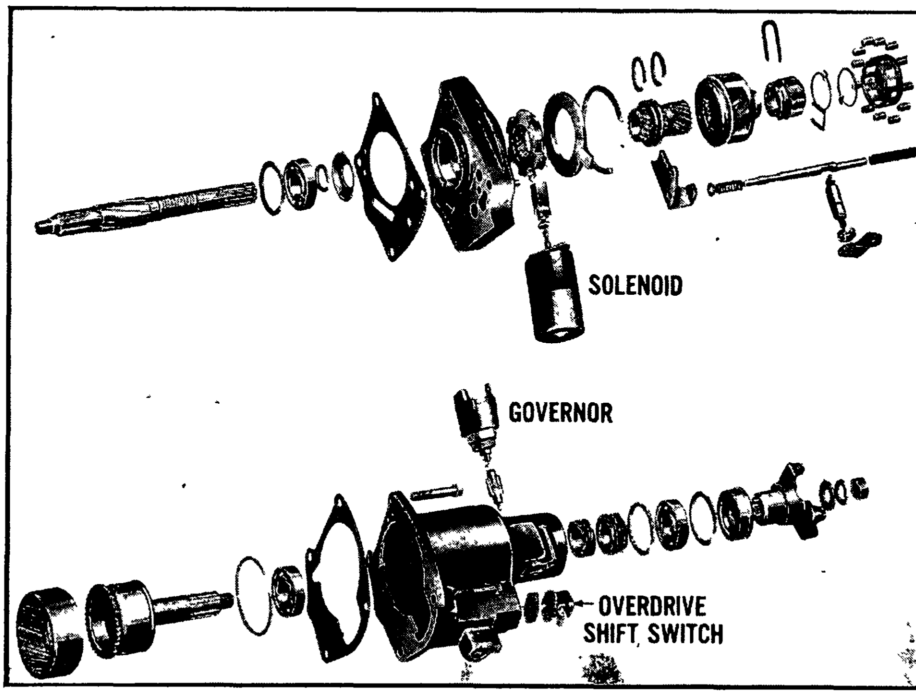


Fig. 4 Second version of full-electric overdrive with centrifugal gov rn r. Shown is late 1946 Studebaker and all 1947-52 but it is typical of Kaiser and Frazer 1947-52, late 1946 Nash and all 1947-52, Packard 1949-52, Willys 1946-52. Ford, Lincoln and Mercury is similar except for shap of housing

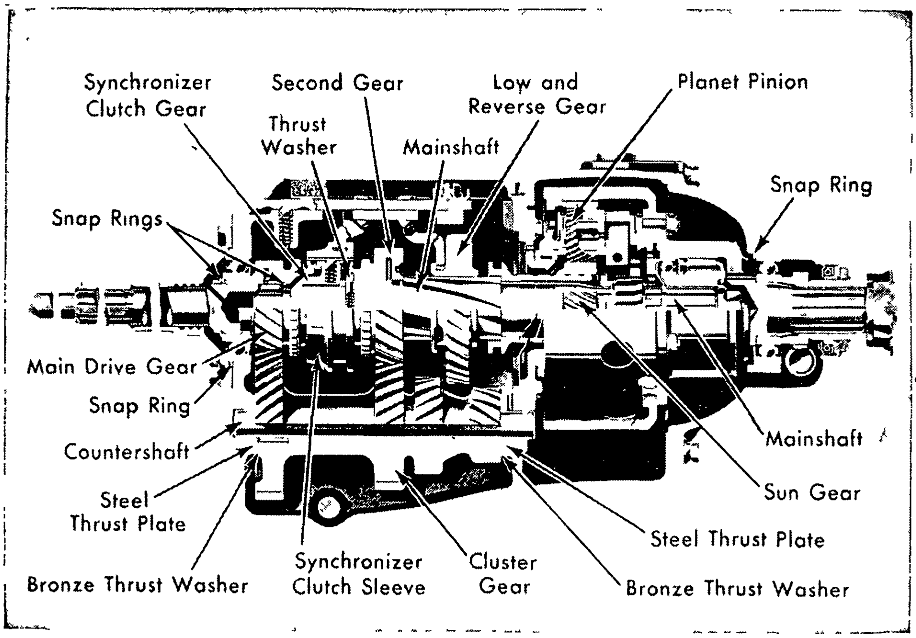


Fig. 6 Overdrive without electric control. Similar to Fig. 5 except that all internal overdrive and transmission parts are housed in a single case. Chrysler and De Soto 1936 application. Typical of Graham 1936-37; Nash 1936-37; Studebaker 1936 Dictator

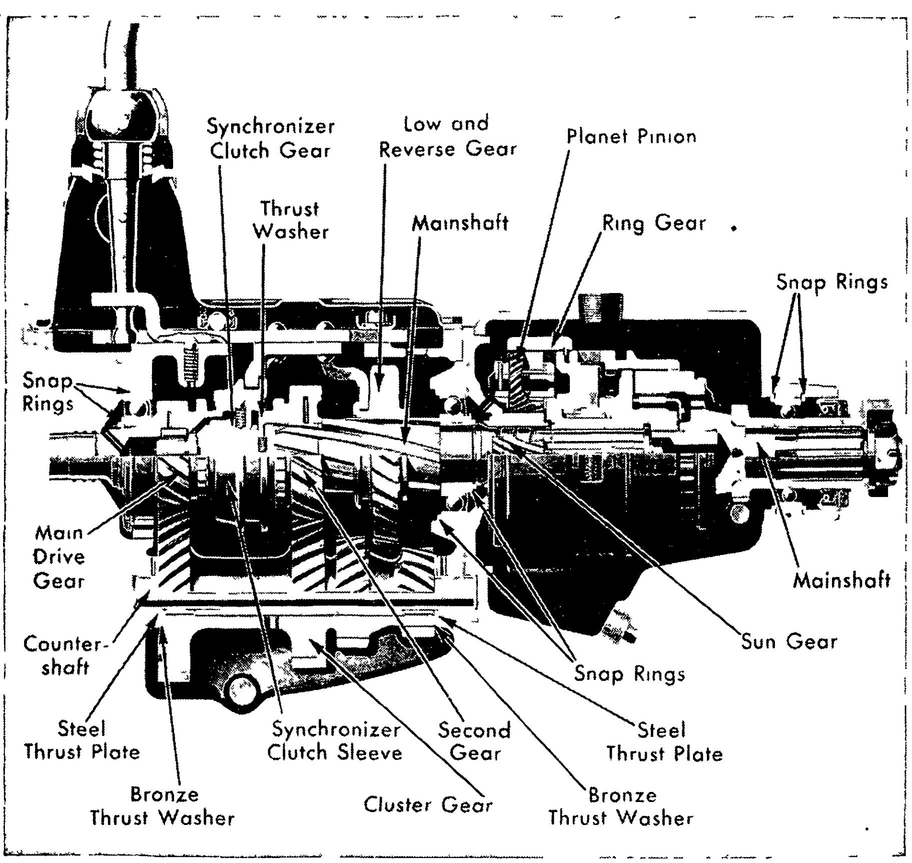


Fig. 5 Overdrive with ut electric control. Typ with three planet pinions. Chrysler and D S t 1937-38 applicati n. Typical of Graham 1937; Nash 1937-39; Stud baker 1937 Dictat r and all 1938

the solenoid in place and energized, at which time the clearance at the arrow should not be less than .015 inch. Adjust by adding gaskets under the solenoid. Whenever the solenoid is removed, be sure that it is installed with the original gaskets or with new gaskets of the same total thickness as the originals.

Some of the pinion cage assemblies are provided with spring-loaded split pinions to prevent gear backlash noise. When this construction is encountered, be sure to wind up the free portion of each pinion until the tooth marks align before meshing the pinions into the ring gear. The amount of wind up is about 1½ teeth.

When assembling the freewheel cam it may be necessary, in some instances, to provide a means of securing the rollers to prevent them from dropping out. In such cases, apply cup grease to the rollers and assemble them into the cam, holding them in place with a tight-fitting rubber band, Fig. 29.

To facilitate installation of some overdrive housings it may be necessary to insert the finger into the housing to help align and engage the splines in the shifter collar with those on the mainshaft. Access to collar can be achieved through a drain plug hole on Packard and through a plug on top of Studebaker housing.

OVERDRIVE CONTROL CABLE

A control cable is provided as a means of cutting the overdrive in or out at the will of the driver. It runs from the overdrive housing to the instrument panel. This cable insures proper travel of the overdrive shift collar so that in the overdrive, or operative position, the slots in the collar will be in line with the overdrive pawls and the shift collar will be completely engaged with the gear on the clutch hub to lock out the overdrive mechanism.

The cable is adjusted for length at the lever on the overdrive housing. To make the adjustment, loosen the binding screw which holds the control wire to the lever. Then push the lever back as far as possible to place the overdrive in its engaged position. Now move the hand control button (on dash) in as far at it will go and then pull it back ⅛ in. to insure full travel of the button. Tighten the binding screw on the wire at the lever.

Be sure that the cable is properly anchored in the lever to prevent it from slipping. Looseness at this point will prevent proper engagement of the control into overdrive. The cable and conduit should be free from sharp bends and so located that they will not interfere with any other part of the car.

ADJUSTMENT OF CUT-IN SPEED

The centrifugal clutch shown in Fig. 30 is adjusted at the factory to cut in the overdrive at about 25 to 35 mph road speed depending on car make. These clutches are set at the factory, and range of adjustment is very limited. It is recommended that the original adjustment be maintained. If it is found that adjustment has been changed a correction may be effected as follows:

If the cut-in occurs above or below this range, remove the plug at the top

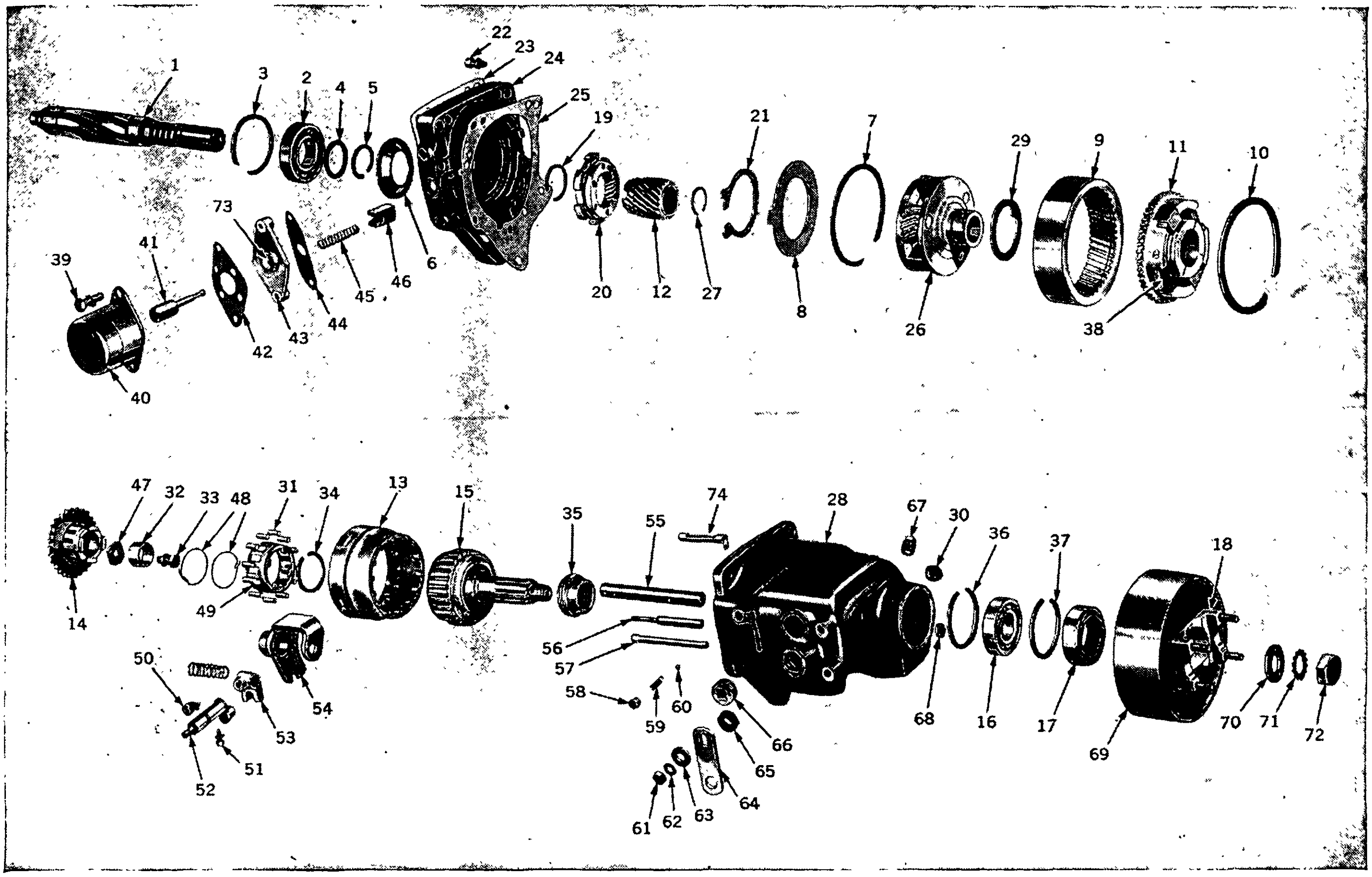


Fig. 8 Exploded view of overdrive, Chrysler and De Soto 1939-40. See Fig. 2 for other cars using this typ

1. Transmissi n mainshaft
2. Mainshaft rear bearing
3. Snap ring
4. Washer
5. Snap ring
6. Oil baffle ring
7. Snap ring
8. Sun g ar c ver plate
9. Internal gear
10. Snap ring
11. Clutch c r
12. Sun gear
13. Clutch pawl shell
14. Free wheel cam
15. Overdriv tailshaft
16. Bearing
17. Oil seal
18. Flang
19. Snap ring
20. Sun gear plate
21. Balk ring
22. Screw and washer
23. Gasket
24. Adapter
25. Gasket
26. Pinion cage
27. Snap ring
28. Overdrive housing
29. Thrust washer
30. Drain plug
31. Free wheel roller
32. Pilot bushing
33. Screw and washer
34. Snap ring
35. Speedometer drive gear
36. Snap ring
37. Snap ring
38. Spring and washer
39. Screw and washer
40. Solenoid
41. Solenoid core
42. Gasket
43. Base and seal
44. Base gasket
45. Spring
46. Sun gear pawl
47. Cam retaining washer
48. Retainer springs
49. Cam roller retainer
50. Set screw and washer
51. Screw and washer
52. Control shaft
53. Shift rail lug
54. Shift fork
55. Shift rail
56. Revers l ckup plunger
57. Shift fork guide pin
58. Ball spring seat
59. Spring
60. Poppet ball
61. Nut
62. Lockwasher
63. Washer
64. Control lev r
65. Oil seal
66. Plug
67. Inspecti n plug
68. Expansi n plug
69. Transmissi n brak drum
70. Washer
71. Lockwasher
72. Flange nut
73. Solenoid bas seal
74. Oil trough

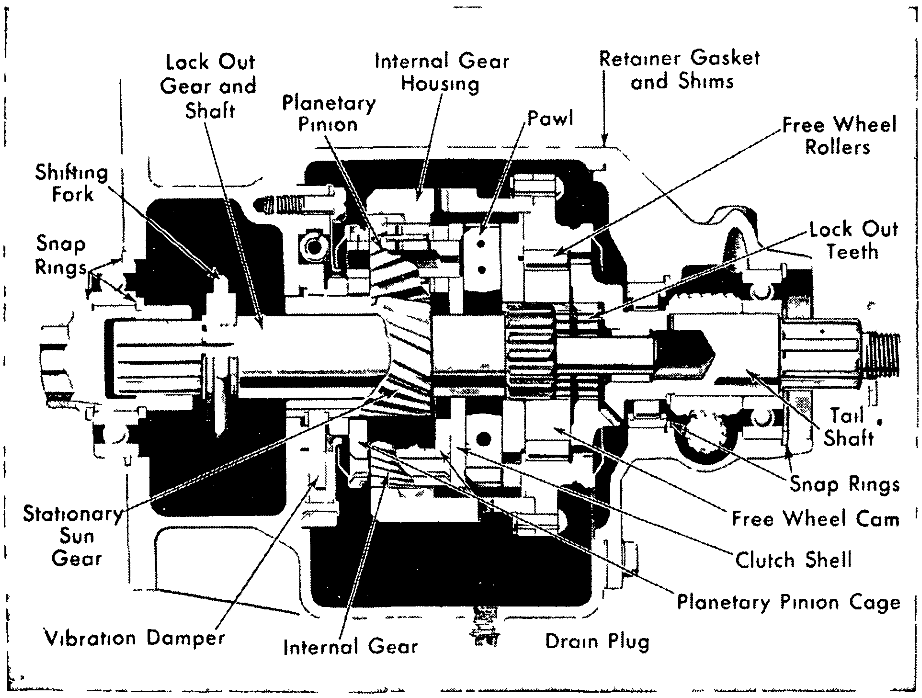


Fig. 7 Overdrive without electric control. Type with five planet pini ns. Chrysler 1936-38 Eight-cylinder application. Typical of Nash 1936 series 20, 80; Studebaker 1936 President

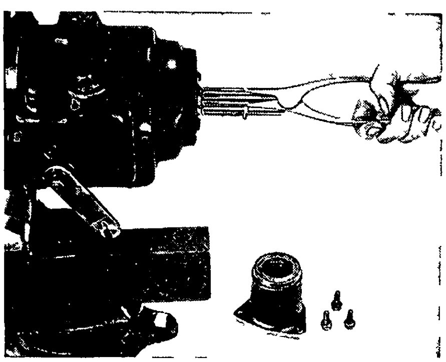


Fig. 9 Rem ve rear bearing snap ring and pull ut bearing

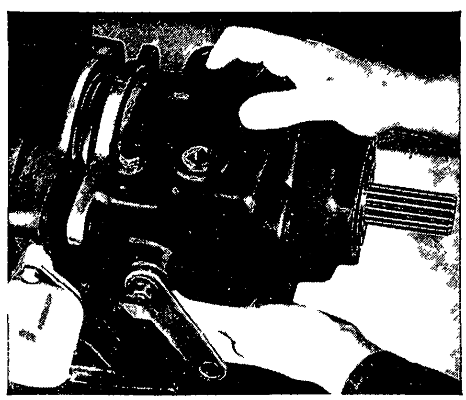


Fig. 11 In removing housing line up free wheel shifter case with finger to release it. Tap end of overdrive shaft lightly to prevent it from coming off with housing

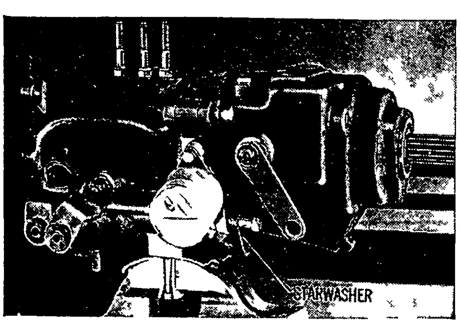


Fig. 10 Detach v rdrive cas from transmissi n. When r placing, the scr w with the star washer must b install d in p sition sh wn to pr v nt leakage of lubricant

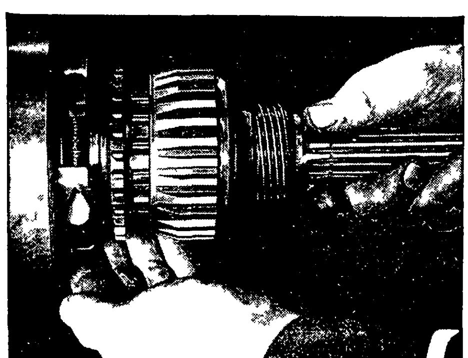


Fig. 12 Pull shaft to rear, h lding hand und r r llers t catch them as th y fall

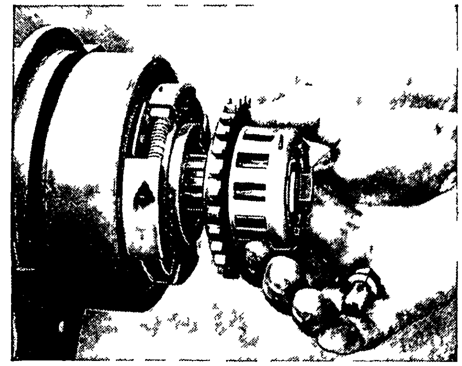


Fig. 13 After removing cap screws, tak out free wheel cam and hub bushing. Upon reinstallation, tongue of special wash r must be installed toward cam. (In s me applications, needle bearings ar us d instead of bushing.)

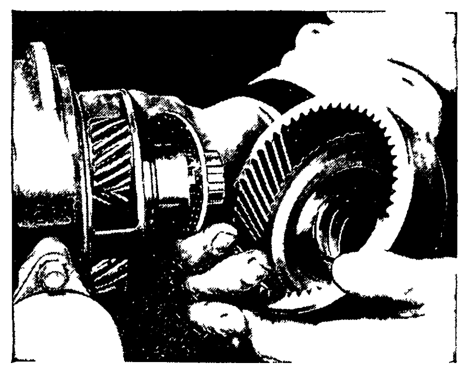


Fig. 14 Remove overdrive clutch and g ar and cage thrust washer. If clutch is t be removed from ring gear, r leas snap ring and paint a mark on ring gear and clutch to permit reassembly in sam l cati n

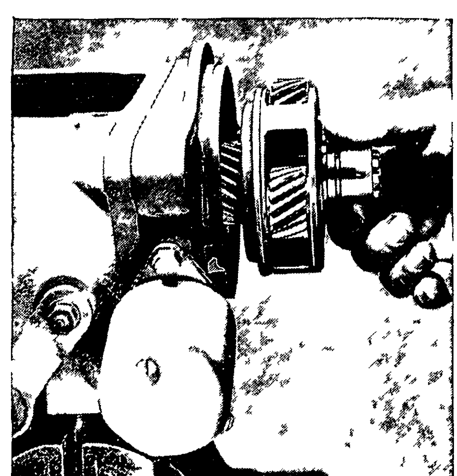


Fig. 15 Pull pini n cag ff shaft

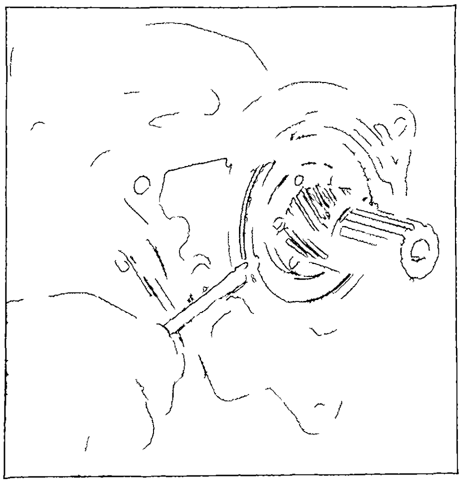


Fig. 16 Remov adapter plate snap ring and thrust plate

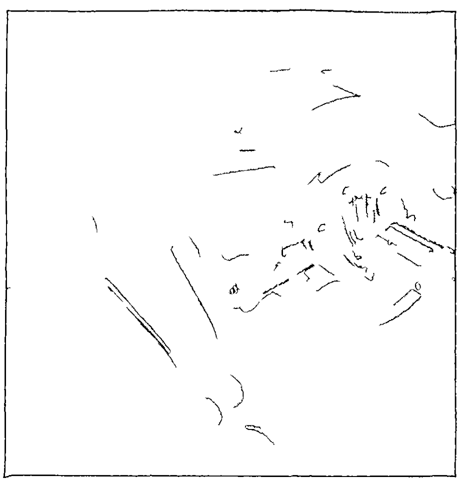


Fig. 17 Unfasten and take off solenoid

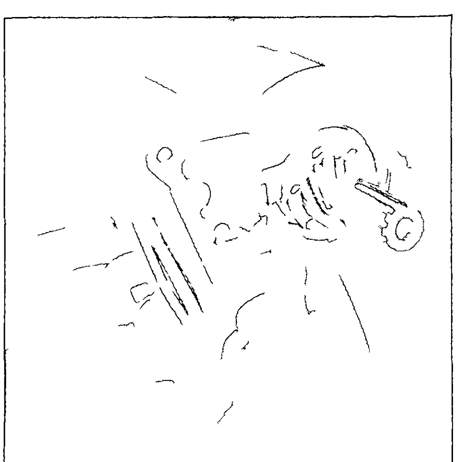


Fig. 18 Remove solenoid pawl and plung r

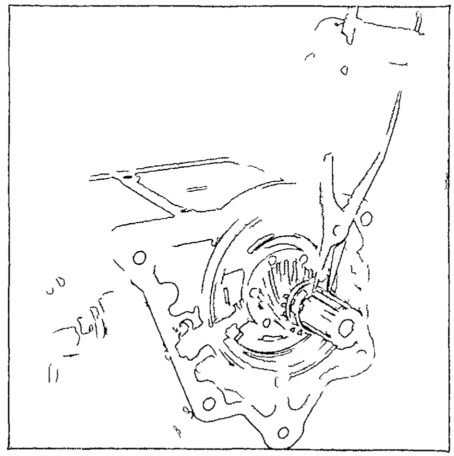


Fig. 19 Release snap ring from shaft behind sun gear

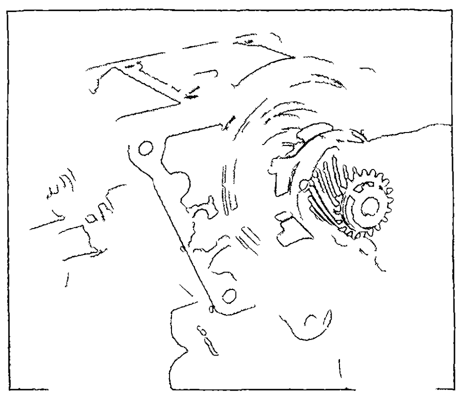


Fig. 20 Slide off sun gear and blocker ring (At this point, if repairs are to be made to the transmission, follow procedure given in the *Transmission* section of the car chapter for the unit being serviced.)

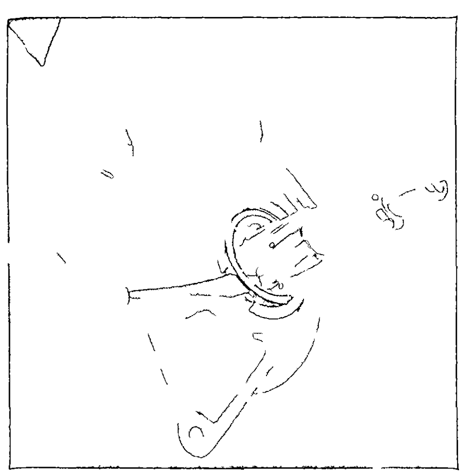


Fig. 21 After removing mainshaft from transmission, rem ve snap ring and press shaft and bearing out of adapter plate

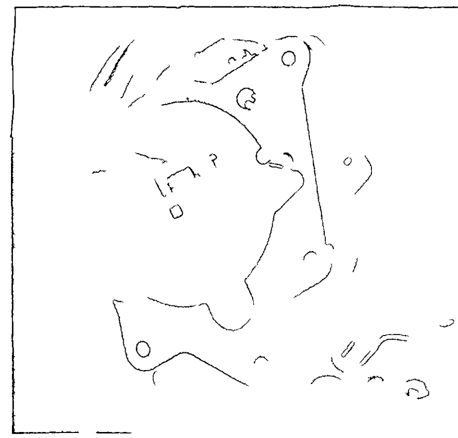


Fig. 22 After removing lock screw and shift lever, take out shift l ver and shaft

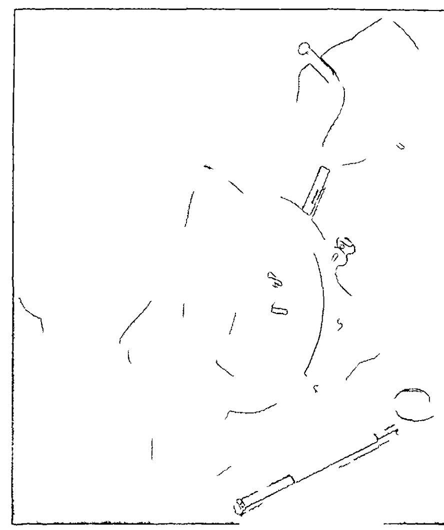


Fig. 23 To remove the overdrive shift yoke, back out lock screws, remove plug and loosen retaining screw

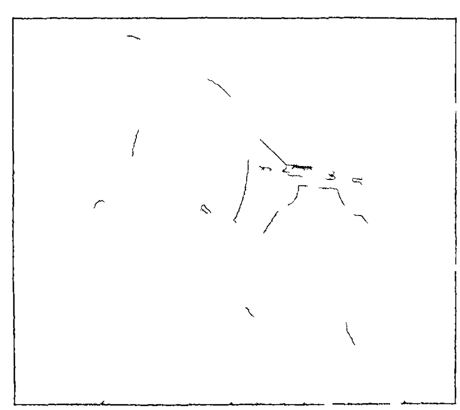


Fig. 24 Remove shift shaft fork and spring

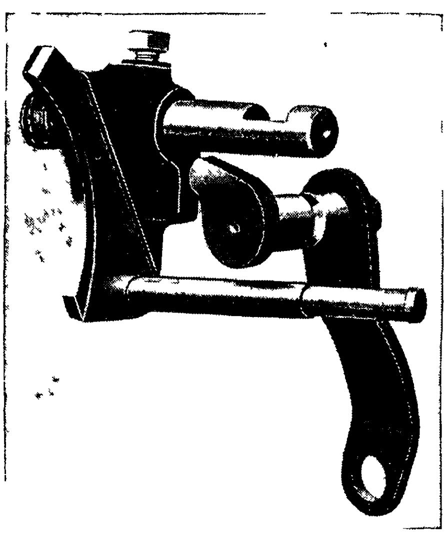


Fig. 25 R lati nship of shift mechanism as it appears when assembled in case

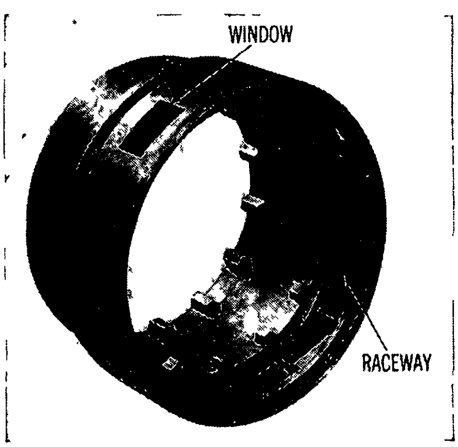


Fig. 26 Clutch sleeve. Wear at points indicat d may r sult in rasping noise at certain speeds

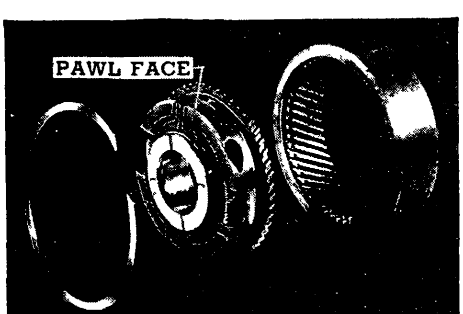


Fig. 27 Centrifugal clutch should b installed with ut end play. Installing a thick r snap ring r duces play

of the overdrive housing or drain plug and jack up the rear wheels. Rotate the propeller shaft until one of the windows of the clutch sleeve aligns with the head of one of the adjusting screws. Turning this screw to the right, or IN, raises the cut-in speed, and a "click" can be heard at each half-turn of the screw. Then rotate the propeller shaft

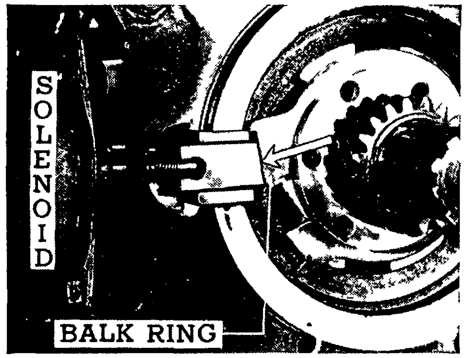


Fig. 28 With solenoid energized there should be .015 inch play between solenoid pawl and balk ring

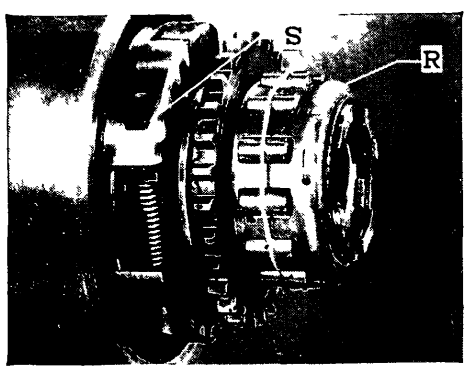


Fig. 29 Using tight-fitting rubber band to hold free wheel rollers in place when installing case. S. Pawl adjusting screw. R. Free wheel cam

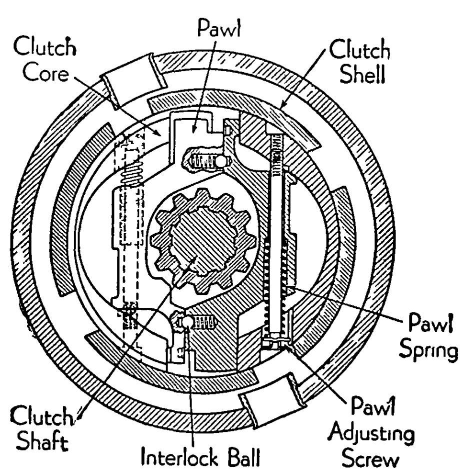


Fig. 30 Centrifugal clutch us d n s mi-electric units to c ntr l cut-in sp ds

until the other pawl adjusting screw is visible and turn it the same number of "clicks" as the first screw was turned. So that each screw can be identified, one of them has a single slot while the other screw is cross-slotted, to prevent the same screw from being adjusted twice These screws should not be turned out to a point where the heads extend beyond the rim of the clutch core.

FULL-ELECTRIC TYPE

NOTE—The illustrations accompanying the semi-electric controlled overdrive may be used as a guide in servicing the first version of the full-electric type Bear in mind, however, that the centrifugal clutch is not used in this unit. This, of course, eliminates the necessity of giving any thought to adjusting the cut-in speed by this means.

SECOND VERSION—As shown in Fig. 4, the internal parts differ somewhat from the overdrives previously described To disassemble the unit, proceed as directed in the Studebaker illustrations, Figs. 31 to 40 inclusive.

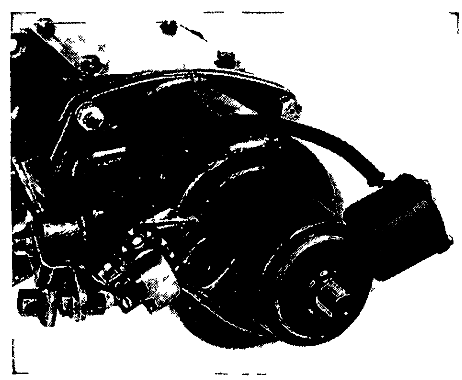


Fig. 31 Remove companion flang , l ck ut switch and govern r

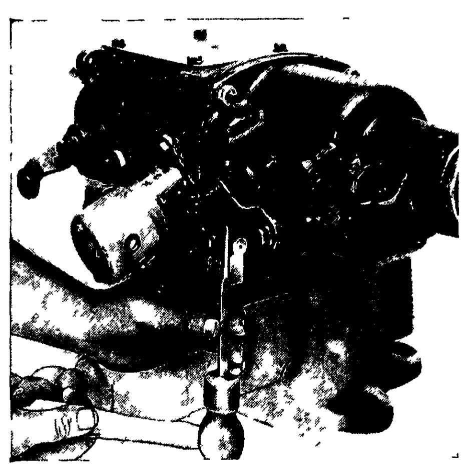


Fig. 32 After driving ut l cating pin, pull shift shaft as far as p ssible t disengage perating cam fr m shift rail. Rem ve overdrive h using. Tap nd f shaft t prevent its c ming ff with housing and spilling fr e wh l r llers. Parts inside h using may th n b rem v d

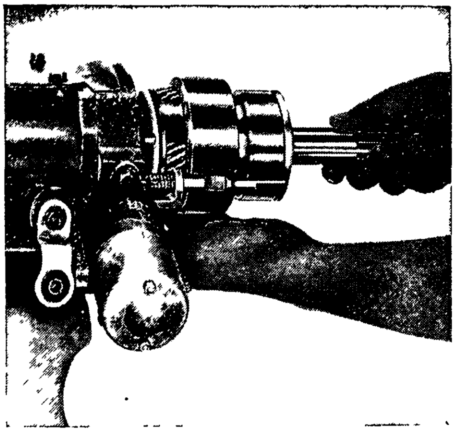


Fig. 33 H ld the adapter plate to the transmissi n case with one screw and re-m ve the v rdrive shaft, catching the free wh el r ll rs as shown. Removing snap ring permits ring g ar to be taken off shaft

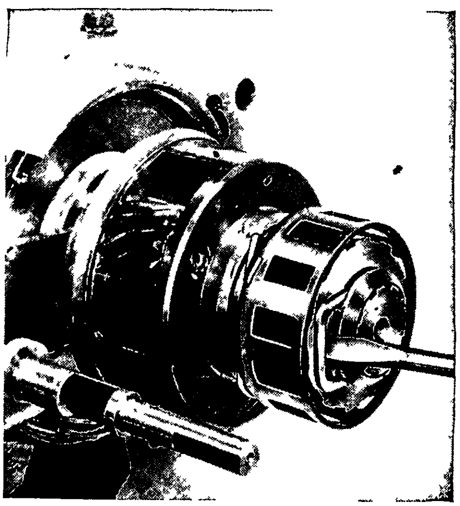


Fig. 34 R m v retaining clip and take off free wh l unit and pinion cage

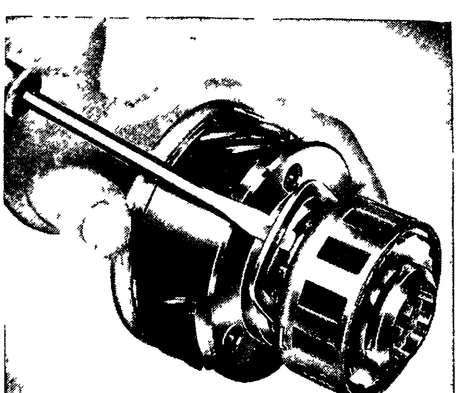


Fig. 35 Separate pini n cage fr m fr wheel unit by rem ving retaining clip

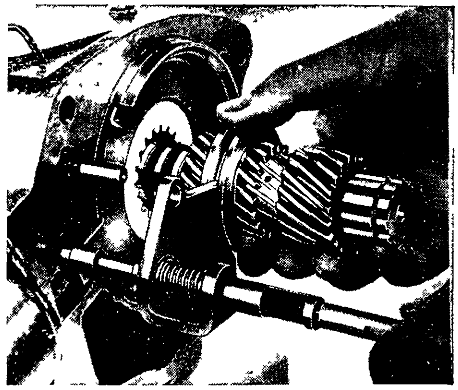


Fig. 36 Remove overdrive sun gear and shift rail

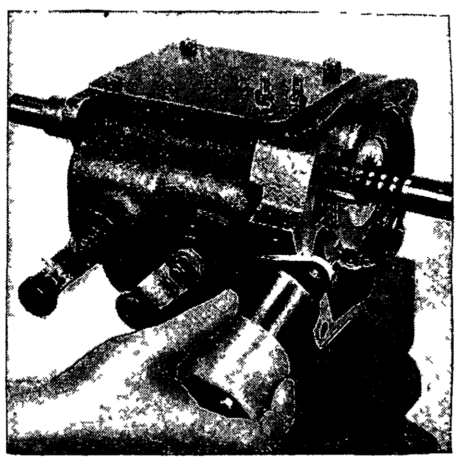


Fig. 37 Remove attaching screws, rotate solenoid 1/4 turn and take off

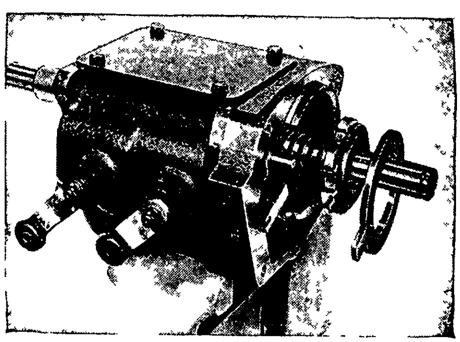


Fig. 38 After releasing snap ring from adapter plate, remove sun gear cover plate, blocker and solenoid pawl

TYPES WITHOUT ELECTRIC CONTROL

These units may be divided into three classifications: (A) Type with three planet pinions and separate housings; (B) built-in type; (C) type with five planet pinions. Types A and B are quite similar in construction to the semi-electric unit previously described, so

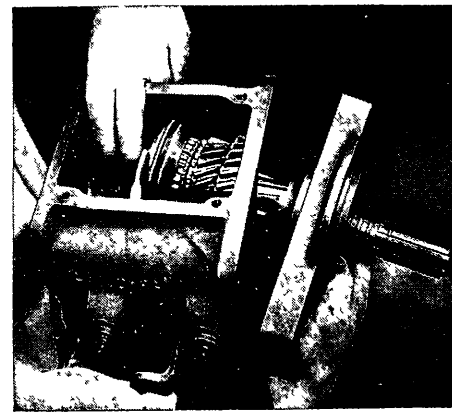


Fig. 39 At this point, if repairs ar t be made on the transmission, rem ve the mainshaft, adapter plate, gears and syn-chronizer as a unit

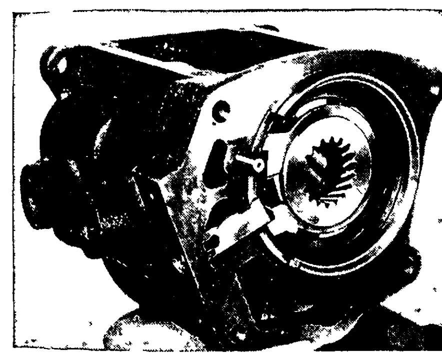


Fig. 40 Reverse the ord r of disass mbly to assemble the unit. Aft r inserting the pawl with the notched side up as sh wn, install blocker assembly and c ver plat , being sure blocker ring and pawl ar pr p-erly positioned. Then install large snap ring in adapter plat

much so that the instructions given for that type may be used successfully in repairing these units. Fig. 41 is a layout of the parts comprising the type having three planet pinions and separate housing, while Fig. 42 shows the sequence of assembly of the built-in type.

In the five-pinion type, Fig. 7, the overdrive mainshaft (lockout gear and shaft) is splined to the mainshaft. The overdrive housing is bolted to the rear of the transmission so that if repairs to the overdrive only are required, the transmission need not be dismantled.

The overdrive may be removed from the transmission by simply unfastening it and sliding it straight back, disengaging the overdrive shaft from the transmission mainshaft. After separating the unit from the transmission, pry the snap ring from in front of the shift fork collar. Unfasten the rear bearing retainer from the housing and pull the retainer, together with the tailshaft and free wheel unit, from the housing. The pinion cage, centrifugal clutch and mainshaft can now be removed from the rear. Remove the cap screws holding the sun

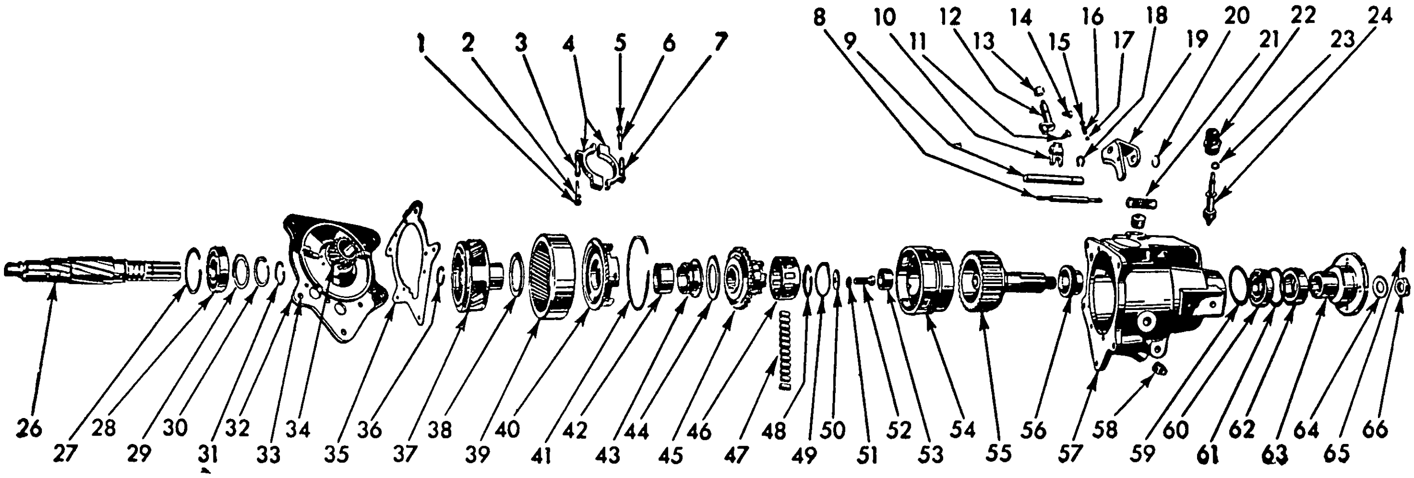


Fig. 41 Overdrive without electric control. Type with three planet pinions and separate housings. See Fig. 5 for car application

1. Clutch pawl adjusting screw
2. Adjusting screw washer
3. Adjusting screw spring
4. Clutch pawls
5. Clutch pawl adjusting screw
6. Adjusting screw washer
7. Adjusting screw spring
8. R v rs l ck-up plunger
9. C ntr l shift rail
10. Shift rail lug
11. Rail s t screw
12. C ntrol shaft
13. Oil seal
14. Shaft locating screw
15. P pp t spring seat
16. P ppet spring
17. P pp t ball
18. Shift rail "C" washer
19. Shift f rk
20. Rail expansion plug
21. Shift fork spring
22. Sp ed m ter pinion sleeve
23. Oil seal
24. Speedometer pinion
26. Mainshaft
27. Snap ring
28. Bearing
29. Washer
30. Snap ring
31. Sun gear snap ring
32. Adapter gasket
33. Adapter
34. Sun gear
35. Housing gasket
36. Pinion cage snap ring
37. Pinion cage
38. Thrust washer
39. Ring gear
40. Clutch pawl core
41. Snap ring
42. Clutch hub bushing
43. Clutch core hub
44. Thrust washer
45. Free wheel cam
46. Roller retainer
47. Free wheel rollers
48. Snap ring
49. Retainer spring
50. Cam retaining washer
51. Lock washer
52. Screw
53. Pilot bushing
54. Clutch pawl shell
55. Overdrive mainshaft
56. Speedometer drive gear
57. Housing
58. Drain plug
59. Snap ring
60. Bearing
61. Snap ring
62. Oil seal
63. Mainshaft flange
64. Washer
65. Cotter pin
66. Flange nut

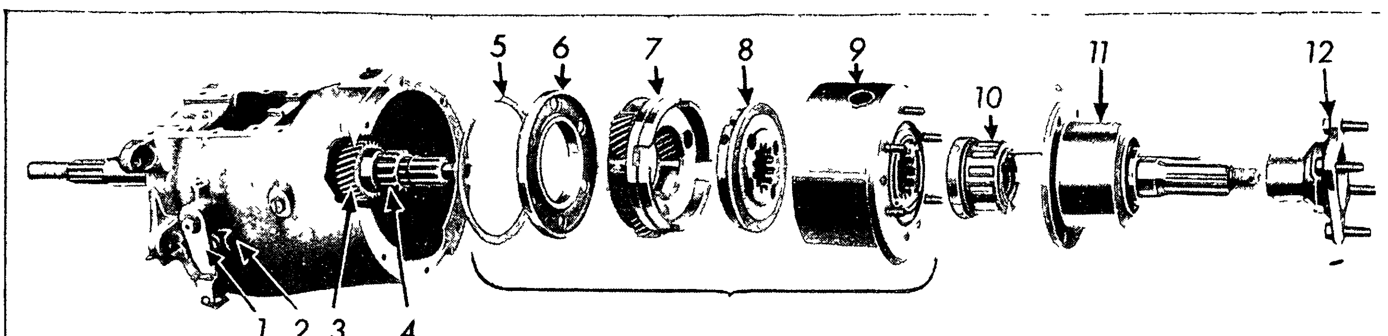


Fig. 42 Sequence of assembling built-in type overdrive. See Fig. 6 for car application

1. C ntr l l ver
2. St p
3. Sun gear
4. Shift sleeve
5. Snap ring
6. Bearing race
7. Pinion cage
8. Clutch
9. Ring gear
10. Free wheel unit
11. Free wheel h using
12. Flange

gear and vibration damper to the housing and lift off these parts. Carefully collect and lay aside for future use the gasket and shims at the rear of the housing as they control the end play of the overdrive.

Reverse the order of the above procedure to assemble the unit and check the end play as follows: Replace the rear bearing retainer, together with the free wheel and tail shaft, without using any shims or gasket. Install the two top screws in the retainer and run them up finger tight. Now measure the clearance between the gasket faces of the housing and the retainer, using a feeler gauge. To this measurement, add not less than .015 inch of shimming. The total measurement thus obtained indicates the thickness of shims to be installed between the housing and the retainer.

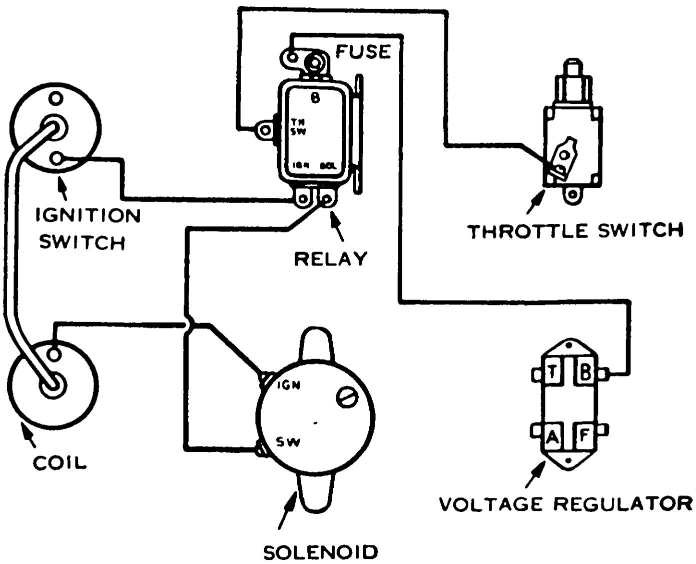


Fig. 44 Hudson 1940 semi-electric overdrive control wiring diagram

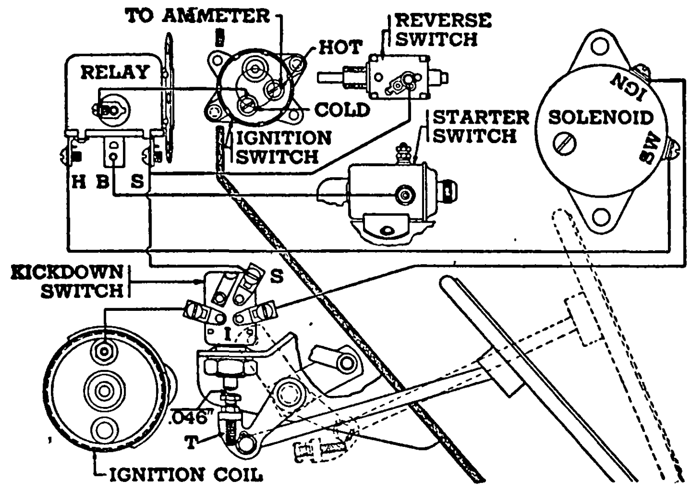


Fig. 45 Late 1939 Packard semi-el ctric overdrive control wiring diagram

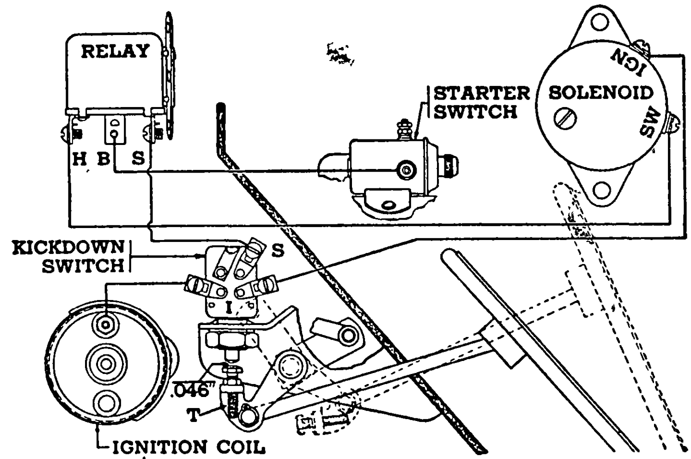


Fig. 46 Early 1939 Packard semi-electric overdrive contr l wiring diagram

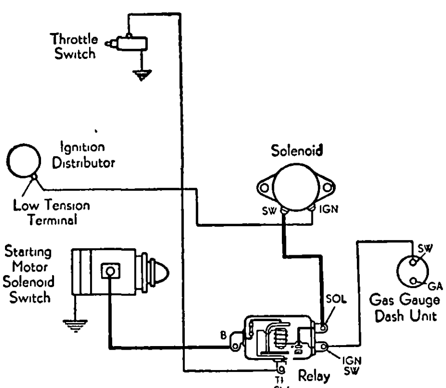


Fig. 43 Chrysl r semi-electric overdrive control wiring diagram. Typical of 1939-40 Chrysler and De Soto; 1941 Chrysler Eight; Studebaker 1939 to early 1946 (except 1941-42 Presidents)

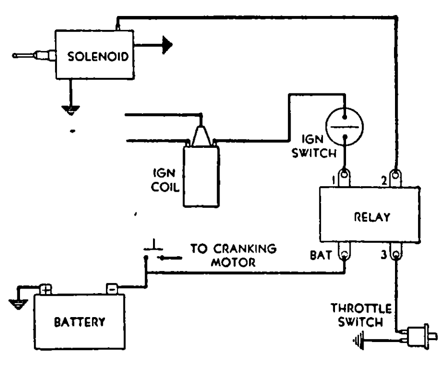


Fig. 47 Nash 1940-46 semi-electric overdrive control wiring diagram with Delco-Remy controls

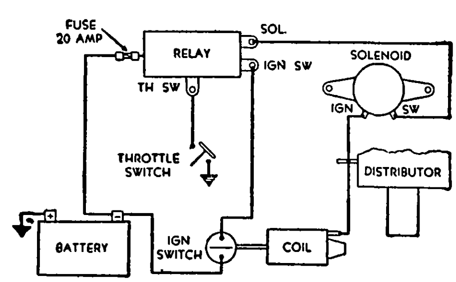


Fig. 48 Nash 1940-46 semi-electric overdrive control wiring diagram with Auto-Lite c ntr ls

ELECTRICAL SERVICE

SEMI-ELECTRIC TYPE

The electrical units for this type overdrive are only for the purpose of restoring conventional direct drive operation for quick acceleration. Normal engagement or disengagement of the overdrive is controlled by the centrifugal clutch.

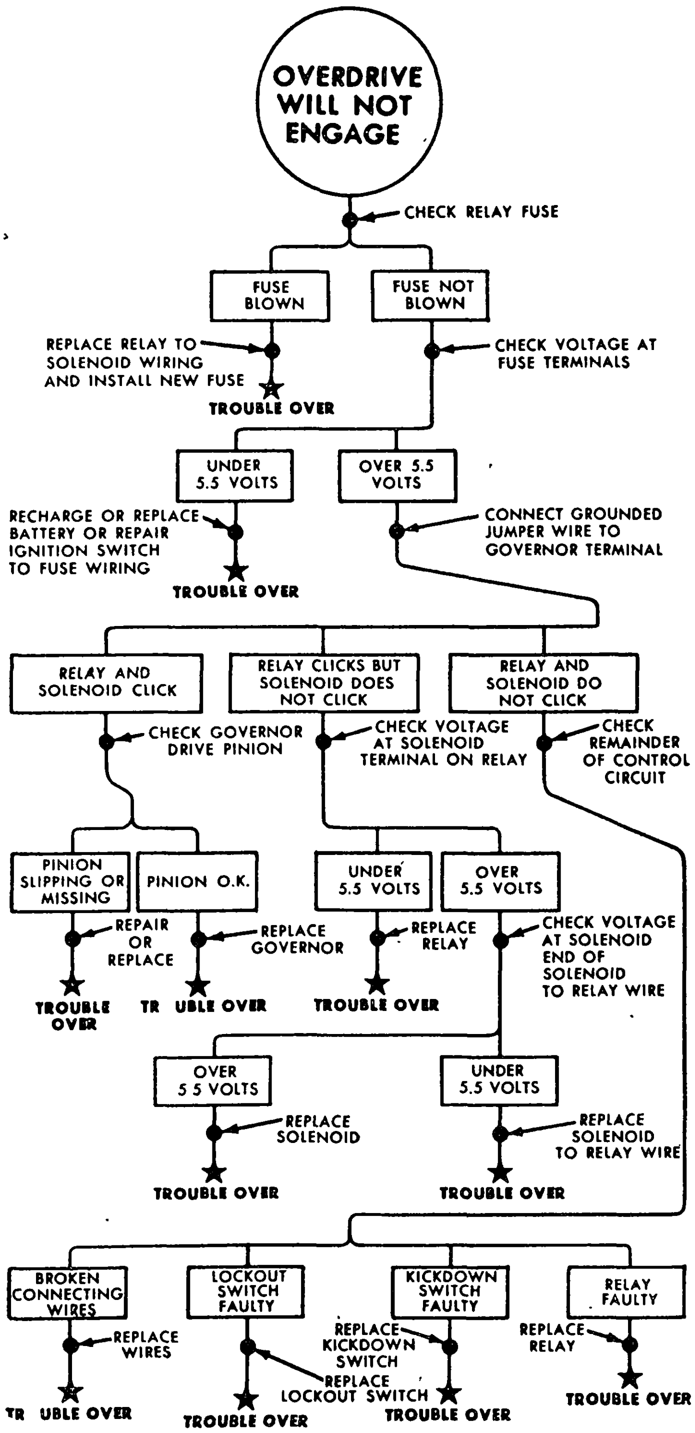
In checking trouble turn on the ignition switch and depress the accelerator pedal to the floorboard. This may or may not result in a click being heard. A click or failure to click determines the procedure to follow as given below. (Figs. 43 through 48 illustrate wiring diagrams for the various cars employing this type overdrive.)

If a Click is Heard—A click at both the relay and solenoid indicates the trouble to be in the overdrive mechanical parts.

A click at the relay only calls for an inspection of the fuse and fuse holder. If the fuse is bad and a new fuse also burns out, look for a grounded wire from the solenoid to the relay. If this wire is not grounded, replace the solenoid.

If inspection showed the fuse to be not blown, connect a test lamp to the ignition terminal of the relay and a ground. If the lamp fails to light, replace the wire connected to the terminal. However, if the test lamp glows, move it to the throttle switch terminal on the relay, establish ground and close the throttle switch. If the lamp fails to glow, replace the relay. If the lamp glows, continue testing as follows:

Connect the test lamp to the solenoid



←Fig. 49 Trouble shooting sequence when overdrive will not engage

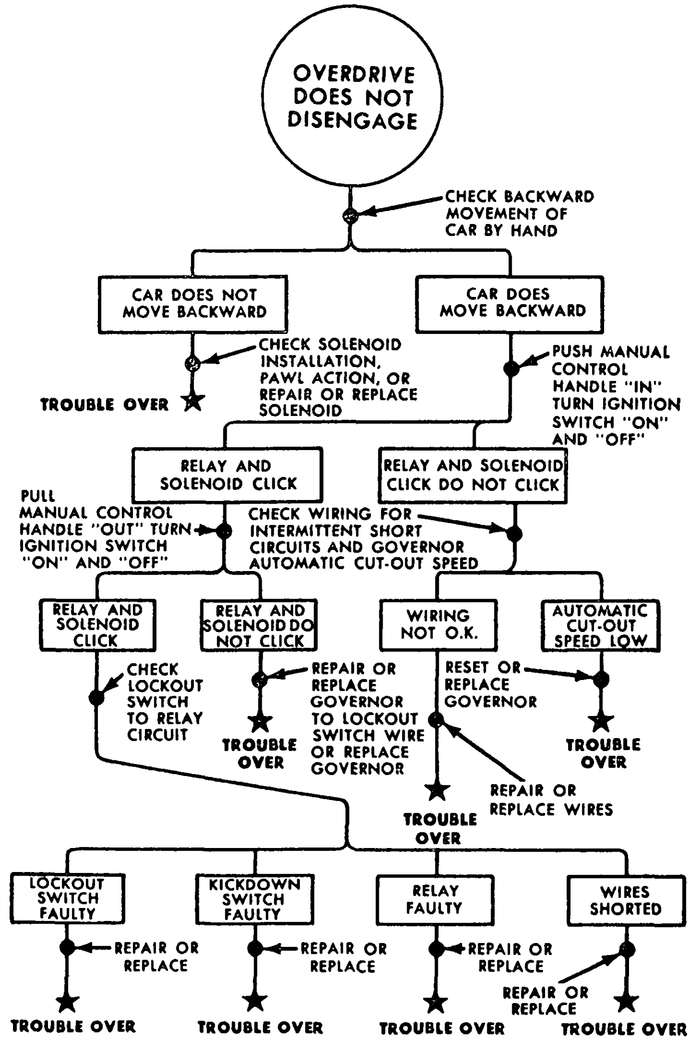
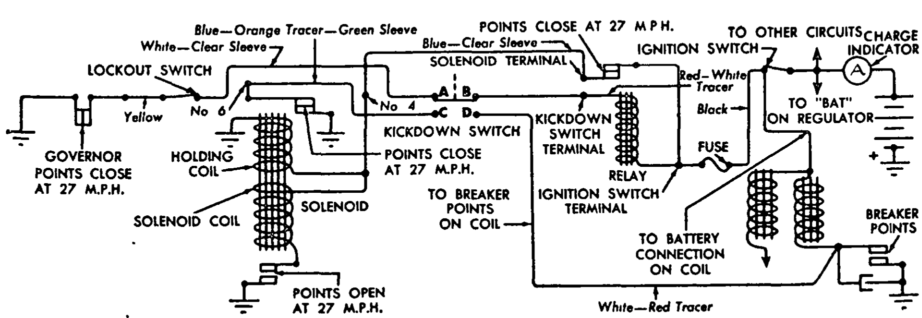


Fig. 50 Trouble shooting sequence when overdrive will not disengage



"SW" terminal and ground and close the throttle switch. If the light burns, replace the solenoid. If it does not burn, replace the wire connected to the solenoid "SW" terminal.

If No Click Is Heard — Operate the throttle switch by hand. If a click is heard, adjust the throttle linkage. If no click is heard, test as follows:

Connect a test lamp to the battery terminal of the relay and a ground. If the lamp burns, move the ground to the wire connected to the throttle switch. Then if a click is heard replace the throttle switch. If the throttle switch fails to click when it is grounded, continue as follows:

Ground the throttle switch relay terminal. Then if no click is heard, replace the relay. A click on the other hand shows the "TH" relay wire is defective.

←Fig. 53 F rd 1949-50 overdrive wiring diagram. 1951-52 has no l ck ut switch

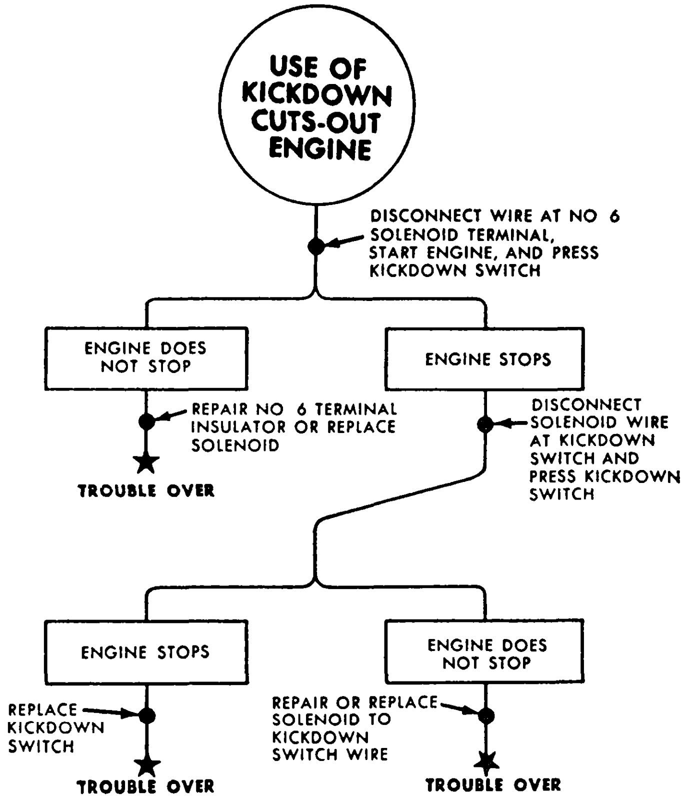


Fig. 51 Trouble shooting sequence when use of kickdown stops engine

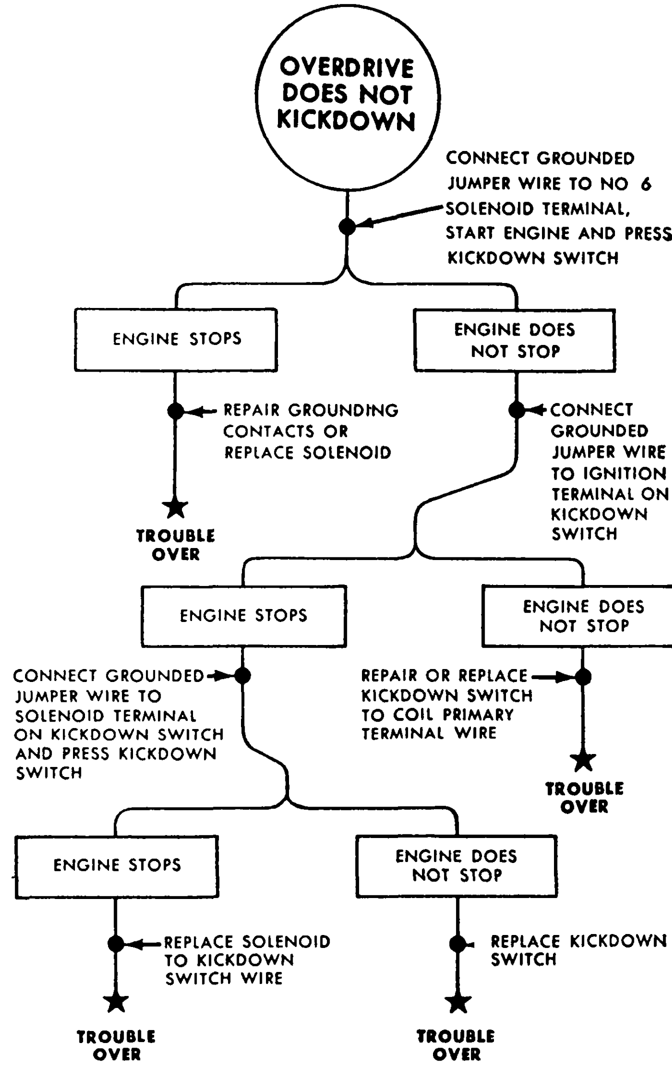


Fig. 52 Trouble shooting sequ nce when overdrive will not kickd wn

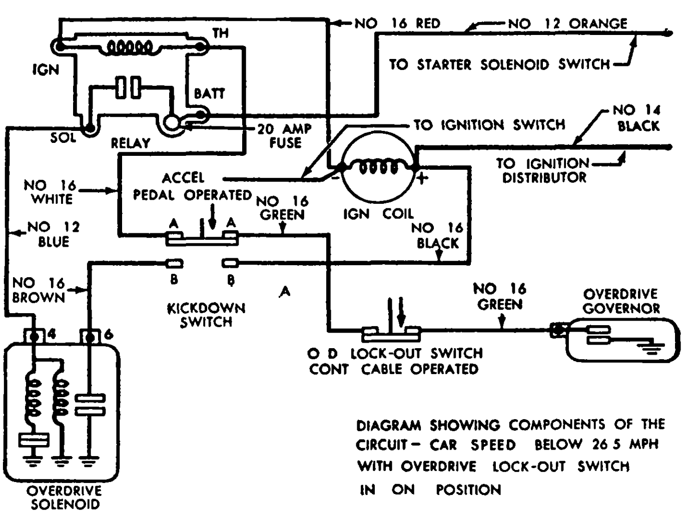


Fig. 54 Kaiser-Frazer 1947-52 overdrive wiring diagram

FULL ELECTRIC TYPE

In checking overdrive electrical troubles according to the procedure which follows, be guided by the wiring diagrams for the particular car being serviced. These wiring diagram are shown starting with Fig 53.

Overdrive Does Not Engage — This is usually caused by a failure in the overdrive electrical control system With the ignition switch turned on, the relay is

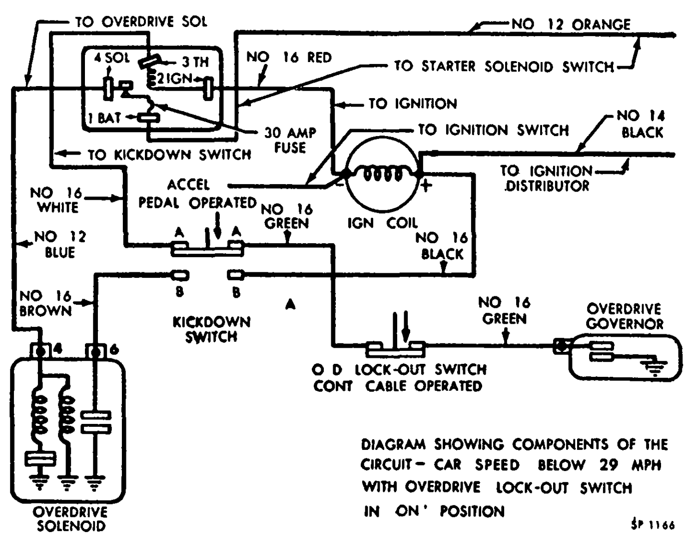


Fig. 55 Henry J 1951-52 v rdriv wiring diagram

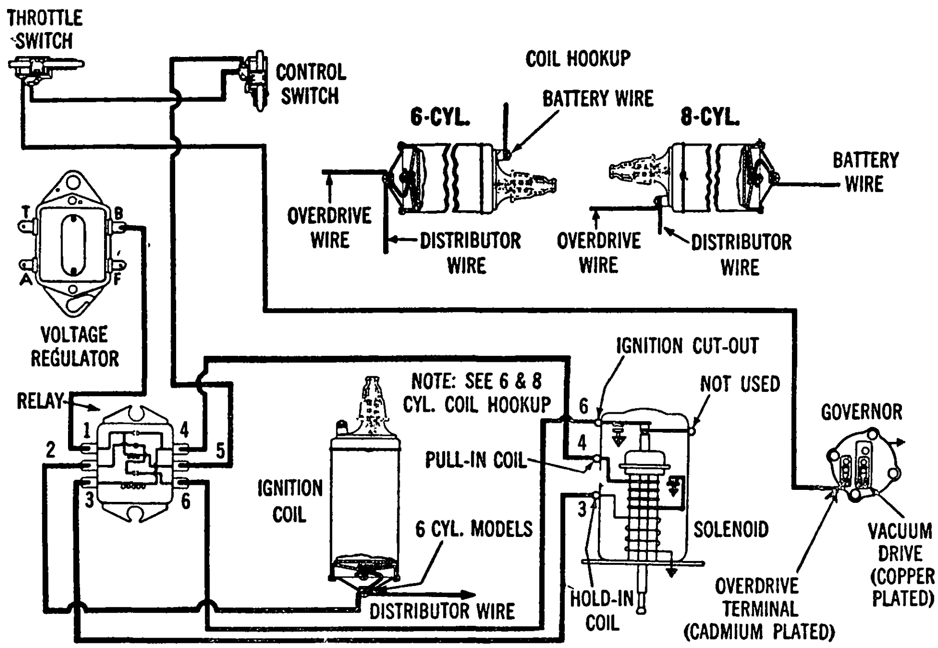


Fig. 56 Hudson 1941-47 overdrive wiring diagram

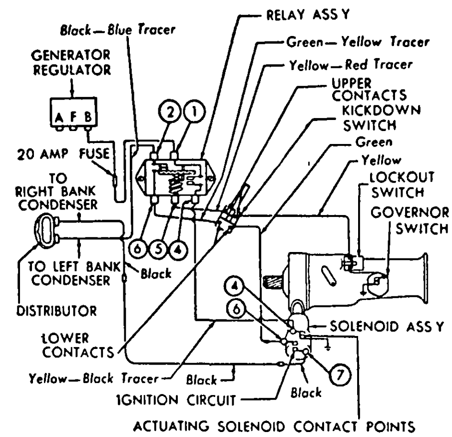


Fig. 59 Lincoln 1941 overdrive wiring diagram prior to November 10 pr ducti n

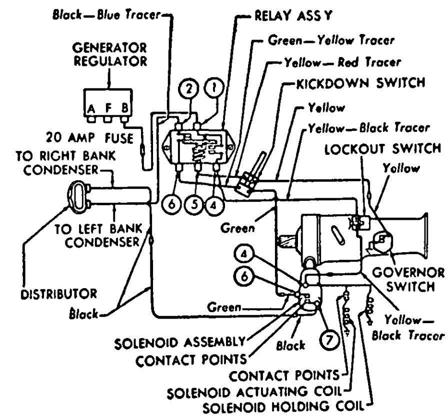


Fig. 60 Lincoln 1941 overdrive wiring diagram after November 10 pr ducti n

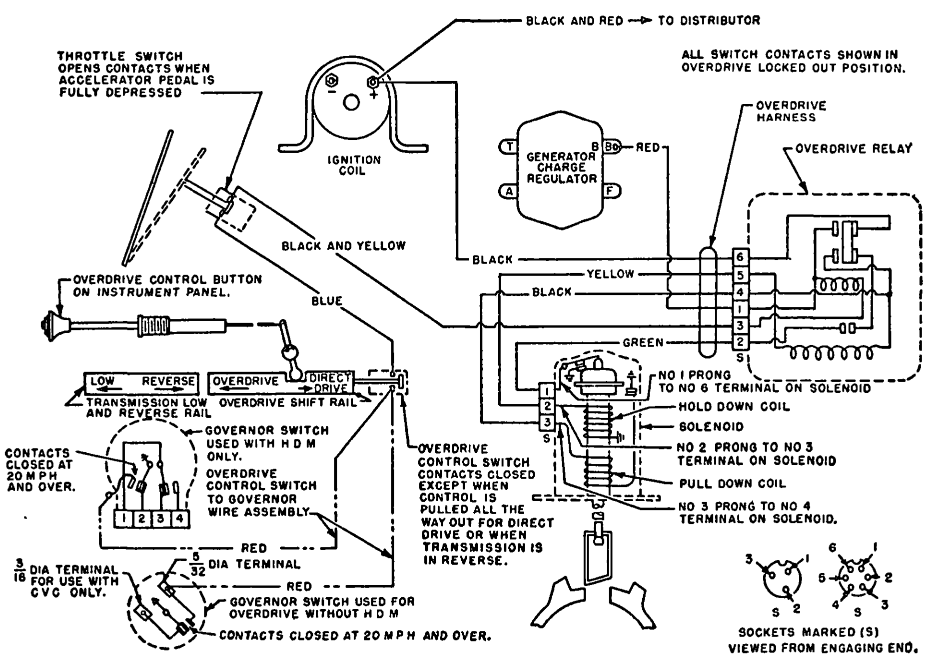


Fig. 57 Hudson 1948-49 overdrive wiring diagram

supplied with current. This current causes the relay points to close, provided the:

1. Fuse is good,
2. Kickdown switch is in the up position,
3. Lockout switch is closed, and
4. Governor points are closed.

When the relay points close, current will flow through the solenoid coil and solenoid holding coil. The solenoid now moves into the "energized" position and opens the points in the solenoid coil circuit. When the solenoid coil points are opened, the solenoid coil is disconnected, but the holding coil will keep the solenoid in the energized position, forcing the pawl into engagement.

See the chart in Fig. 49. But before performing any of the following operations, make sure the manual control lever is pushed in, the ignition switch turned on and the transmission out of reverse gear.

Check the relay fuse. If it is blown, check the wiring from the solenoid to

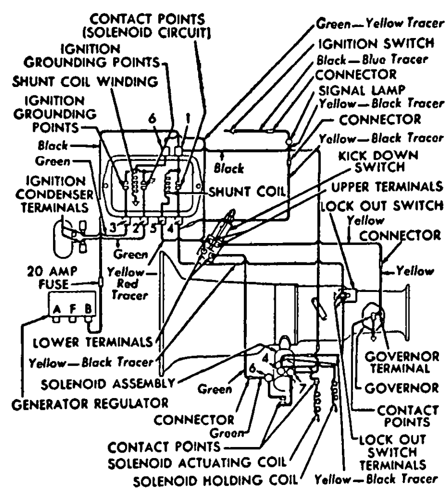


Fig. 61 Linc ln 1942 v rdriv wiring diagram

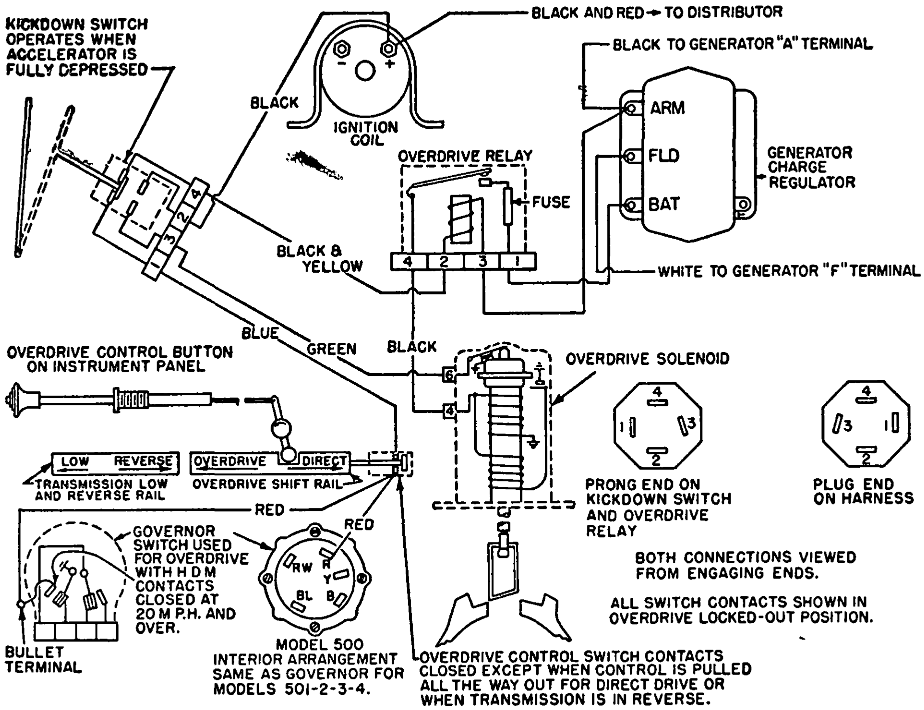


Fig. 58 Hudson 1950-52 overdrive wiring diagram

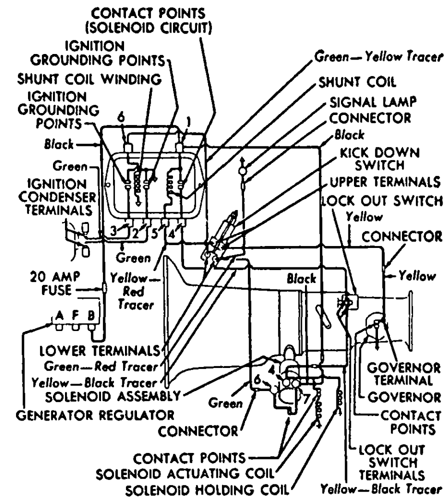


Fig. 62 Lincoln 1946-48 overdrive wiring diagram.

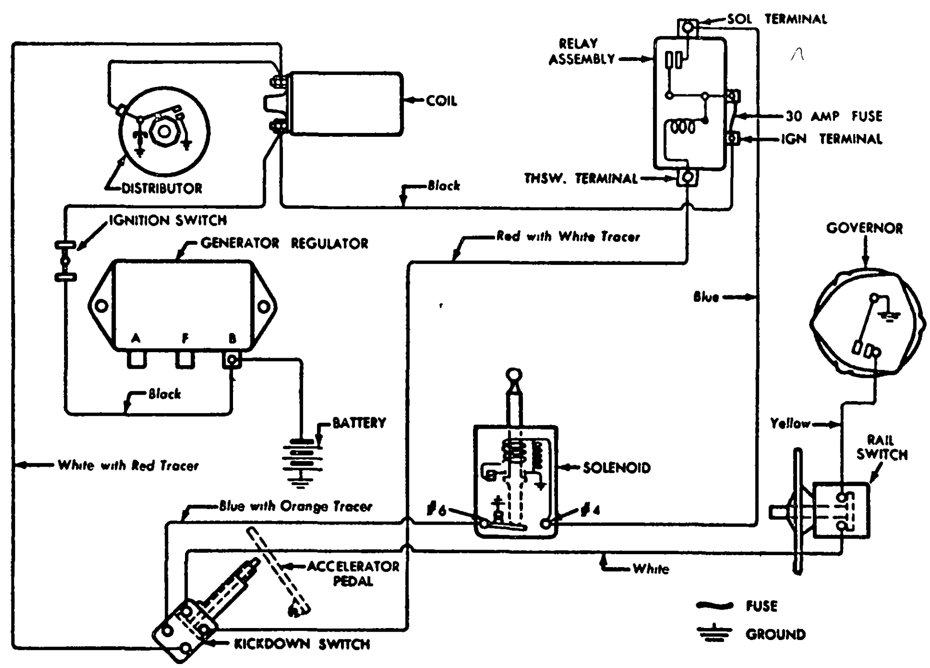


Fig. 63 Lincoln and Mercury 1949-52 overdrive wiring diagram

the relay and relay terminals for a short circuit. Repair the insulation or replace the wire or relay as necessary. Install a new fuse.

If the fuse is not blown, check the voltage at the fuse terminals. If the voltage is less than 5.5 colts, proceed with paragraph (1) below. If the voltage is over 5.5, proceed with paragraph (2) below.

(1) If the voltage is less than 5.5 volts, recharge or replace the battery as necessary. If battery is fully charged, inspect wiring from fuse terminal back to ignition system for resistance (open circuit or partially broken wire). Repair or replace wiring as necessary.

(2) Check governor, relay and solenoid: Connect a grounded jumper wire to the governor terminal and listen for a click at the relay and solenoid. If the relay and solenoid click, proceed with paragraph (3) below. If the relay clicks but the solenoid does not click proceed with paragraph (4) below. If the relay and solenoid do not click, proceed with paragraph (5) below.

(3) If the relay and solenoid click, check for a missing or slipping governor drive pinion. If either of these conditions exist, repair or replace the drive pinion. If the drive pinion is in good condition, the trouble is in the governor assembly and it must be replaced.

(4) If the relay clicks but the solenoid does not click, check the voltage at the solenoid terminal of the relay. If the voltage is under 5.5 volts, proceed with paragraph (6) below. If the voltage is over 5.5 volts, proceed with paragraph (7) below.

(5) If the relay and solenoid do not click, connect a grounded jumper wire to the governor terminal of the lookout switch. If the relay and solenoid click, replace the governor-to-lockout switch wire. If the relay and solenoid do not click, check the lockout switch by connecting a grounded jumper wire to the kickdown switch terminal on the lockout switch. Then if the relay and solenoid do not click, proceed with paragraph (8) below. If the relay and solenoid click, proceed with paragraph (9) below.

(6) If the voltage at the solenoid terminal on the relay is under 5.5 volts, the trouble is in the relay and it must be replaced.

(7) If the voltage at the solenoid terminal on the relay is over 5.5 volts, check the voltage at the solenoid end of the solenoid-to-relay wire. If the voltage is under 5.5 volts, replace this wire. If the voltage is over 5.5 volts, replace the solenoid.

(8) If the relay and solenoid do not click, connect a grounded jumper wire to the lockout switch terminal on the

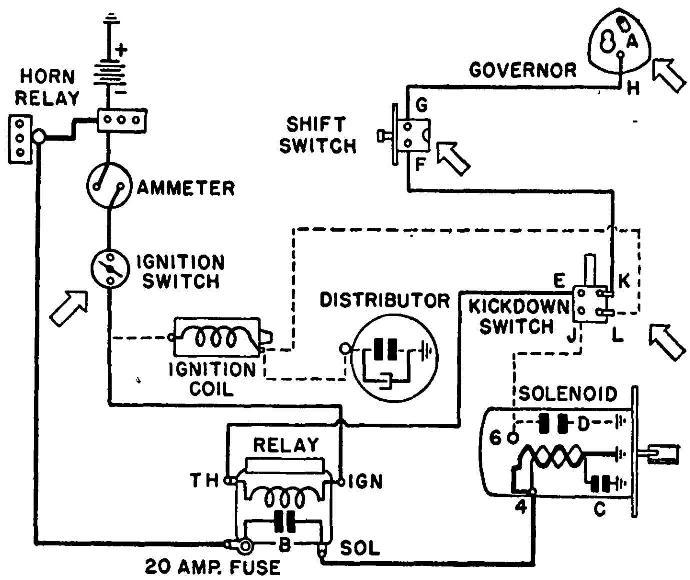


Fig. 64 Nash 1946-48 overdrive wiring diagram

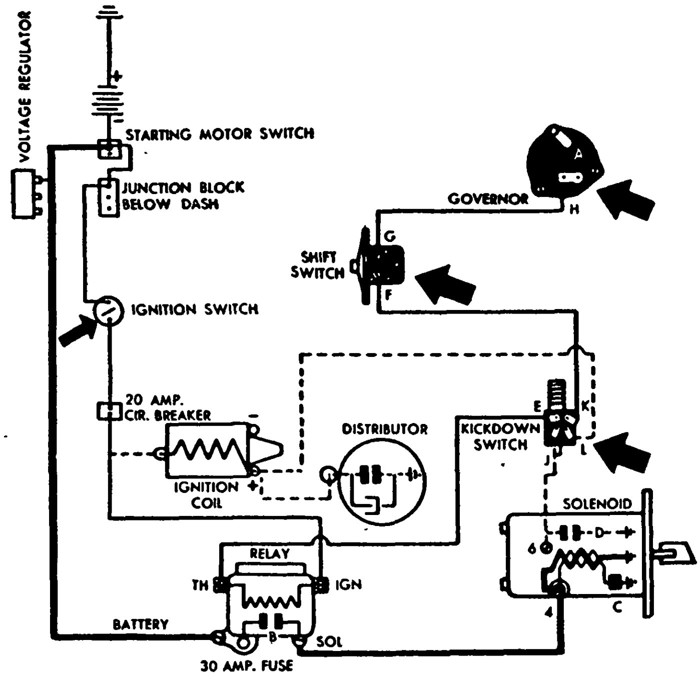


Fig. 65 Nash 1949-52 overdrive wiring diagram

kickdown switch. If the relay and solenoid click, replace the lockout switch-to-kickdown switch wire. If the relay and solenoid still do not click, connect a grounded jumper wire to the relay terminal on the kickdown switch. If the relay and solenoid do not click, proceed with paragraph (10) below. If the relay and solenoid click, proceed with paragraph (11) below.

(9) If the relay and solenoid click, check the manual control linkage by making sure that the manual control lever on the side of the overdrive housing moves all the way back when the manual control handle is pushed in. If the lever does not move all the way back, it may prevent the lockout from closing; also it may hold the shift rail in a position that will prevent the pawl from making a full engagement. To correct this condition, remove the manual control wire from the lever, pull the manual control handle out approximately ¼", then connect the wire to the lever. If the manual control lever is functioning properly, check the overdrive-to-transmission alignment by disconnecting the manual control wire at the lever and moving the lever foward. If the lever moves forward more than ¼", the overdrive is not properly aligned with the transmission. To properly align the overdrive with the transmission, loosen the capscrews attaching the overdrive to the transmission, tap the adapter plate and overdrive housing until the shift rail moves freely; then tighten the capscrews. If the overdrive was properly aligned with the transmission, the trouble is in the lockout switch and it must be replaced.

(10) If the relay and solenoid do not click, connect a grounded jumper wire to the kickdown switch terminal on the relay. If the relay and solenoid click, replace the kickdown switch-to-relay wire. If the relay and solenoid do not click, the trouble is in the relay and it must be replaced.

(11) If the relay and solenoid click, the trouble is in the kickdown switch and it must be replaced.

Overdrive Will Not Disengage — This may be caused by either an electrical or mechanical failure. See the chart shown in Fig. 50. But before performing any of the following operations make sure the ignition is off and the gearshift lever is in neutral before checking backward movement of car as described below.

If the car does not move backward by hand push, follow instruction in paragraph (1) below. If the car does move backward, proceed with paragraph (2) below.

(1) If the car does not move backward, remove the solenoid and check the pawl action. If the solenoid can be removed without rotating it ¼ turn, it indicates that the solenoid is not properly installed and it will not pull the pawl out of overdrive engagement. If the solenoid was properly installed, use pawl-pulling tool and attempt to withdraw from engagement. If it will not withdraw freely, the unit is probably damaged internally and must be repaired or replaced. If no such damage is apparent, the trouble is in the solenoid and it must be repaired or replaced.

(2) If the car does move backward, push the manual control handle in, turn the ignition switch on and off, and listen for a click at the relay and solenoid. If the relay and solenoid click, proceed with paragraph (3) below. If the relay and solenoid do not click, proceed with paragraph (4).

(3) Pull the control handle out, turn ignition switch on and off, and listen for a click at the relay and solenoid. If

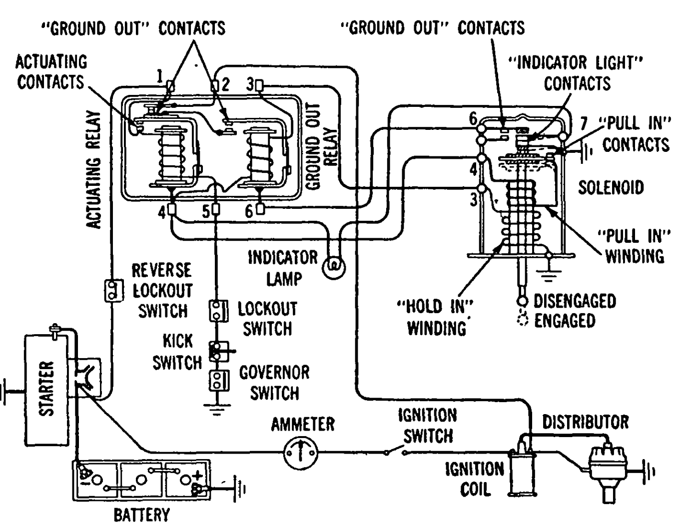


Fig. 66 Packard 1948-52 v rdriv wiring diagram. 1941-47 is id ntical except n rev rse l ck ut switch is provided

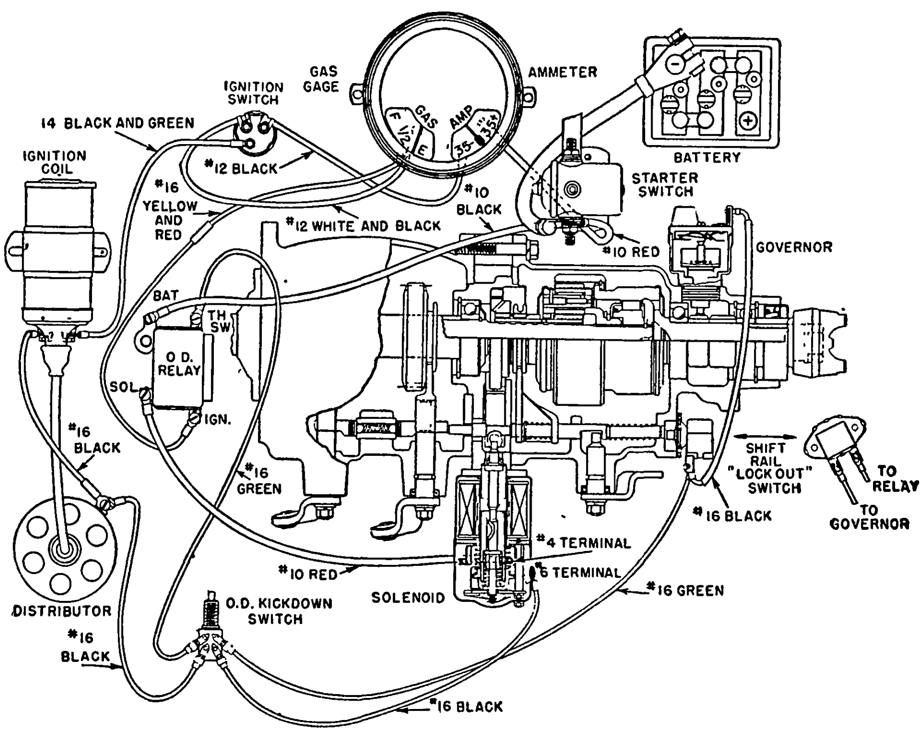


Fig. 67 Studebaker 1946-52 overdrive wiring diagram

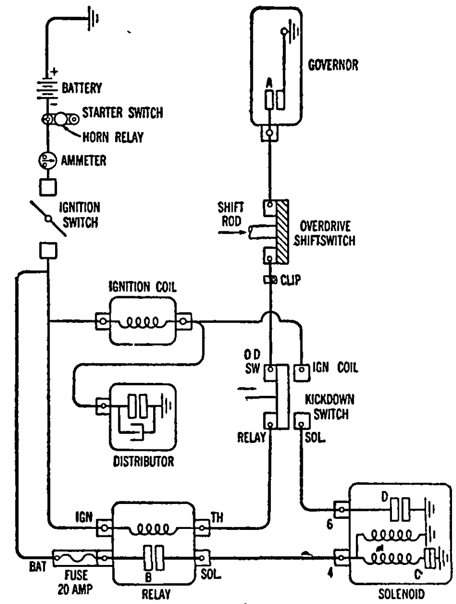


Fig. 68 Willys 1946-52 overdrive wiring diagram

the relay and solenoid click, proceed with paragraph (5) below. If the relay and solenoid do not click, proceed with paragraph (6) below.

(4) Check the overdrive electrical system wiring for intermittent short circuits. If the insulation is not in good condition, repair or replace the damaged wire. If the wiring is in good condition, remove the governor and check the automatic cut-out speed. If the governor does not cut out automatically at approximately 21 mph, replace the governor.

(5) Push the manual control handle in, press the kickdown switch stem, turn ignition on and off, and listen for a click at the relay and solenoid. If the relay and solenoid click, proceed with paragraph (8) below.

(6) Push the manual control in, turn ignition switch on, and disconnect the governor. If the relay and solenoid do not click, replace or repair the governor-to-lockout switch wire.

(7) Disconnect wire from lockout switch to kickdown switch at the lockout switch. If the relay and solenoid click, repair or replace the lockout switch. If the relay and solenoid do no click, disconnect the lockout switch wire at the kickdown switch. If the relay and solenoid click, repair or replace the disconnected wire.

(8) Disconnect the wire running from the kickdown switch to the relay at the kickdown switch. If relay and solenoid click, replace kickdown switch. If relay and solenoid do not click, disconnect the wire running from the kickdown switch to the relay at the relay. If relay and solenoid click, repair or replace disconnected wire. If relay and solenoid do not click replace relay.

Use of Kickdown Cuts Out Engine — This trouble is usually caused by either wire connecting the two units. See Fig. 51 and follow the procedure given below.

Before performing any of the following operations, make sure the gearshift lever is in neutral and the overdrive manual control pushed in.

Disconnect the kickdown switch wire at the solenoid. Start the engine and press the kickdown switch. If the engine does not stop, proceed with paragraph (1) below. If the engine stops, proceed with paragraph (2).

(1) Repair kickdown switch terminal insulator at solenoid or replace solenoid.

(2) Disconnect solenoid wire at kickdown switch and press kickdown switch. If engine stops, replace kickdown switch. If engine does not stop, repair or replace disconnected wire.

Overdrive Does Not Kickdown — This trouble is usually caused by a defective solenoid or kickdown switch or in the circuits supplying current to these units. See Fig. 52. But before performing any of the following operations, make sure the transmission is in neutral and the overdrive manual control handle is pushed in.

Connect a grounded jumper wire to the kickdown switch terminal at the solenoid. Start the engine and press the kickdown switch. If the engine stops, proceed with paragraph (1) below. If the engine does not stop, proceed with paragraph (2).

(1) Repair grounding contacts inside solenoid, or replace solenoid.

(2) Connect a grounded jumper wire to the ignition terminal of the kickdown switch. If engine stops, proceed with paragraph (3) below. If engine does not stop, proceed with paragraph (4).

(3) Connect a grounded jumper wire to solenoid terminal on kickdown switch and press kickdown switch. If engine stops, replace solenoid-to-kickdown switch wire. If engine does not stop, check for a bent kickdown switch plunger. If plunger is bent, loosen switch slightly and then see if engine stops. If it still won't stop, replace kickdown switch.

(4) If engine does not stop, repair or replace wire from kickdown switch to ignition system.

HYDRA-MATIC TRANSMISSION

CONTENTS

SUPPLIED by the Detroit Transmission Division of General Motors Corporation to three of its car manufacturing divisions (Cadillac, Oldsmobile and Pontiac) the Hydra-Matic transmission is also furnished to Hudson, Kaiser-Frazer, Lincoln and Nash.

On models prior to 1952, the transmission provides four different control or operating ranges which may be manually selected by the driver through movement of the shift control lever at the top of the steering column. A pointer on the control housing and a stationary dial or quadrant mounted on the steering column aid in locating the lever for each range. Letters on the dial, reading from left to right, identify each range as follows:

N - Neutral.
Dr - For all normal forward driving.
Lo - For maximum power forward, such as operating up steep grades or in sand and also to be used as a brake when descending steep grades.
R - Reverse.

The 1952 Hydra-Matic Drive provides two driving ranges. One range has the normal first, second, third and fourth gear speeds which is used for country and boulevard driving. The second is a new first, second and third gear range particularly adapted for driving in congested traffic and hilly or mountainous country. How the 1-2-3 range operates is described further on.

The starting circuit is wired so the starting motor will not operate unless the control lever is in neutral.

The complete transmission, Fig. 1, consists of the following major elements:

1. Fluid coupling.
2. Three planetary gear sets.
3. Two multiple disc clutches.
4. Two bands.
5. Two oil pumps.
6. Two servos.
7. One hydraulic control system with a number of valves.

HYDRA-MATIC DRIVE OPERATION 1940-1951

It is possible to obtain only two forward speeds, reduction and direct, from one planetary gear set when applying power at the same source—sun or center gear, for example. However, as a greater variation of speed ratios is required for satisfactory operation of a vehicle, the Hydra-Matic transmission contains two planetary gear sets arranged to provide four forward speeds, Fig. 2. This is accomplished by various combinations of bands and clutches.

It also contains a third planetary gear set for reverse. In all forward speeds the reverse planetary unit has no function and simply revolves with the output shaft.

In Fig. 2, a new type of reverse, used

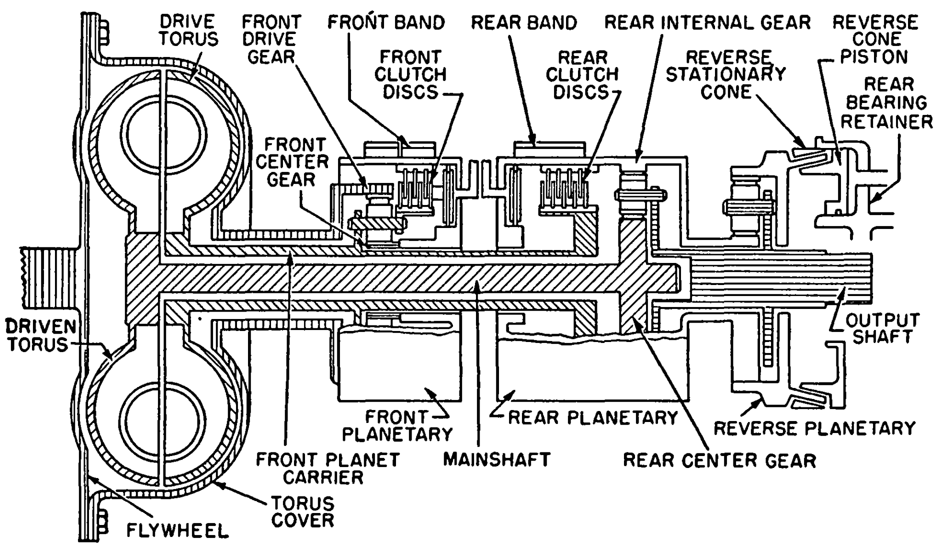


Fig. 2 Location of Hydra-Matic components, 1951-52 models. Earlier units are similar except for reverse mechanism

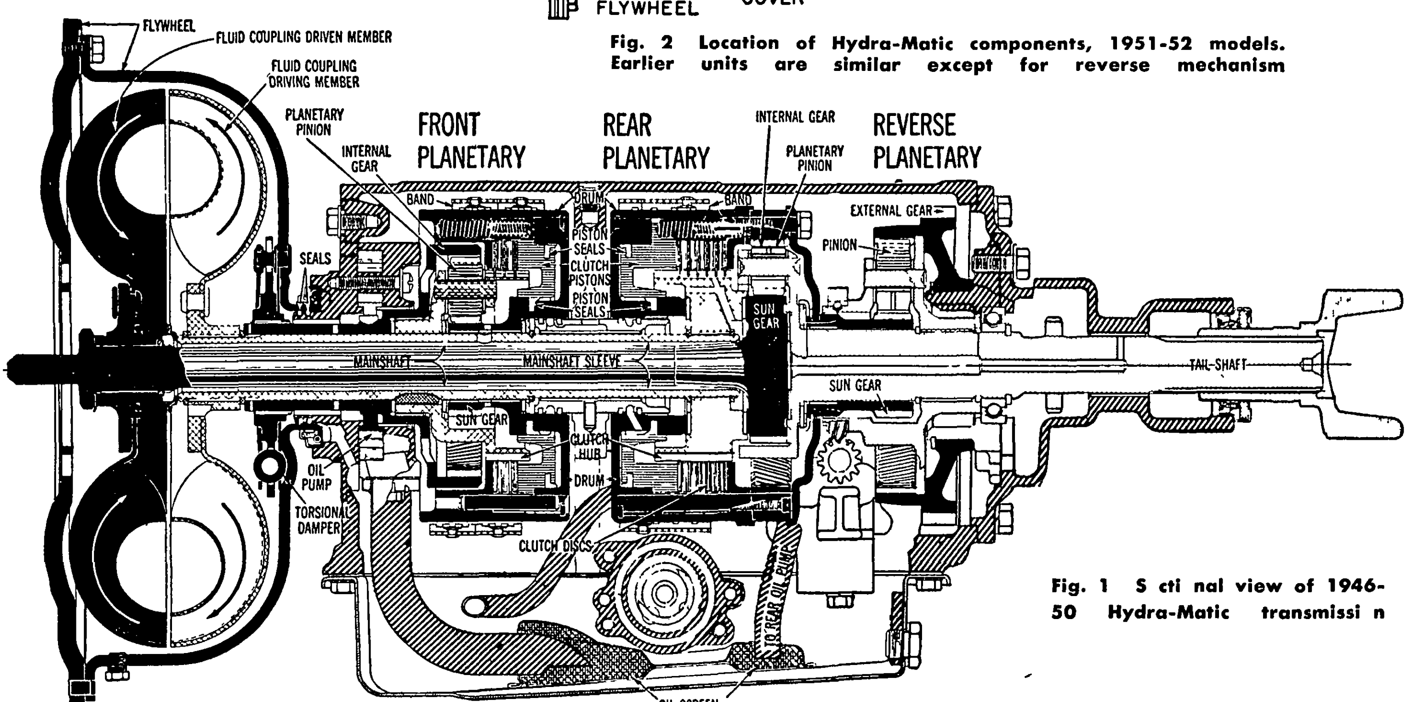


Fig. 1 S cti nal view of 1946-50 Hydra-Matic transmissi n

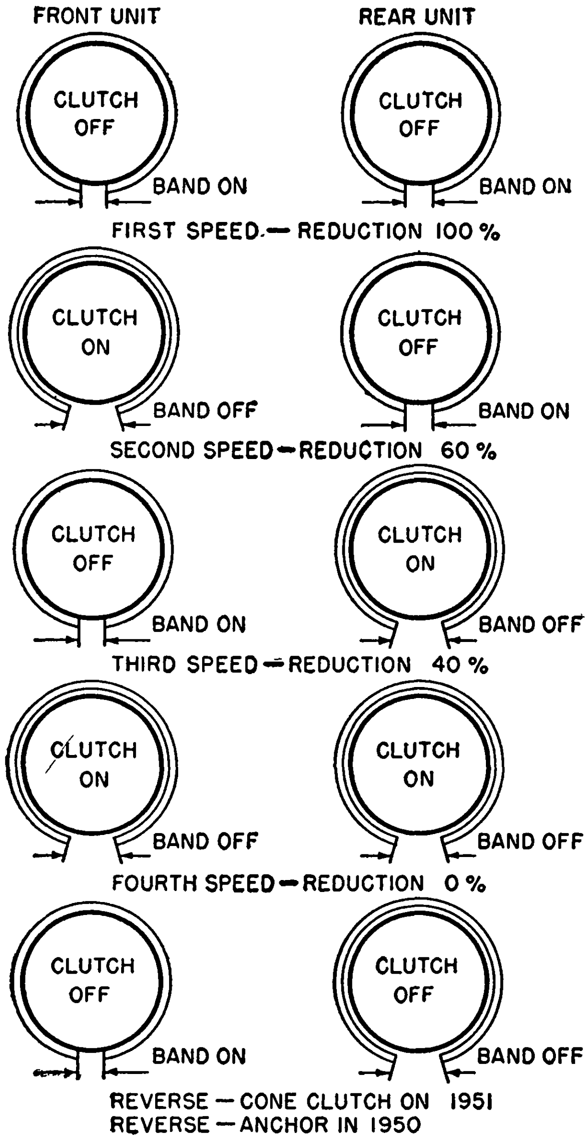


Fig. 3 Band and clutch application

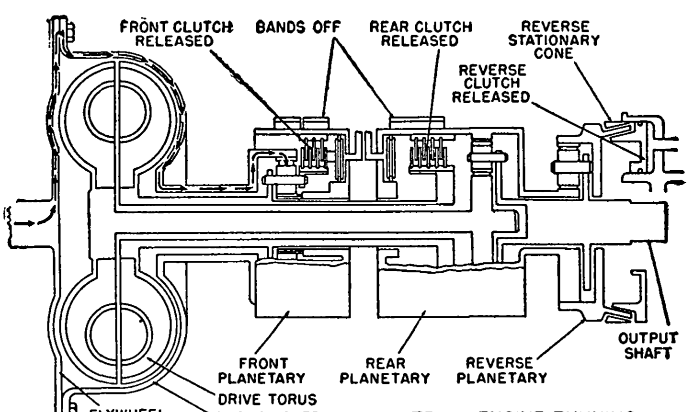


Fig. 4 P wer flow in neutral

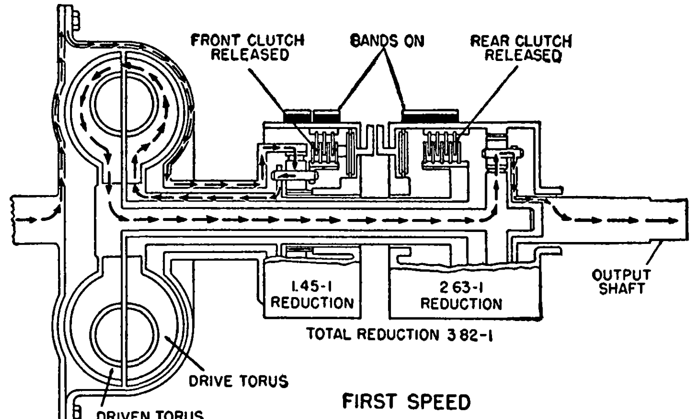


Fig. 5 Power flow in first sp ed

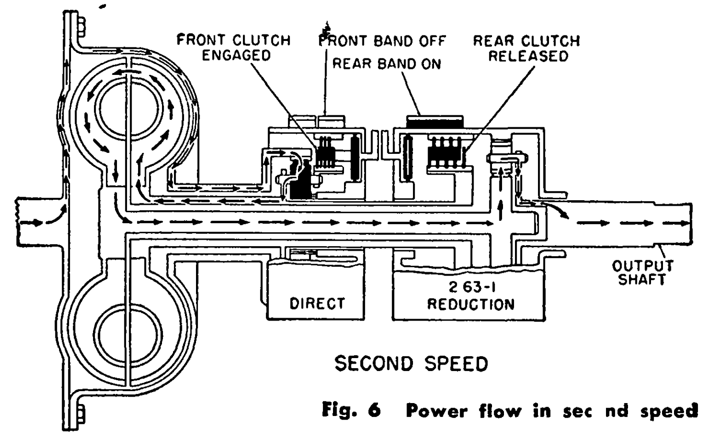


Fig. 6 Power flow in sec nd speed

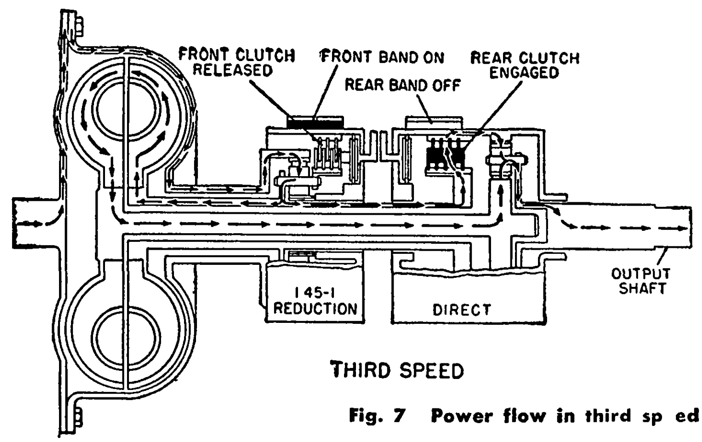


Fig. 7 Power flow in third sp ed

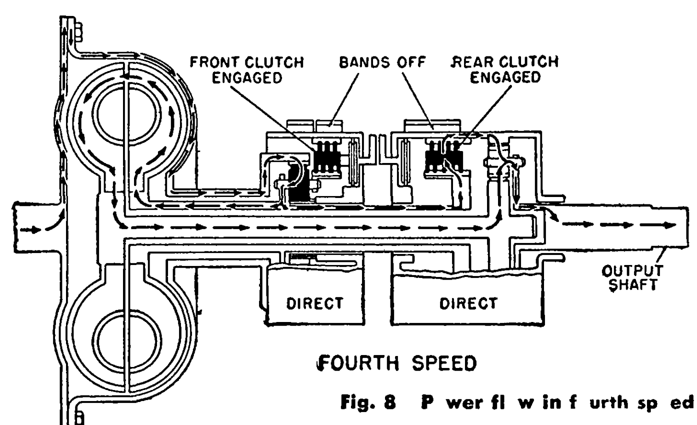


Fig. 8 P wer fl w in f urth sp ed

on 1951 and later models, is shown. Previously, reverse was obtained by manual engagement of a pawl with the reverse gear. Now, reverse is obtained by the hydraulic application of the cone clutch shown.

Although the two forward speed planetary units are similar, the rear unit differs in two ways from the front unit: (1) It is longer, has more clutch plates and greater gear reduction. (2) The rear unit is normally applied by spring pressure and released by oil pressure.

The reader is urged to bear in mind that in either planetary unit in the Hydra-Matic transmission (1) when the band is applied the clutch is disengaged and the unit is in reduction, (2) when the clutch is applied the band is released and the unit is acting as a coupling for direct drive.

As shown in Fig. 3, the greatest forward speed reduction will be wanted in first speed—call this 100% reduction. The next greatest reduction will be wanted in second speed—call this 60% reduction. The next greatest reduction will be wanted in third speed—call this 40% reduction. In fourth speed, direct drive is wanted—call this 0% reduction.

For simplicity in this example, the front unit will be considered capable of giving 40% reduction and the rear unit 60% reduction. The two units then can be used in various reduction and direct drive combinations to provide four speeds forward and reverse.

OPERATION IN NEUTRAL

HYDRAULIC ACTION—The front servo is applied by oil and released by a spring. Therefore, when the car is standing and engine not running the front band and front clutch are released by springs.

The rear servo is spring and oil applied, and oil released. When the car is standing and the engine not running, there is no oil pressure. The band is applied by spring pressure, placing the rear unit in reduction. The clutch is released by spring pressure.

When the car is standing with engine running, the hydraulic action is as follows. When the manual valve is in the neutral position, oil is directed to the rear servo to release the band. No oil can get into the line leading to the front servo so it is held in the released position by a retracting spring. Both bands and clutches are then released and the transmission is in neutral.

POWER FLOW IN NEUTRAL—Fig. 4. The flywheel, torus cover and front drive gear (front unit internal gear) are all attached to each other and rotate at engine speed. The internal gear's rotation causes the front planet pinions to rotate on their pins. And since no member of the front unit is held, no power is transmitted to the planet carrier and drive torus.

FIRST SPEED OPERATION

HYDRAULIC ACTION—Placing the selector lever in the Dr range positions the manual control valve for all forward speeds. It cuts off oil pressure to the rear unit servo, permitting the spring to apply the band, and at the same time directs oil pressure to the front unit servo, applying the band.

There is no oil pressure to the clutches. Oil is directed to the shifter valves but their position is such that the oil is blocked off from the units.

When the car is set in motion, the output shaft and governor start to rotate. Oil from the governor (governor pressure) is directed against the governor plugs. Both planetary units are in reduction and the transmission is in first speed.

POWER FLOW IN FIRST SPEED—Fig. 5. When the car starts to move, the path of power is through the flywheel to the torus cover and front unit internal gear to the front planet carrier. The front band is holding the front unit center gear, causing the planet pinions to "walk around" the center gear, carrying the front planet carrier in the same direction as the internal gear but at a reduced speed.

Since the drive torus is connected to the front planet carrier it also turns at reduced speed. From the drive torus the power is transferred through fluid to the driven torus and along the mainshaft to the center gear of the rear planetary. It then proceeds through the planet pinions to the planet carrier on the output shaft in reduction because the internal gear of the rear unit is held stationary by the band.

SECOND SPEED OPERATION

HYDRAULIC ACTION—Governor pressure increases with car speed to a point where it will overcome the 1-2 shifter valve spring and automatically open the valve. Oil is then directed to the front unit where it releases the band and applies the clutch.

Application of the front unit clutch locks the planet carrier to the center gear and the front unit acts as a coupling. The drive torus is now revolving at the same speed as the flywheel. The rear unit meanwhile remains in reduction.

POWER FLOW IN SECOND SPEED—Fig. 6. Power travels from the flywheel to the torus cover, through the front planetary unit in direct drive. It then proceeds forward to and through the fluid coupling then back along the mainshaft through the rear planetary, which is in reduction to the output shaft.

THIRD SPEED OPERATION

HYDRAULIC ACTION—Two additional valves are needed to make the shift from second to third speed. (1) A 2-3 shifter valve to place the rear unit in direct drive, (2) a double transition valve to cut off the oil holding the front unit in direct drive, allowing it to go back into reduction automatically.

The 2-3 shifter valve opens at a higher speed than the 1-2 valve because of greater spring tension. When vehicle speed is such that the increasing governor pressure overcomes the 2-3 shifter valve spring, the valve opens, allowing oil to flow to the rear unit where it releases the band and applies the clutch.

At the same time, oil is directed against the double transition valve, moving it over and cutting off the oil that holds the front unit in direct drive. The front servo "apply pressure" applies the front unit band, causing the unit to go into reduction. With the front unit in reduction and the rear unit in direct drive, the transmission is in third speed.

From the foregoing, therefore, it can be seen that to transfer from second to third speed, a complete change or transition takes place in each planetary unit.

POWER FLOW IN THIRD SPEED—Fig. 7. Power flows from the flywheel to the torus cover, then through the front unit in reduction. However, at the front planet carrier the power divides. Part of it travels through the shaft of the front planet carrier, through the fluid coupling and back along the mainshaft to the center gear and planet gears of the rear unit.

The other part of the power travels back through the shaft of the front planet carrier, through the rear unit clutch to the internal gear where it is combined with the power from the fluid coupling at the center gear and planet pinions where it passes to the output shaft.

FOURTH SPEED OPERATION

HYDRAULIC ACTION—A 3-4 shifter valve is added to obtain the shift into fourth speed. The 3-4 shifter valve spring is heavier than the 2-3 shifter valve spring and therefore its operation requires higher governor pressure.

When the vehicle reaches sufficient speed, governor pressure will overcome the 3-4 shifter valve spring, opening the valve and directing oil through the double transition valve to the front unit without affecting the rear unit. This applies the front clutch and releases the front band and the transmission is in fourth speed.

POWER FLOW IN FOURTH SPEED—Fig. 8. The path of power is exactly the same as in third speed except that it passes through the front planetary in direct drive instead of in reduction. The same division of power applies in fourth speed as in third. Thus the fluid coupling is relieved of excess strain which prevents it from slipping.

TIMING THE SHIFTS

With the shifter valves, valve springs and governor described above, the shifts will always occur at the same vehicle speed. This arrangement is undesirable in a vehicle because many circumstances arise when shifts at higher or lower speeds are desirable. Examples of this are when rapid getaway is desired or when climbing a hill.

To delay the shifts for rapid acceleration or hill climbing, a throttle valve assembly is used, Fig. 9. This valve assembly is operated by linkage from the accelerator pedal and regulates the oil pressure which varies with the carburetor throttle opening.

This pressure, called "throttle pressure", works against three regulator plugs to increase shifter valve spring pressure. Therefore, higher vehicle speeds and higher governor pressure will be required to accomplish each shift.

When accelerating slowly the accelerator pedal is depressed only slightly. The shifts will then occur at low vehicle speed.

When accelerating rapidly the accelerator pedal is almost fully depressed and, therefore, the shifts will not take place until a higher vehicle speed is reached.

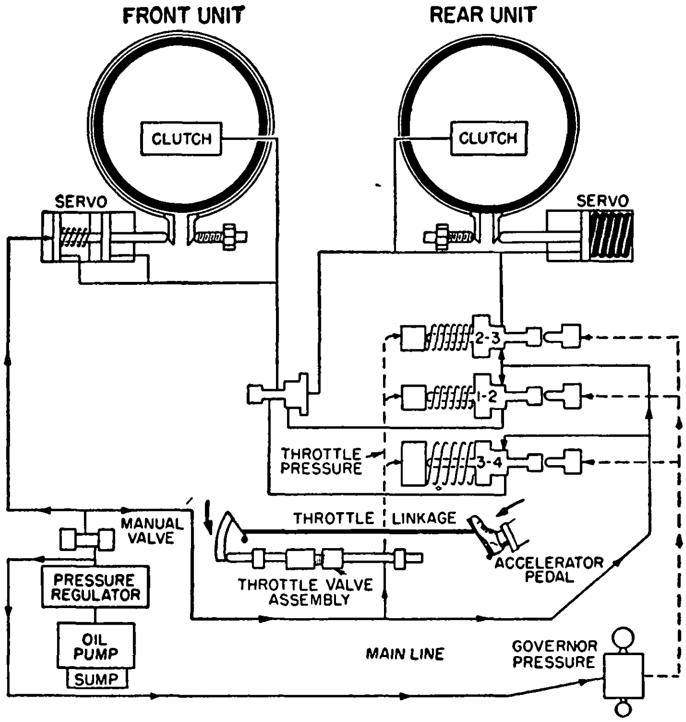


Fig. 9 Throttle pressure to delay shifts

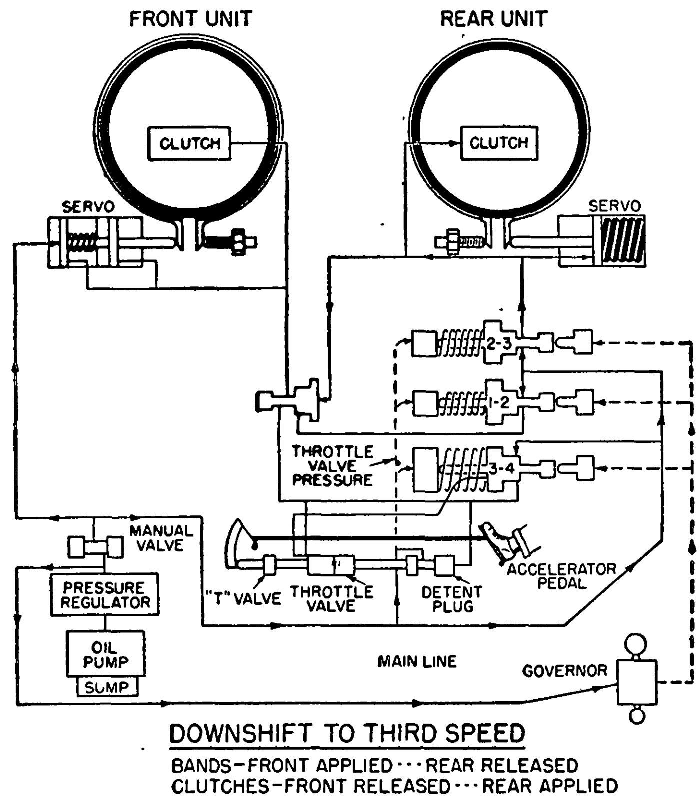


Fig. 10 Forced 4-3 downshift

FORCED 4-3 DOWNSHIFT

It is sometimes desirable while driving in fourth speed to shift the transmission into third speed for rapid acceleration. The 4-3 downshift is accomplished through the T valve (part of the throttle valve assembly) and a detent plug. The detent plug is located at the end of the throttle valve assembly, Fig. 10.

When the accelerator pedal is depressed to wide open throttle position, the throttle valve comes into contact with the detent plug where resistance can be felt in the pedal. Depressing the pedal further will overcome this resistance and move the detent plug. The T valve then reaches a position where it opens a port, directing main line pressure back of the 3-4 shifter valve, forcing it closed. This cuts off the pressure to the front unit clutch and it is disengaged by spring pressure. Pressure is also cut off from the release side of the front servo and pressure on the apply side of the servo applies the band. The transmission is then in third speed.

The main line pressure which was directed behind the 3-4 shifter valve to force it closed is cut off by the shifter valve as it closes. With the accelerator pedal fully depressed, however, throttle pressure with spring pressure is sufficient to hold the valve closed until a higher vehicle speed is reached.

If the accelerator pedal is released, the shift from third to fourth will occur when governor pressure overcomes throttle and spring pressures.

LO RANGE OPERATION

When descending steep grades where maximum braking power of the engine is desired or when pulling through deep sand or up steep grades it is desirable to keep the vehicle operating in first and second speeds regardless of vehicle speed.

This is accomplished by moving the manual valve to the LO position which directs main line pressure back of the 2-3 shifter valve, locking it closed, Fig. 11.

The vehicle speeds obtainable in first and second speed do not develop enough governor pressure to open the 2-3 shifter valve against spring and main line pressure. Therefore, the transmission will not shift above second speed.

OPERATION IN REVERSE

HYDRAULIC ACTION—When the selector lever is moved to the R position the manual valve directs oil to the front servo to apply the band and to the rear servo to release the band. And on 1951 and later models, oil is directed to the reverse clutch to hold the reverse internal gear.

POWER FLOW IN REVERSE—Figs. 11A and 11B. Power travels from the flywheel and torus cover through the front planetary in reduction to the fluid coupling. It then proceeds along the mainshaft to the sun gear of the rear planetary. The clutch and band of the rear planetary are released and the planet carrier is held by the propeller shaft. The planet pinion gears then act as idlers and the rear unit sun gear turns the internal gear in the opposite direction. The internal gear, through a flange, drives the sun gear of the reverse unit in the reverse direction.

Power then travels through the reverse planetary to the output shaft (which is also the planet carrier of the rear unit) in reduction because the internal gear is held by the reverse anchor, Fig. 11A, or reverse clutch, Fig. 11B.

COMPENSATOR PRESSURE

The increased torque developed under rapid acceleration requires additional pressure to hold the bands to the drums without slipping. This pressure is obtained through the use of a compensator valve which directs a variable regulated oil pressure to both the front and rear servos, Fig. 11C.

The compensator valve is operated by throttle pressure. Therefore, the greater the accelerator pedal travel (giving greater throttle pressure) the greater the resulting compensator pressure.

1952 DUAL RANGE OPERATION

The normal first, second, third and fourth Hydra-Matic gear speeds for country and boulevard driving is identical with the operations described previously for 1951 and earlier Hydra-Matics.

When driving in the new 1-2-3 or traffic range, the car will normally remain in third gear. This produces three results which make it adaptable to mountain and heavy traffic usage:

1. The car operating under normally greater reduction is more flexible in normal city traffic.
2. Engine braking is increased on steep grades.
3. Because of greater reduction in the

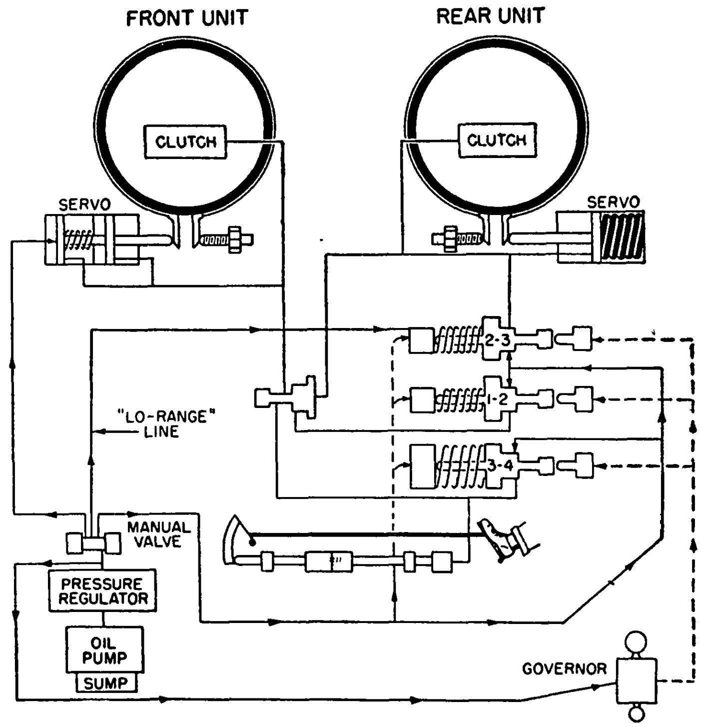


Fig. 11 Manual lever in LO range

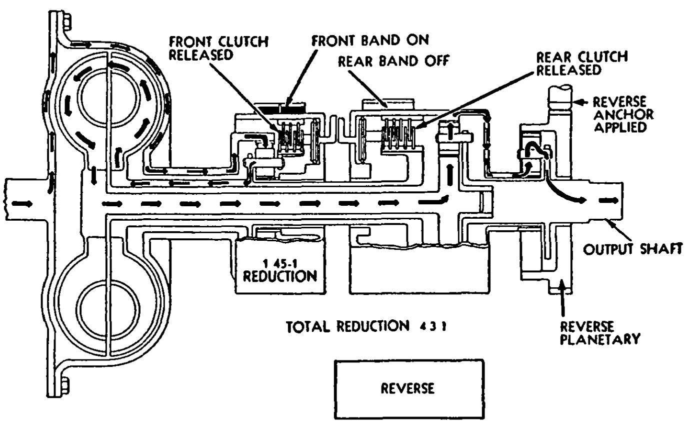


Fig. 11A Power flow in reverse. Units prior to 1951

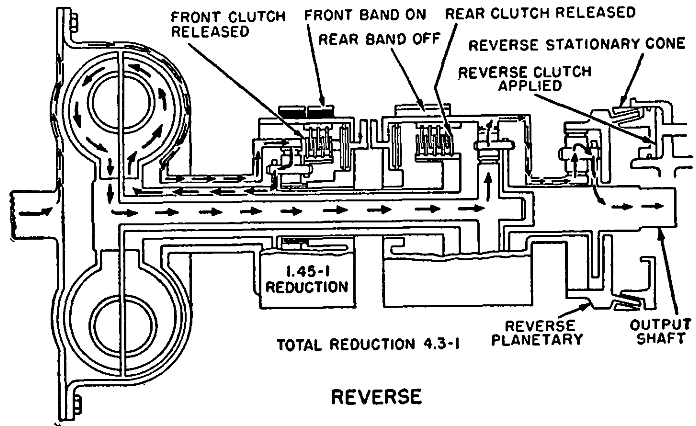


Fig. 11B Power flow in reverse. Units after 1950

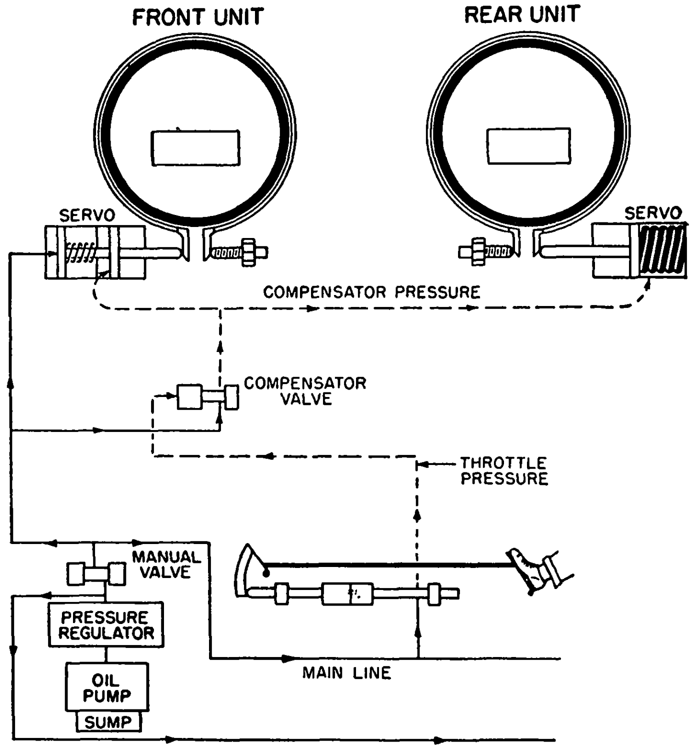


Fig. 11C Compensator valve pressur

gear box it allows for a lower rear axle ratio.

When using this 1-2-3 range, high gear operation is in third gear.

From the driver's standpoint, selection of either of the two ranges is achieved by simply moving the selector lever. The gear shift indicator has been redesigned so that the driver will have no difficulty in making his selection. The drive (DR) range is split into two positions—1-2-3-4 range is to the left of and the 1-2-3 range is to its right. It is permissible to move the control lever at will from one position to the other when travelling at any moderate car speed on paved, dry roads.

If for any reason it is desired to shift down to a lower gear ratio, as for example, when passing a car on an upgrade, pressing the accelerator pedal completely will accomplish the downshift in either of the above-mentioned ranges. When in the left-hand or 1-4 range, with the car speed below 60 mph, the transmission will shift down to third gear. When in the traffic or 1-3 range, and at a car speed below 20 mph, the transmission will shift down to second gear.

Another improvement which has been made concerns the "LO" range. This has now been changed so that with the control lever position at "LO", start and drive will be in second gear only. This feature is particularly advantageous when starting on icy roads—giving a surer start.

Should first gear operation be desired at a car speed of 10 mph or less, which may be desired in heavy mud or sand, the system is arranged so that an automatic shift to first gear results when the accelerator is depressed completely. Thus, first gear operation is automatically available without moving the control lever.

TROUBLE SHOOTING

The Hydra-Matic trouble shooting chart, Fig. 11D, provides a uniform and systematic trouble diagnosis procedure. Before testing the car with this guide, a road test route should be established to permit comparison of different cars over the same route. Where possible, the route should include a hilly section to test for open throttle upshift, slippage and throttle downshifts. A level section for testing upshift points, and a quiet section for testing for noise.

In testing the car, the following instructions should be followed:

1. Check the transmission fluid for proper level with engine running at its proper slow idle speed with gearshift lever in Neutral position. Either of these items will cause

many different irregularities in transmission operation

2 While driving the car, be on the alert for any indications of improper engine performance If any, correct them before making final diagnosis

3 The shift points shown in Fig 11E are average and may vary slightly. One or two miles per hour either way is no cause for adjustment as long as the shifts are smooth

4 The various causes of any particular condition are listed in order of the trouble, Fig 11D Over one-fourth of these can be remedied by *external adjustments,* and over three-fourths can be repaired with the transmission *in the car* Never remove the transmission from the car until the "on car" repairs have been completed or until visual inspection of the transmission after removal of the oil pan and side cover (for oil sediment, excessive backlash, burned drums, etc) definitely indicates the need for complete disassembly Always check the causes in the sequence listed

5. The only exception to Step 4 is when two or more conditions have one common cause, then fix that particular item first

6 When checking linkage, always inspect rods and relay levers for wear as well as for proper adjustment because worn linkage will never hold proper adjustment (linkage adjustments are given in the car chapters).

7. When checking for slippage, always use the "stall test" as outlined below.

STALL TEST

A stall or torque test may be made to determine engine and transmission performance and always when the complaint is "slippage" This test must be used in moderation because considerable strain is exerted on the drive line, differential gears and axles The procedure is as follows

1 Start engine and warm up to operating temperature
2 Set hand brake and apply foot brake firmly
3 Place shift control lever in DR position
4 Connect electric tachometer
5 Depress accelerator pedal to floor.

The action here has placed the transmission in first speed Brakes are applied, therefore the car cannot move Opening the throttle and speeding up the engine is comparable to slipping a mechanical clutch, as the driving torus is turning and trying to turn the driven torus which is held stationary by the transmission being in first speed and brakes locked

The engine will speed up until the friction created between the torus members equals the power output of the engine Engine efficiency will be noted by its stall rpm which should be between 1400 and 1600 If engine rpm is less than 1400 the engine is in need of adjustment or the front planetary is locked up

If engine rpm exceeds 1600 and continues to speed up to or above 2000 rpm, it indicates that bands are not holding properly or that there is slippage in the fluid coupling due to missing check valve, front pump relief valve, or damaged torus members

PRELIMINARY TEST

Bring fluid to proper level
Set engine idle at 365 385 RPM
Check oil pressure as outlined in Hydra Matic Manual

OPERATING CONDITIONS

CONDITION	✓	Possible Causes	CONDITION	✓	Possible Causes
Upshifts not normal (high___ Low___ varies___misses one or more shifts___ violent shifts___)		B F H J R	No drive or slipping in reverse only		C D E F O
Slips in 1st 3rd and reverse (Front Band)		D F L M U V	Drives in reverse only (after reverse application)		B F G O
Slips in 1st and 2nd only (Rear Band)		D F N U V	Reverse application during forward movement in Dr or Lo (1951)		E F O
Slips in 2nd and 4th only (Front Clutch)		R T U V	Low oil pressure		E H K Q V
Slips in 3rd and 4th only (Rear Clutch)		S T U V	Parking pawl will not engage when engine is shut off (1951)		H
Slips in all speeds or no drive forward		B C P U V	Locks up on reverse coast (prior to 1951)		C E F N Q
Improper throttle downshift		B C F J Q	Clashes when shifted to reverse (prior to 1951)		A B F I N O
Engine speeds up band apply rough		B E M	Jumps out of reverse (prior to 1951)		B
Shifts above second in low range		F J	Noisy		See Noise Section
Rough downshift (coasting to stop)		F N	Ratching noise when shifted to reverse with car moving (1951)		A C F H
Excessive creeping		A			
Moves forward in reverse		S			
Cannot move lever to reverse (engine running) (1951)		H J			

LEGEND

	MINOR REPAIRS—Trans in Car			MAJOR REPAIRS—Trans Removed from Car	
A	Engine Idle	I	Reverse Shifter Bracket	P	Fluid Coupling
B	Linkage	J	Governor	Q	Front Oil Pump
C	Oil Pressure	K	Rear Oil Pump	R	Front Unit
D	Servo Bands	L	Front Servo	S	Rear Unit
E	Pressure Regulator	M	Front Servo 4 3 Valve	T	Oil Delivery Sleeve
F	Control Valve Assembly	N	Rear Servo	U	Restriction in Oil Circuit
G	Manual Detent Lever	O	Reverse Unit	V	Excessive Leak in Oil Circuit
H	Parking Brake Bracket (1951)				

OIL LEAKS

WHERE NOTICED	POSSIBLE CAUSE	✓
Between Flywheel & Crankshaft Flange	Loose Flywheel to Crankshaft Bolts Loose Dowel or Insufficient Sealer	
Torus Cover and Flywheel	Flywheel to Torus Cover Gasket Flywheel Sealing Area Drain Plug or Dampener Rivets	
Front of Transmission	Front Pump Cover or Screws or Front Oil Seal	
Oil Pan	Oil Pan Gasket or Drain Plug	
Side Cover	Side Cover Gasket or Screws Throttle & Manual Shaft Seals Pressure Line Plug	
Rear of Transmission	Rear Oil Seal Rear Bearing Retainer Gasket Rear Bearing Retainer Bolts	

NOISE

OCCURS UNDER FOLLOWING CONDITIONS	POSSIBLE CAUSE	✓
Neutral and all Gears whenever engine is running	Front Oil Pump	
Neutral only (disappears when shifted to drive)	Rear Unit Planetary Gears	
Neutral, 1st and 2nd Speeds only	Rear Unit Planetary Gears	
Neutral, 1st, 3rd reverse speeds only	Front Unit Planetary Gears	
Reverse Gear, Acceleration only	Reverse Unit Planetary Gears	
Reverse Gear Deceleration only	Rear Unit Planetary Gears	
Metallic scraping at front of transmission	Excessive Backlash—Torus Members	
Vehicle coasting 20 to 35 MPH, Engine not running & selector lever in neutral	Rear Oil Pump Gears	

Fig. 11D Trouble shooting chart

Extreme care must be used in making this test Never hold the throttle open more than one minute If engine speeds up to 2000 rpm, close throttle immediately to avoid possible damage to the transmission

Sometimes it is desirable to know which band is slipping After making tests with the control lever in DR position, place lever in R position and test again If slippage still occurs, the fault is with the front band or, on 1951 and later models, the reverse cones If no slippage is apparent with this test, then the slippage is in the rear band

To test for a faulty driven torus check valve and front pump relief valve, proceed as follows Set the hand brake firmly Run engine at a speed equivalent to 20 mph for approximately 1½ minutes Then, with engine idling and control lever in DR position, check fluid level in transmission, it should be at the "Full" mark. After level has been checked, shut off engine, wait ten minutes and recheck fluid level Then if the fluid level has not raised more than ½", the check valve and relief valve are operating satisfactorily

CHECKING OIL PRESSURE

NOTE—Due to the use of modulated main line pressure in 1951 transmissions a different procedure will have to be used than for the previous models

MODELS PRIOR TO 1951—

1 Remove floor cover over band adjusting screws
2 Remove pipe plug from transmission case (between band adjusting screws)
3 Attach a suitable oil pressure gauge in hole from which pipe plug was removed
4 Start engine and operate for several minutes to warm transmission oil to normal operating temperature When oil is thoroughly warmed,

UPSHIFTS

	DRIVE RANGE		LO RANGE	
SHIFT	MINIMUM THROTTLE	FULL THROTTLE	MINIMUM THROTTLE	FULL THROTTLE
1-2	5-7	10-15	No Shift*	19-24
2-3	10-13	27-35		
3-4	14-18	55-70		

*With control lever in Lo Range, ⅓ to ½ throttle, 1-2 shift will occur at approximately 16-21 MPH.

DOWNSHIFTS

	DRIVE RANGE			LO RANGE		
SHIFT	CLOSED THROTTLE	FULL THROTTLE	FORCED	CLOSED THROTTLE	FULL THROTTLE	LOCKOUT
4-3	14-10	20-15	60-15			
3-2 or 3-1 (P50, 51)	6-2					
3-2 or 3-1 (D50, 51)	10-6					
3-1 (1948-49)	8-4					
3-2		12-9				
2-1		8-4		6-3	14-10	
4-2						48-40

STALL TEST

TEST CONDITIONS	1400 TO 1600 ENG. R. P. M.	UNDER 1400 ENG. R. P. M.	OVER 1600 ENG. R. P. M.
With the engine at operating temperature, set control lever in Dr position. Fully apply hand and foot brake, and accelerate engine to wide open throttle.	NORMAL	Poor engine performance such as need of tune up, etc.	Transmission slippage or excessive torus coupling slippage. (Do not hold throttle open.)

Fig. 11E Average shift points

check pressure in N, DR and LO positions. Pressure should be between 75 and 90 lbs. at 1000 rpm and should be equal in all positions.

5. With engine running at idle speed, note pressure indicated on gauge with selector lever in DR and LO positions. Pressure should be 75 to 90 lbs. When lever is moved to the R position on 1951 and later models only, pressure should be higher than that indicated in either DR or LO.
6. If pressure checked satisfactorily in Step 5, place selector lever in reverse and apply foot brake. Accelerate engine to approximately half throttle, at which time the pressure should increase to at least 125 lbs. (this applies to 1951 and later models only).

1951 AND LATER MODELS—

1. Install pressure gauge as outlined above and operate engine to warm up transmission oil.
2. Make zero throttle pressure test by road test. Depress accelerator pedal to give a car speed of over 30 mph in fourth speed. Close throttle and note pressure gauge reading when car speed drops to exactly 30 mph. Gauge reading should be between 45 and 72 lbs.
3. Make full throttle pressure test by road test as follows: With car moving forward at approximately 25 mph in fourth speed, depress accelerator pedal to detent plug without going into forced 4-3 downshift. Note pressure gauge reading when car speed reaches exactly 30 mph, at which time pressure should be between 75 and 105 lbs.
4. With engine running at proper idling speed, note pressure indicated on gauge with selector lever in DR and LO positions. In each case pressure should be between 45 and 72 lbs. Then move lever to R position. Pressure should be higher than in either DR or LO. When shift lever is moved to reverse, pressure will momentarily drop before the higher pressure reading.
5. If pressure checked satisfactorily in Step 4, place selector lever in reverse and apply foot brake. Accelerate engine to about half throttle, at which time pressure should be at least 125 lbs.

MAINTENANCE

TRANSMISSION FLUID

Only "G. M. Hydra-Matic Fluid" or "Automatic Transmission Fluid (Type A)" from containers bearing the Armour Institute Qualification number "AQ-ATF" should be used in the Hydra-Matic.

DRAINING TRANSMISSION FLUID

Draining should be done immediately after operation before the fluid has a chance to cool.

1. Remove flywheel housing bottom cover.
2. Remove hex head pipe plug from torus cover, using a six-point socket (a twelve-point socket will damage head of soft pipe plug).
3. Remove oil pan drain plug at back of pan, allowing fluid to drain. (Flushing is not recommended.)
4. After draining, install and tighten both drain plugs. Tighten torus cover drain plug to 6 or 7 lbs. ft. with a torque wrench and six-point socket. Tighten oil pan drain plug to 35-40 lbs. ft.
5. Replace flywheel housing bottom cover.
6. Cover seat to protect upholstery and raise right side of floor mat.
7. Remove transmission inspection floor hole cover. Clean all gravel, sand or lint from the floor and around oil level indicator before it is removed.

REFILLING TRANSMISSION

1. Remove dipstick and wipe it clean. Clean dipstick cap air cleaner in solvent.
2. Pour approximately 8 quarts of fluid into the transmission, being sure container, spout or funnel is clean.
3. Set selector lever in N position and apply hand brake. Run engine at a speed equivalent to 20 mph for approximately 1½ minutes to fill fluid coupling.
4. Reduce engine speed to slow idle (carburetor off fast idle step).
5. Add sufficient fluid to bring fluid level up to just below the "L" mark on the dipstick. Again run the engine at a speed equivalent to 20 mph for three minutes to heat the fluid to near operating temperature, which is indicated by a rise in fluid level to near the "F" mark. Reduce engine speed to slow idle and add fluid to bring level to "F" mark. With engine idling and transmission warm, make a final check to be certain transmission is not overfilled.
6. Stop engine, replace dipstick and cover in floor.

CHECKING OIL LEVEL

1. Set selector in N position and apply hand brake. Start engine and allow it to run at idle continuously for a minimum of two minutes until oil is warm.
2. Roll back right side of floor mat and remove inspection hole cover in floor pan directly over transmission oil level indicator.
3. Remove all gravel, sand or lint from floor and around oil level indicator before removing indicator.
4. Remove and wipe indicator and put it back.
5. Again remove and note level.
6. Add oil as required to bring level to "F" mark, being sure the check is made with engine idling.

HYDRA-MATIC SERVICE

About 80 per cent of all malfunctions of the Hydra-Matic drive are due (1) to incorrect engine idling speed, (2) improper linkage adjustment, (3) incorrect fluid level and leaks. Therefore, before tearing down the transmission, always check for these conditions and, if necessary, make corrections according to the manufacturer's specifications of

the car in which the unit is installed. If, after checking and correcting these conditions, a road test indicates further trouble, consult the trouble shooting chart shown in Fig. 11. (Consult the car chapters for linkage adjustments.) PAGE 394 - 395

SERVICE NOTE — While the following procedure applies specifically to the post-war models, it may be used to service pre-war units. In servicing the pre-war models, note that the front oil pump is of the conventional gear type as compared to the crescent design now used. The rear oil pump on post-war models is of the conventional gear type but these have been replaced in later models with the crescent type. The post-war clutches have fewer plates and the steel plates are flat, whereas in the pre-war units, they are dished or coned. The reverse mechanism is much the same but the post-war models incorporate a blocking valve to resist engagement of the anchor while the reverse gear is turning.

HYDRA-MATIC REMOVAL

1. Jack up all wheels to clear floor about eight inches.
2. Remove foot accelerator and floor mat.
3. Remove center floor pan.
4. Disconnect speedometer cable at transmission.
5. Remove propeller shaft.
6. Remove flywheel housing pan.
7. Remove pipe plug from torus cover and drain plug from oil pan and allow oil to drain.
8. Remove throttle lever from shaft at side of transmission.
9. Disconnect lower control relay rod from manual lever at side of transmission.
10. Remove engine rear mounting bolts.
11. Remove brake and other linkage as required.
12. Raise rear of engine, protecting oil pan with wood block.
13. Remove cross member from frame side rails.
14. The transmission may now be removed, using either an under-the-car dolly or a hoist. With either method, proceed as follows:
15. Lift transmission just enough to take strain off attaching bolts.
16. Remove torus cover-to-flywheel bolts.
17. Unfasten rear bell housing from front bell housing.
18. Lower engine slowly until top of bell housing is flush with floor pan opening.
19. Thread two transmission bolts into bell housing (one each side) just below dowel pins. Screw in the bolts to release bell housing from dowel pins. When housing is removed, take out the two bolts.
20. Move transmission toward rear and lower to floor. To prevent end of mainshaft from striking flywheel-to-crankshaft bolts, turn flywheel so end of mainshaft passes between two bolts.

OVERHAULING HYDRA-MATIC TRANSMISSION

Note—Material furnished by Pontiac Division of General Motors Corp. This unit is essentially the same as those used on other car makes

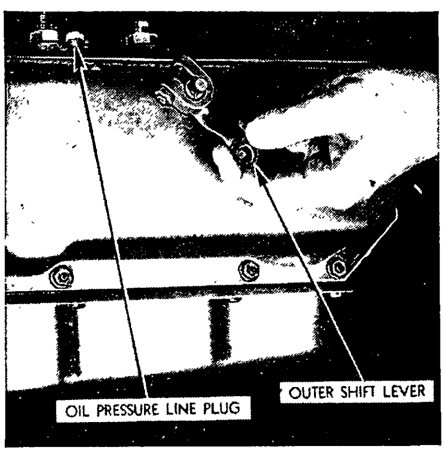


Fig. 12 M ve outer shift lever to reverse position

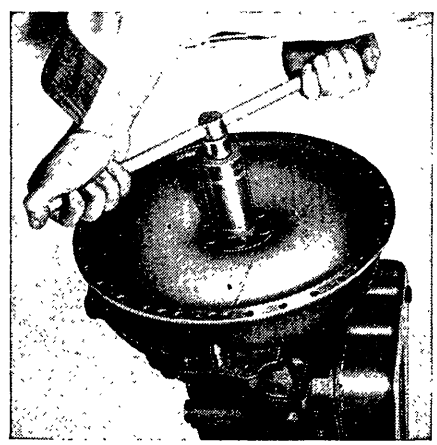


Fig. 13 Remove mainshaft nut

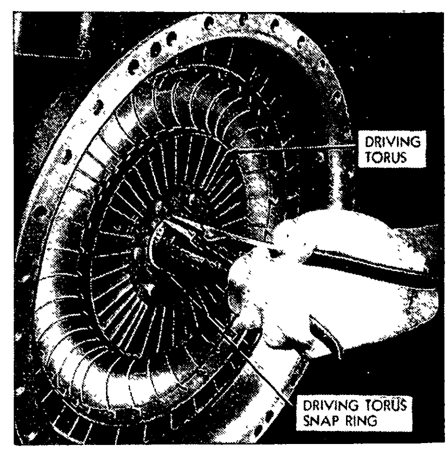


Fig. 14 Remove driving t rus snap ring

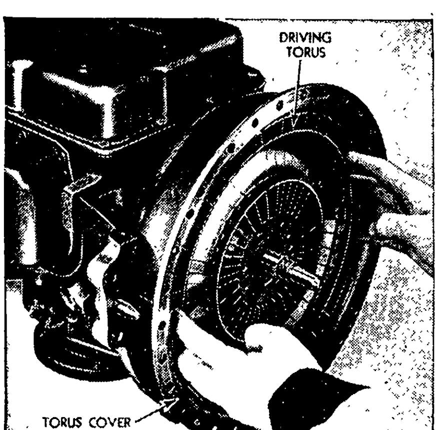


Fig. 15 Remov driving t rus

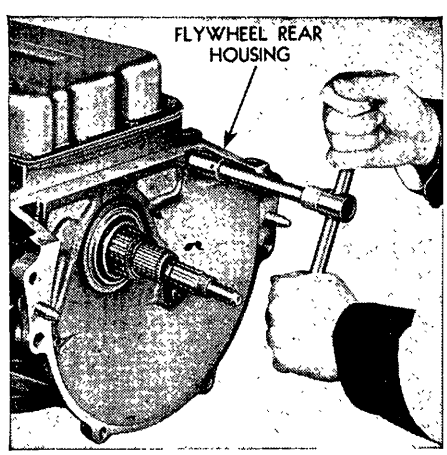


Fig. 16 Remove flywh el rear h using

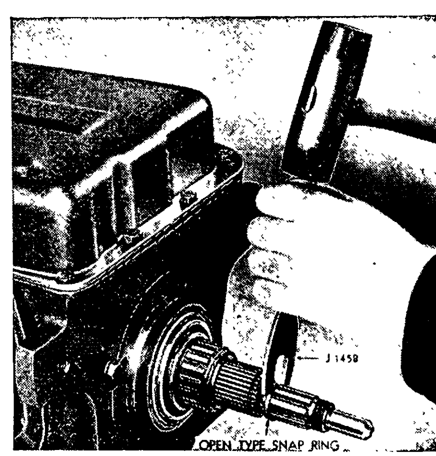


Fig. 17 Rem ve driv n t rus snap ring

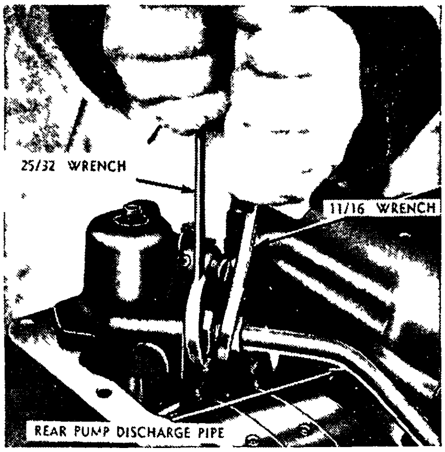


Fig. 18 L sen rear pump discharge pipe fitting

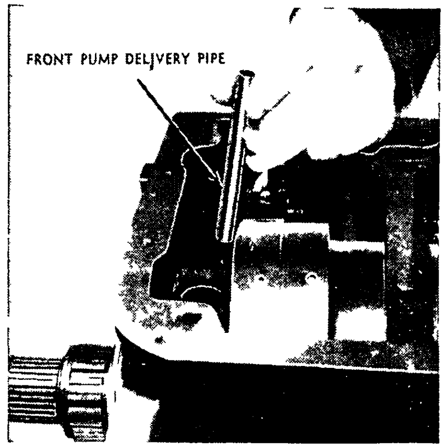


Fig. 19 Remove front pump oil delivery pipe

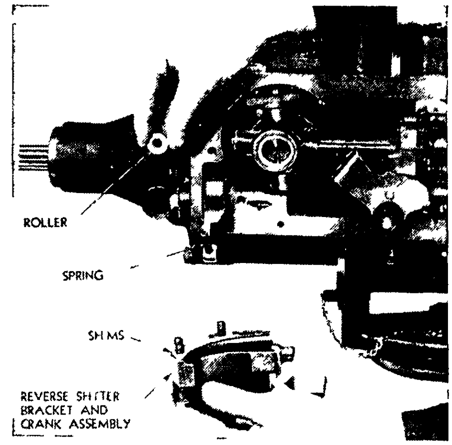


Fig. 20 Remove reverse brack t and shims from case (1946-50)

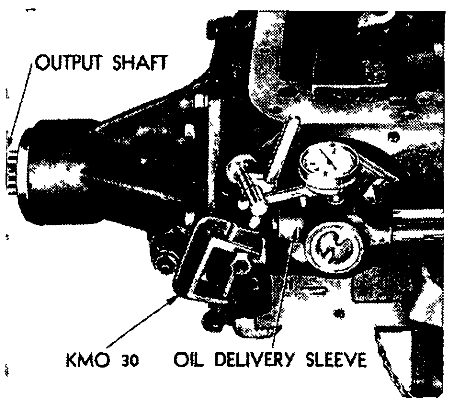


Fig. 21 Check g vernor run-out by mounting dial indicat r as shown. Rotate output shaft s v ral r v lutions. If run-out of oil delivery sl eve xceeds .005", mark positi n of g vern r b dy on drive flange. Then r move c ntr l valve and governor body and ch ck run-out of governor drive flange

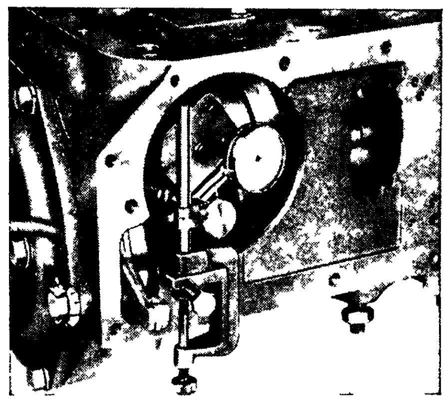


Fig. 22 Check governor drive flange run-out with dial indicator as shown. If run-out exceeds .002', replace one or all of following parts: governor drive flange, gear set or complete oil pump. If run-out is less than .002', rotate governor 180 degrees from original position and reinstall governor body on flange. Then check governor run-out again. If run-out is still more than .005", replace governor and sleeve

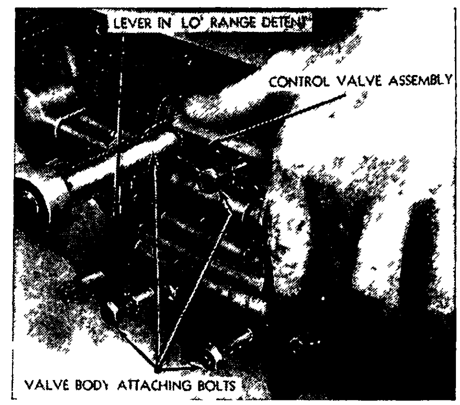


Fig. 23 Remove control valve fr m cas

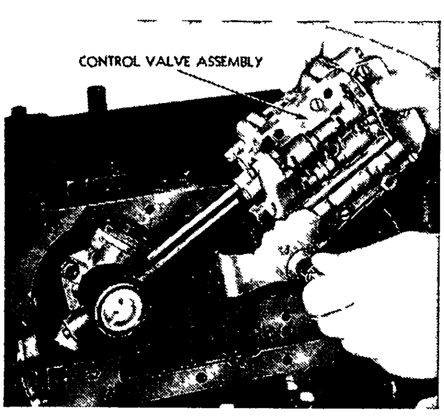


Fig. 24 R m ve c ntr l valve fr m il deliv ry sl ev

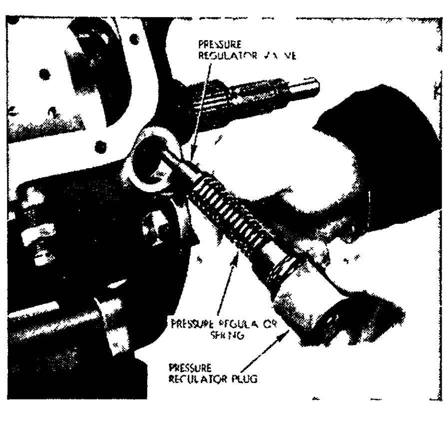


Fig. 25 R m v il pr ssur regulat r plug

Fig. 26 P siti n parts as indicated, shift assembly t ward c ntrol valve side f case, raise r ar f pump t clear case and take ut governor and pump

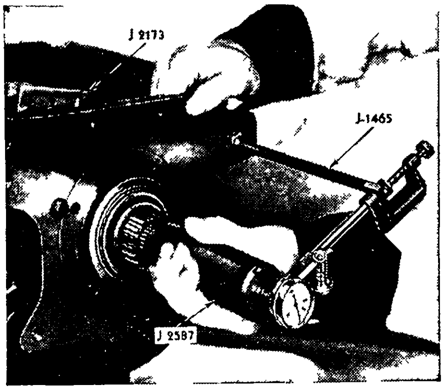


Fig. 27 Check mainshaft end play by m unting dial indicator as shown. Insert to l betw en fr nt clutch drum and center bearing cap t hold the front planet unit f rward. Then move mainshaft back and f rth without undue force. End play should be between .004 and .015". Note end play present s that proper selective washer can be installed when transmission is reassembled

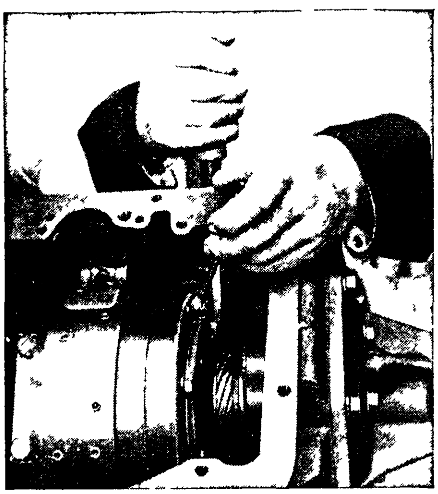


Fig. 30 Lo s n bolts holding rear bearing retain r t reverse internal gear. Then re- m ve reverse center gear and drive flange attaching bolts

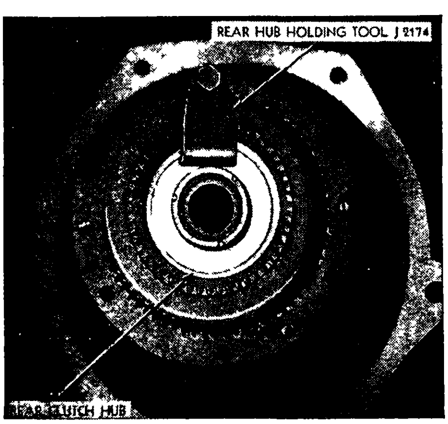


Fig. 33 Install r ar hub retaining t l t rear unit drum using a r verse drive flang attaching b lt. Th n remove c nt r bearing cap

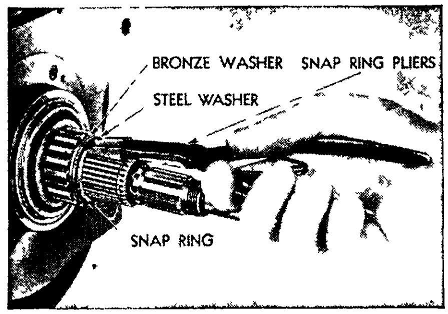


Fig. 28 Remove front drive gear snap ring and take off steel and bronze washers. These washers have a smaller outside diameter than similar washers used elsewhere in the transmission and should be tied together and kept separate to avoid confusion when reassembling

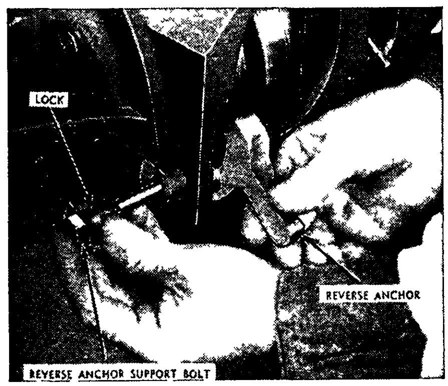


Fig. 31 Remove reverse anchor (1946-50)

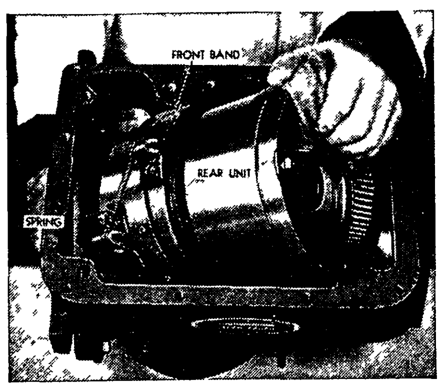
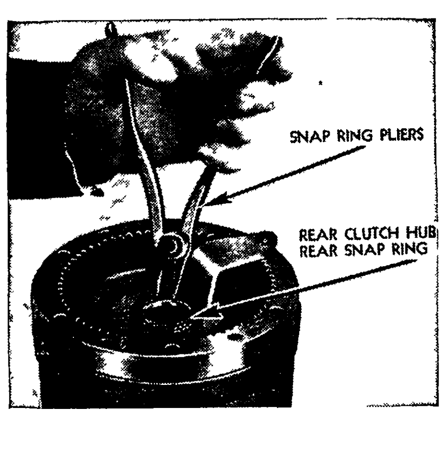


Fig. 34 Remove rear band. Install suitable spring or wire to hold front band on drum. Then raise units from case



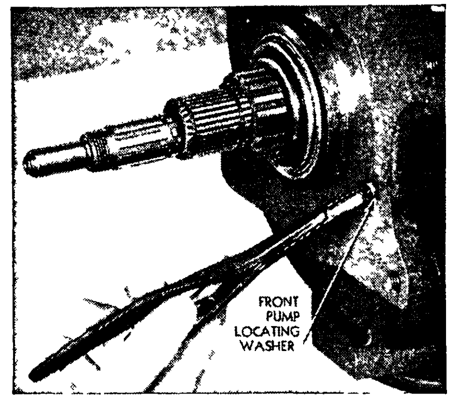


Fig. 29 Remove front pump l cating washer and attaching bolts. Then remov pump and front drive gear as a unit. Remove bronze washer fr m fr nt end f planet carri r

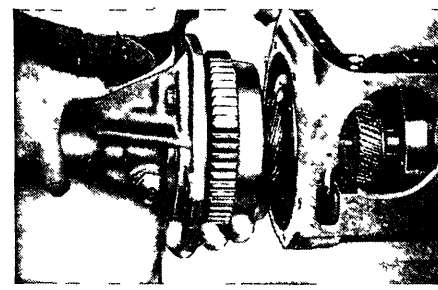


Fig. 32 Unfasten rear bearing r tainer from transmission and slip ut the r verse assembly. Be sure to rem ve the s lectiv washer which may stick t the mainshaft r remain in the counterb re of the utput shaft. Remove mainshaft thr ugh rear f transmission, and the br nze wash r from the rear clutch hub

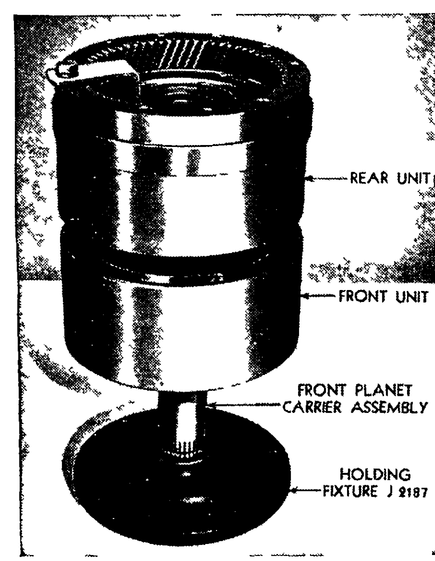


Fig. 35 Disassembly of front and rear units

←

Fig. 36 R move rear clutch hub rear snap ring and lift rear unit fr m planet carrier. Then remov rear clutch hub front snap ring fr m planet carrier

Fig. 37 R mov center bearing cap from il deliv ry sle ve and take sleeve from carri r. Th n remove snap ring from recess in fr nt unit. H ld snap ring open while lifting fr m carri r to avoid damaging bearing surface. Lift fr nt unit from planet carrier. Th n tak bronze and steel washers fr m recess of front unit

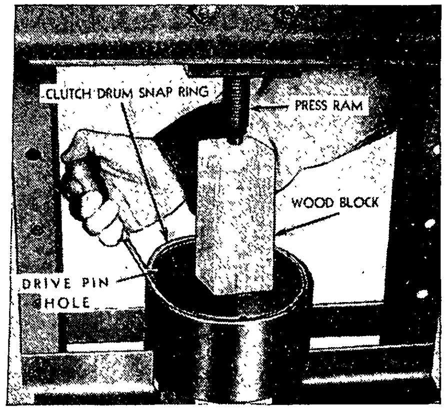


Fig. 38 Place front unit in press and remove clutch drum snap ring

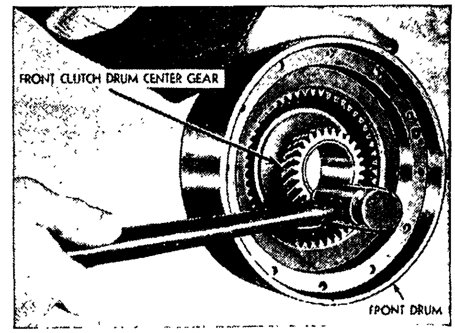


Fig. 39 Separate drums by tapping fr nt face of center gear, using care n t t l s clutch release springs

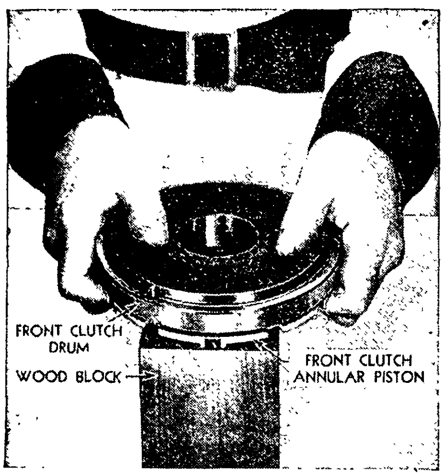


Fig. 40 Rem v front clutch annular piston fr m clutch drum by bumping front face f c nter gear n wood block. Then re m ve inner and outer clutch release springs fr m front drum. Take out composition and steel clutch plates

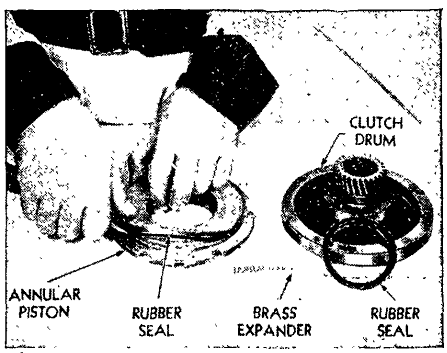


Fig. 41 Remove rubber seals and brass expanders from annular piston and clutch drum piston, using blunt edge screw driver

Fig. 42 To disassemble th rear unit, remove retainer tool from rear unit drum (see Fig . 33). Remove clutch hub and bronze washer. Remove screws and lift internal gear from drum.

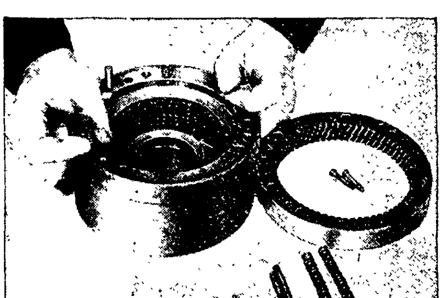


Fig. 43 Remov clutch releas springs and guid pins

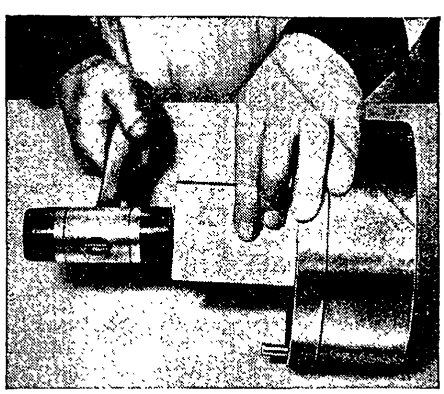


Fig. 44 Rem ve clutch drum retainer ring. Then s parat drums by tapping lightly on clutch drum r ar thrust fac , being careful not to damag t th f c mp siti n clutch plat s

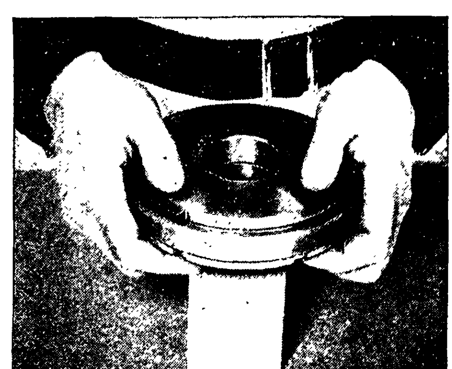


Fig. 45 Remove annular pist n fr m clutch drum by tapping clutch drum thrust fac n w d bl ck. R m v rubber seals and brass xpanders in sam mann r as f r front unit

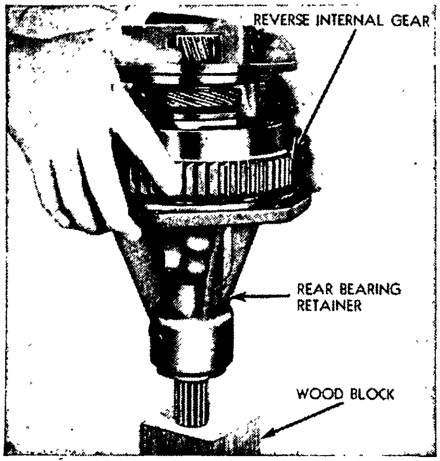


Fig. 46 R m v speedometer driven gear. Then aft r rem ving reverse internal gear support b lts, b unce shaft on wood block t rem ve rear bearing retainer

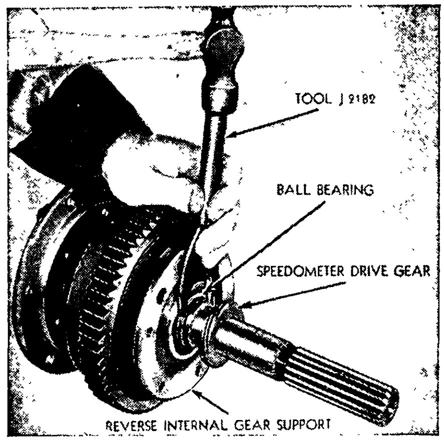


Fig. 47 Remove ball bearing snap ring

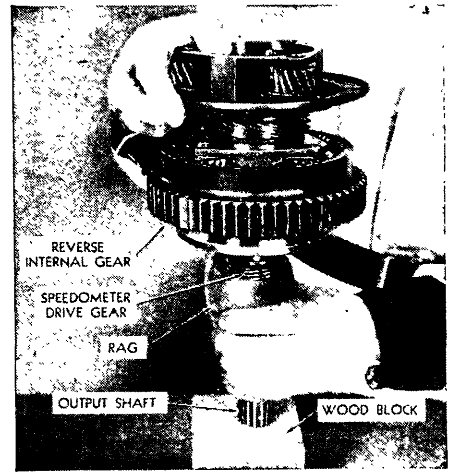


Fig. 48 Bump output shaft t remov speedometer driv gear

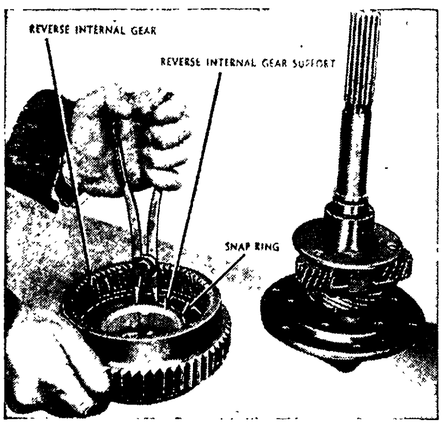


Fig. 49 Rem ve snap ring and take off reverse int rnal g ar support. Tap bearing fr m internal gear support. Remove snap ring fr m utput shaft, keeping it spread t av id damage to splines

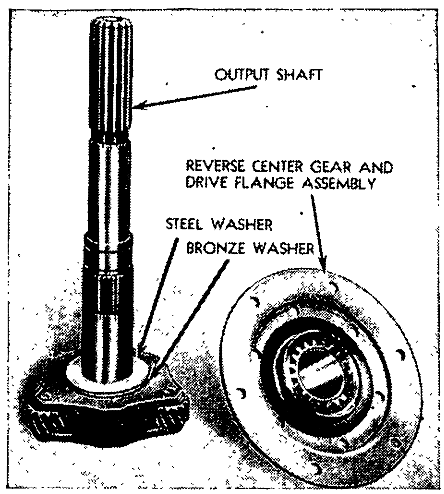


Fig. 50 Lift reverse center gear from output shaft. Center gear and shaft is serviced as a unit—do not take apart

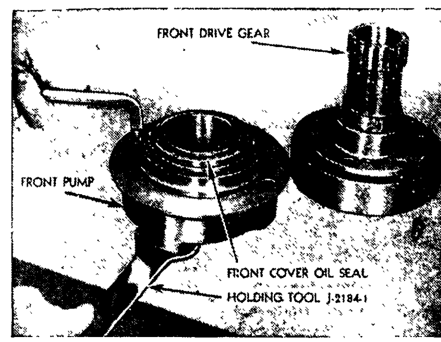


Fig. 51 To disassemble fr nt pump, s parate pump from front driv gear. H ld pump with tool shown and rem v screws from cover. Do not attempt to h ld pump body by inserting bar into intake b re r pressure regulator piston bor as seri us damage may r sult

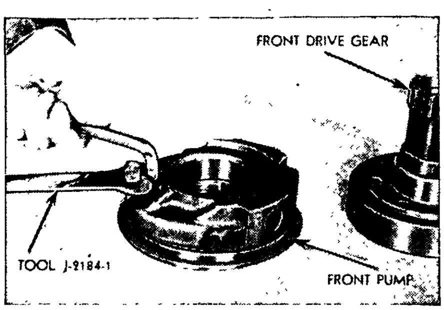


Fig. 52 Rem ve fr nt pump to c v r attaching screw and take ff cover. Tap lightly with s ft hammer (if n cessary) at d wel area n pump b dy but d n't pry with scr wdriver as this will damage lapped surface. When c v r is r m ved, d not all w gears t dr p ut of p ck ts in body

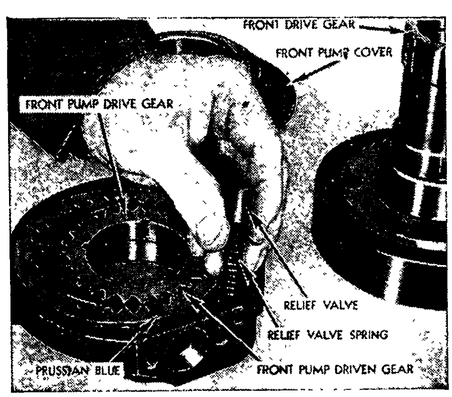


Fig. 53 R m ve reli f valve and spring from fr nt pump b dy. Mark t p fac of driven (ut r) g ar with prussian blu f r identificati n wh n ass mbling. Rem v gear

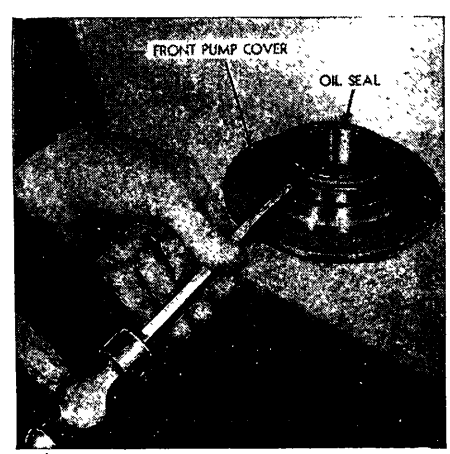


Fig. 54 Use a chisel t rem ve oil s al from c ver

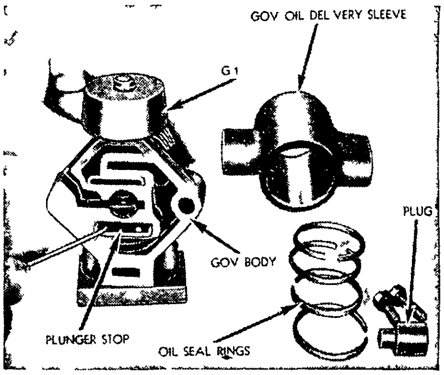


Fig 55 T disassemble governor and rear pump, pull sleev off governor body. Mark edge of body and governor drive flange (if not previ usly marked) so they may be re-installed in riginal position if run-out is within .005 . Then disassemble governor. D n t attempt t remove governor plungers r weights from either plunger assembly

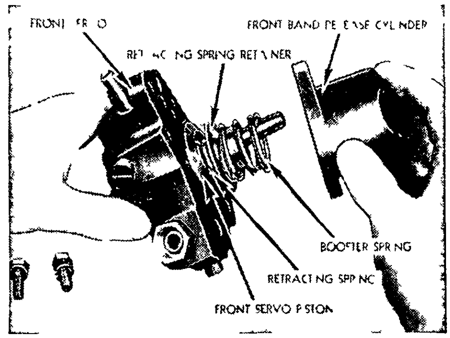


Fig. 56 To disassemble front servo, unfasten band release cylinder from servo body and remove cylinder

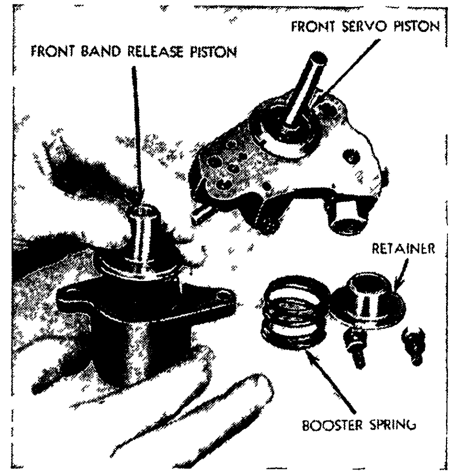


Fig. 57 After removing b ster spring, r - tracting spring retainer and r tracting spring, remove front band rel ase pist n from cylind r

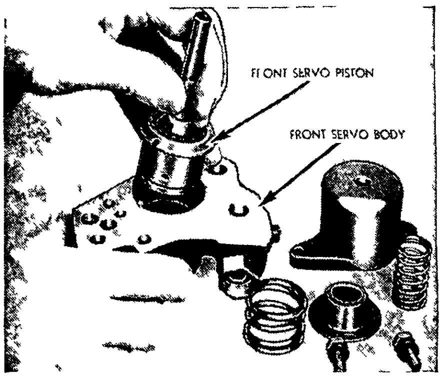


Fig. 58 Take fr nt servo piston from servo b dy. D n t disassemble piston as it is s rviced as a unit

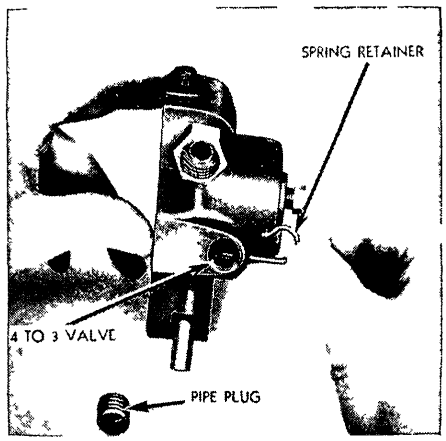


Fig. 59 Remove pipe plug and spring retainer holding 4 to 3 valve in place

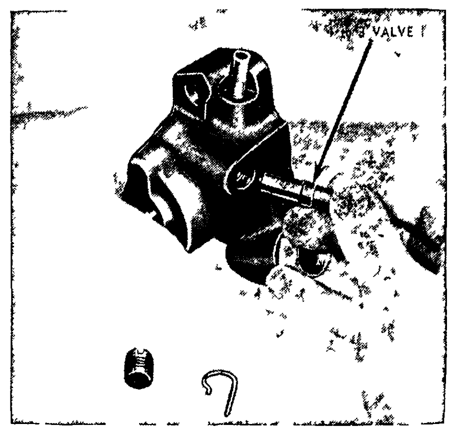


Fig. 60 Take out 4 to 3 valv

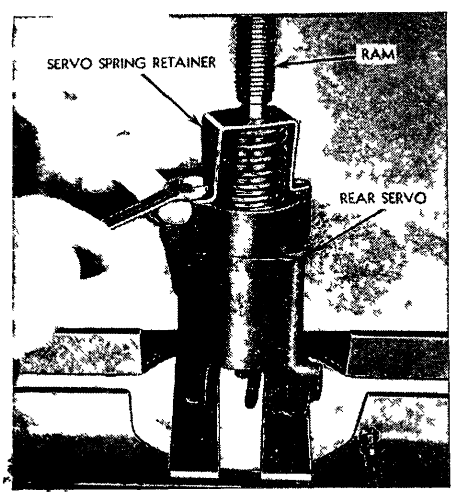


Fig 61 To disassembl rear serv , plac in press and bring ram down to r st n spring retainer. Unfasten r tainer b lts and release pr ss sl wly until springs ar free

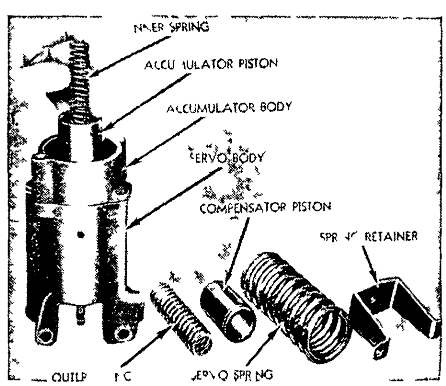


Fig. 62 Disassemble rear serv

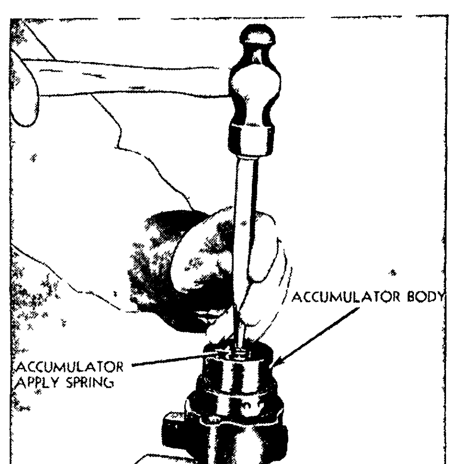


Fig. 63 Tap accumulator pist n thr ugh apply spring and b dy

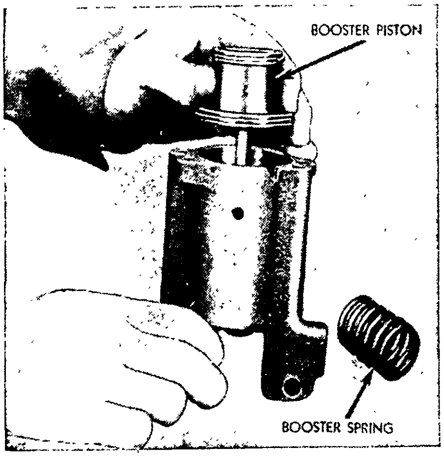


Fig. 64 Rem ve booster spring and piston fr m serv b dy with snap ring pliers. Do not c ck piston in bore

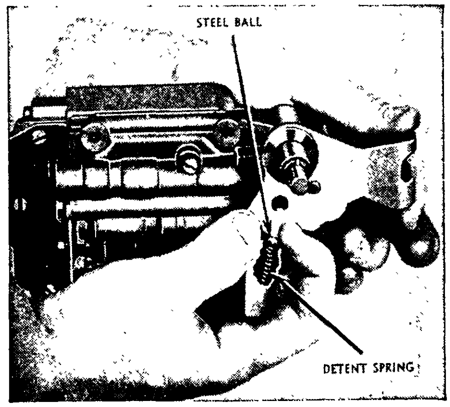


Fig. 65 In servicing the control valve, never grip it in a vise or use force in removing or installing valves or plugs. When disassembling, lay the control valve flat on clean paper, and proceed as follows: Move control lever slowly counter-clockwise while holding rag to catch detent tension spring and ball

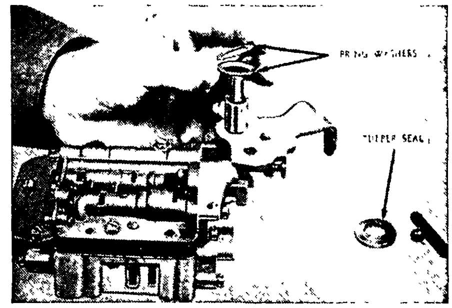


Fig. 66 Take off manual shaft rubber seals and wash r

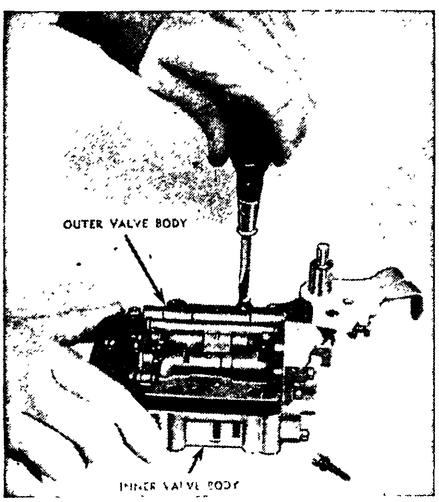


Fig. 67 Separate inner and outer valve b di s (2 scr ws) and remove spacer plate

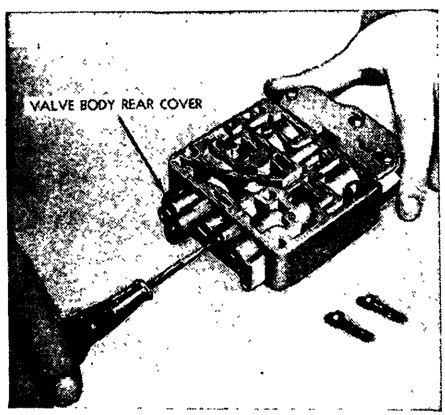


Fig. 68 Separate valve body rear cover from body and remove inner plate

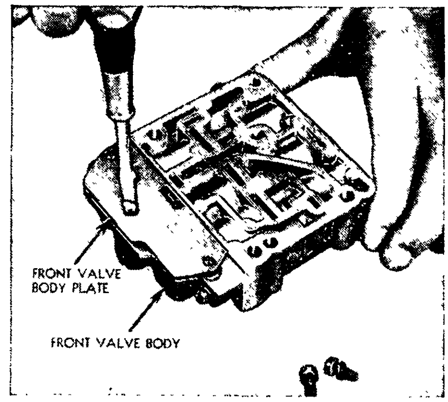


Fig. 69 Remove front valve b dy plate

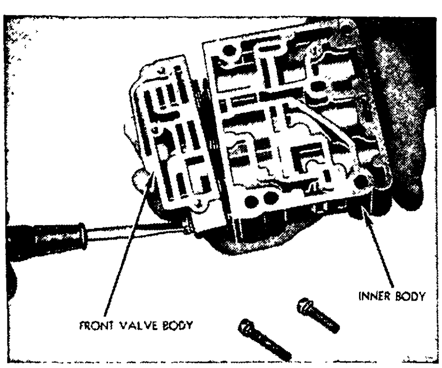


Fig. 70 H ld fr nt valve b dy and inner b dy t g ther while r moving screws t avoid springs jumping ut of place

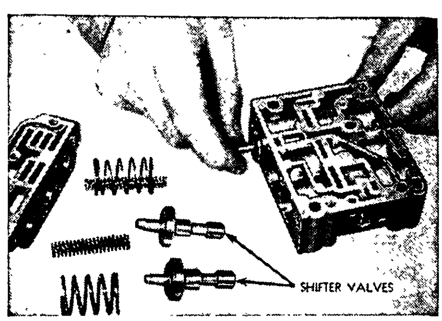


Fig. 71 R m ve shift r valv s and springs. G vern r plugs may b rem ved by bumping valv b dy n palm f hand. R m v regulat r plugs by bumping fr nt valve body n hand

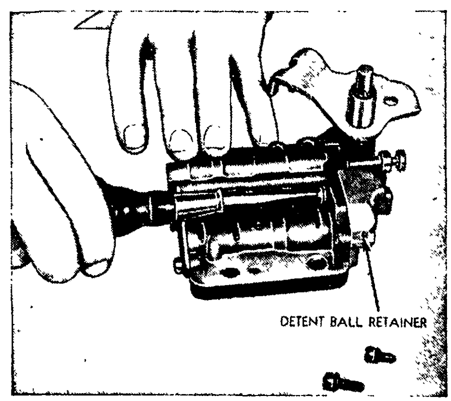


Fig. 72 Remove det nt ball r tain r

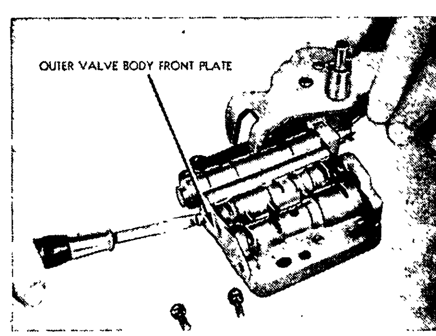


Fig. 73 Remove outer valve b dy fr nt plat

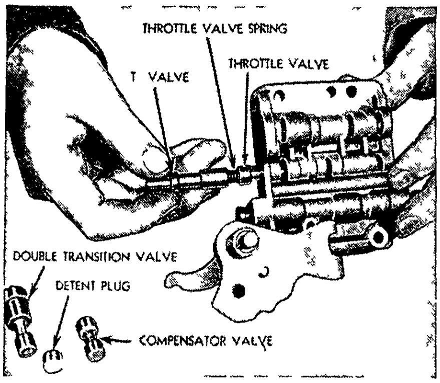


Fig. 74 Rem ve T valve, spring and thr ttle valve

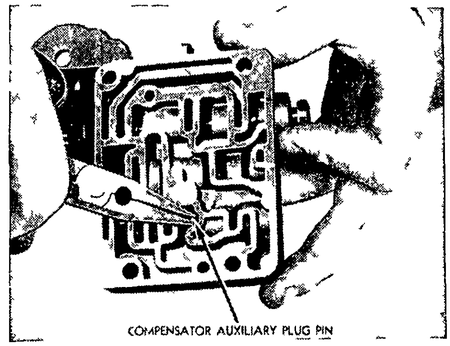


Fig. 75 Remove stop pin (needle bearing roller) holding compensator auxiliary plug in place

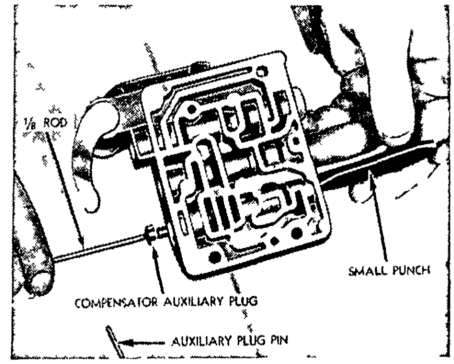


Fig. 76 Insert 1/8" rod in hole in c mpensator auxiliary plug and use a small punch to push plug from b dy. Caution—Be careful not to allow plug t dr p fr m rod and become lodged in valve b dy

HYDRA-MATIC INSPECTION

Inspection of Case, Oil Delivery Sleeve, Pressure Regulator Valve and Front and Rear Bands—

1 Clean transmission case with cleaning fluid

2 Remove oil pressure line pipe plug between band adjusting screws (band anchor stop) Blow out all oil passages, Fig 77

3 Inspect transmission case for cracks

4 Inspect oil delivery sleeve for scored bearing surfaces

5 Insert a wire or paper clip, Fig 78, through both oil delivery sleeve holes to check for open passages into the opening between oil seal ring grooves

6 Check oil seal rings for freedom in grooves and examine grooves for damage

7 Install oil delivery sleeve with dowel hole toward case and tighten cap with dowel on one of the two oil holes Apply oil on each side of bearing cap Apply air pressure Fig 79, to two clutch holes in side of case If movement of oil on oil delivery sleeve is observed, leakage is indicated Attempt correction by installing a new oil delivery sleeve If new sleeve leaks, dress bearing cap down with fine emery cloth on surface plate until sleeve does not leak

8 Remove bearing cap and oil delivery sleeve

9 Inspect adjusting screws (band anchor stop) and threads in case Inspect lock nuts for damage

10 Inspect pressure regulator valve, spring and gasket for damage Pressure regulator valve must have free fit in front pump body, Fig 80 End coils of spring must fit freely over valve

11 Inspect both bands for burned or worn lining

12 Inspect steel bands for distortion or cracks

13 Check strut on rear band for alignment and free pivoting The rear band is furnished with strut attached

14 Inspect anchor ends of front band for broken welds or worn sockets Cau-

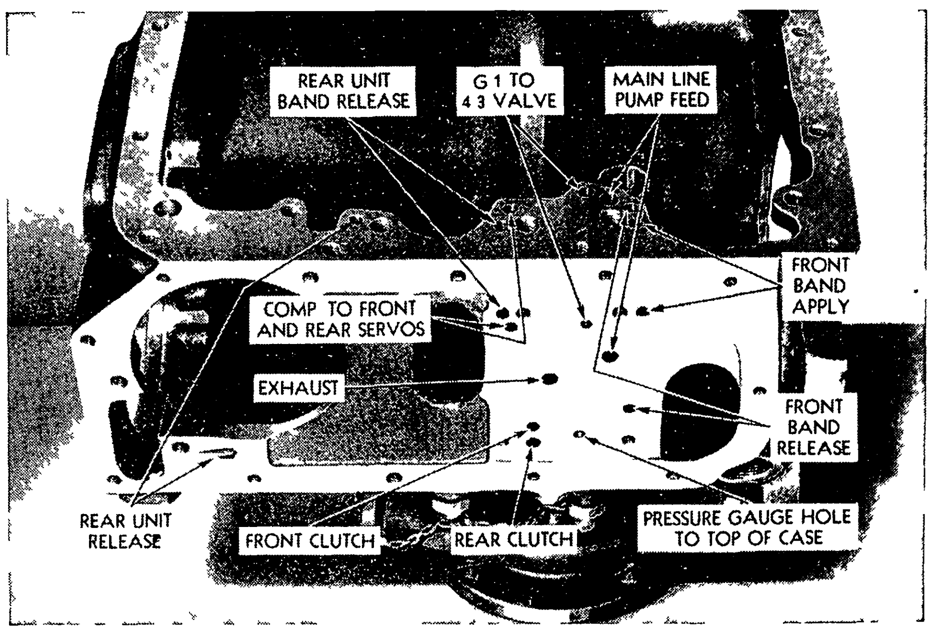


Fig. 77 Oil passages in transmission case

Fig. 78 Inspecting passages in il delivery sleeve

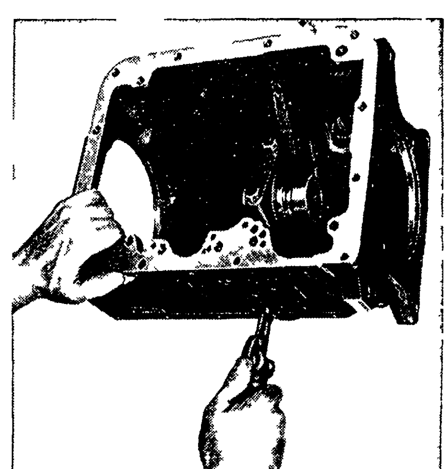


Fig. 79 T sting oil delivery sl ve f r leaks

tion—Do not pry either band open or distort band in any way as they are surface ground at the factory for drum fit.

15. Clean all parts thoroughly and make a list of those to be replaced.

Inspection of Front Unit—

1. Inspect clutch drive pins in front unit drum. If they are scored loose or distorted, replace drum and drive pin assembly. Pins are not furnished separately.
2. Inspect drum for deep grooves or scores at band surface and clutch plate surface.
3. Inspect clutch release springs for distortion or collapsed coils.
4. Inspect clutch drive plates for damaged or loose facings. If flakes of facing material can be removed by scratching the surface with the thumbnail, the plate should be replaced. Discoloration of drive plates is not an indication of failure.
5. Inspect clutch driven plates for scored surfaces. Note—Driven plates in pre-war hydra-matics were coned or dished; post-war plates are flat.
6. Inspect annular clutch piston for scores. Be sure oil seal grooves are clean.
7. Inspect front clutch drum for scores in piston bore, oil delivery sleeve bore and oil seal grooves. Inspect gear teeth and thrust faces for damage.
8. Inspect front planet carrier gears for damaged teeth and excessive roller bearing wear.
9. Inspect bearing surfaces of planet carrier shaft.
10. Inspect steel and bronze thrust washers.
11. Clean all parts and make a list of those to be replaced.

Inspection of Rear Unit—Inspection of these parts should be made in the same manner as outlined for the front unit. In addition, however, inspect the surface of the babbitt bushing in the clutch drum. Inspect the front and rear thrust faces, internal and external splines and blow out drilled passages on rear clutch hub.

Inspection of Reverse Unit and Mainshaft—

1. Inspect ball bearing by first cleaning and oiling, then rotate slowly by hand, feeling for roughness. Do not spin bearing with air.
2. Inspect outer bearing surface of reverse internal gear support.
3. Inspect reverse internal gear for damaged teeth and scored inside bearing surface.
4. Inspect reverse planet carrier for damaged teeth and worn roller bearings.
5. Inspect splines of reverse planet carrier for damage.
6. Inspect bronze oil pump drive for damage or excessive wear.
7. Inspect gear in reverse center gear and flange for damaged teeth and worn bushing. If replacement is necessary, renew assembly as the center gear is not furnished separately.
8. Inspect output shaft for scored thrust and bearings surfaces.
9. Inspect output shaft splines for nicks and burrs.

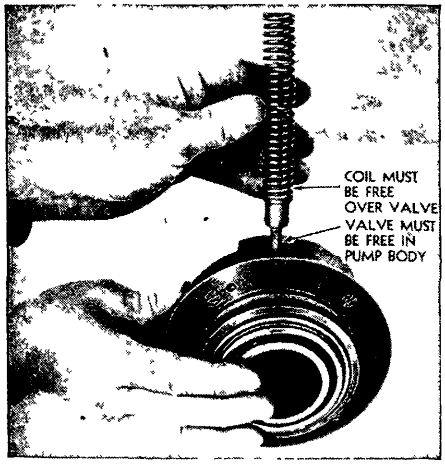


Fig. 80 Checking fit of pressure regulator valve

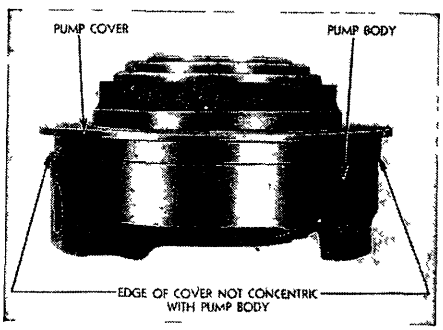


Fig. 81 Inspect fit of pump body to front cover

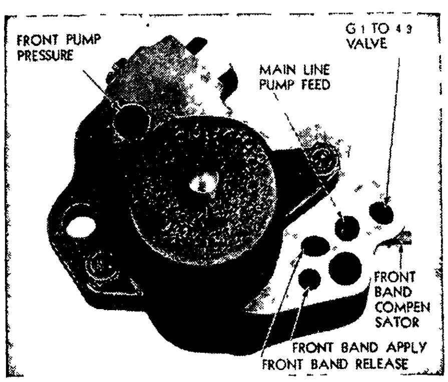


Fig. 82 Oil passages in front servo

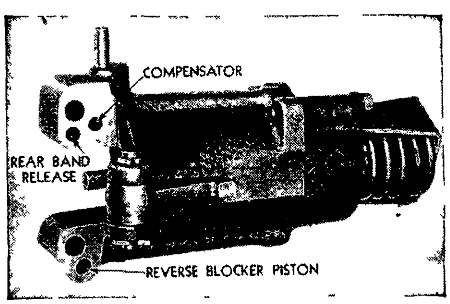


Fig. 83 Oil passages in rear serv

10. Inspect output shaft pinion gears for damaged teeth or worn bearings.
11. Inspect steel and bronze thrust washers for excessive wear.
12. Inspect rear bearing retainer bushing for excessive wear and see that oil holes in retainer are open.
13. Inspect mainshaft for damaged gear teeth, thrust and bearing surfaces.
14. Clean all parts and make a list of those to be replaced.

Inspection of Front Pump and Front Drive Gear—

1. Inspect pump drive and driven gears for damaged teeth or scored end surfaces.
2. Inspect pump body for scored gear pockets.
3. Inspect all passages for obstruction. Be sure small drilled hole at end of pressure regulator bore is open.
4. Inspect babbitt bushing in body for wear or scores.
5. Inspect the fit of the pump body to the front cover Fig. 81. If the edge of the cover is not concentric with the pump body and the babbitt bushing shows excessive wear on one side, it is an indication that the bushing is not concentric with the cover.

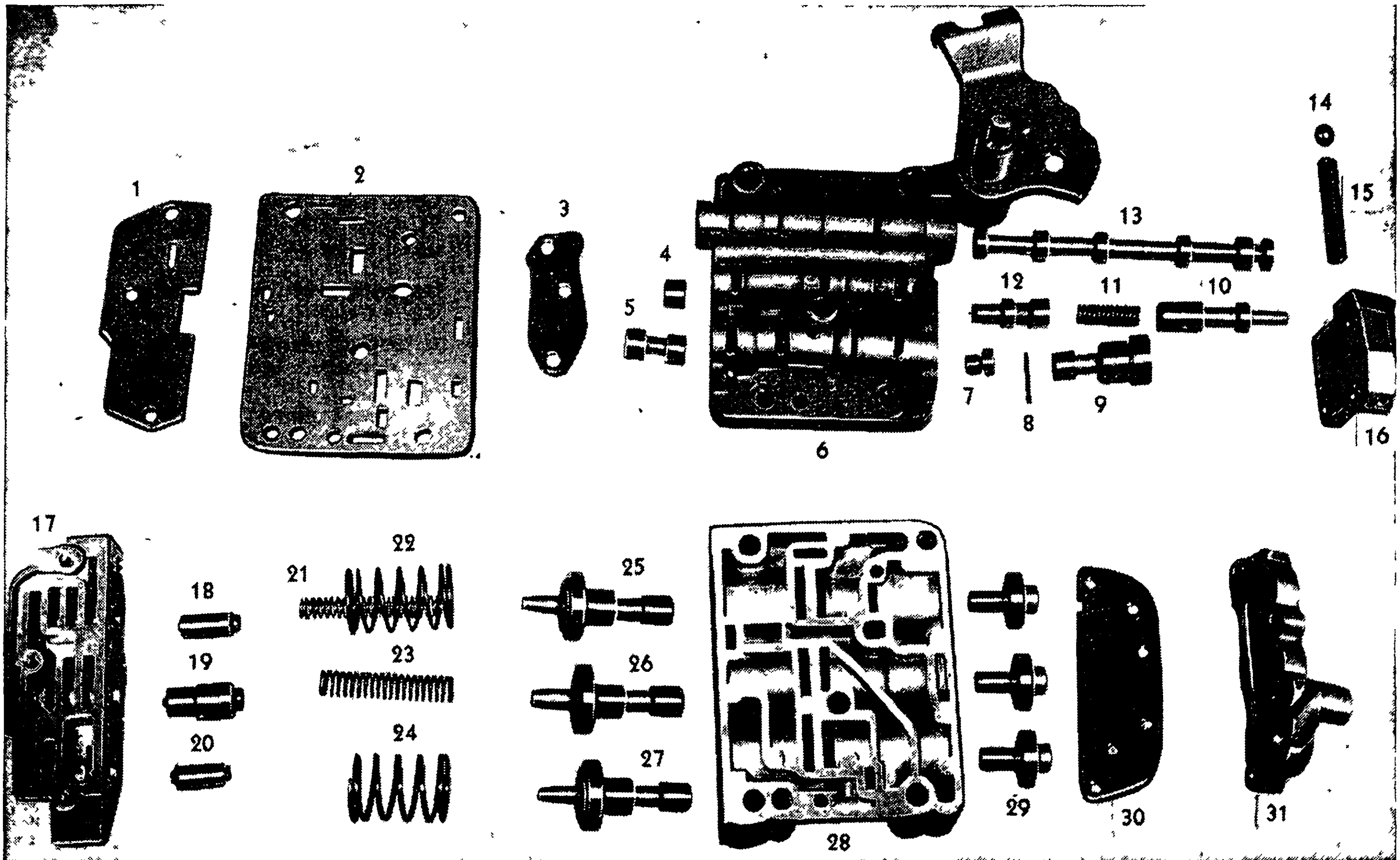
A badly misaligned pump cover and pump body causing excessive wear of the babbitt bushing will no doubt cause excessive wear in the pump gears. This condition will also show up in excessive wear between the small pump gear and crescent. If this condition exists, install a new front pump assembly.

If the front pump alignment is correct, but excessive wear is present on one side of the babbitt bushing, a careful check should be made of the torus cover run-out at the hub which must not exceed .005" total dial indicator reading.

6. Inspect pump cover for scored surfaces, loose dowels or obstructed passages.
7. Inspect oil seal rings for damage and freedom in grooves.
8. Inspect front drive gear for scored surfaces, worn bushings or damaged teeth.
9. Inspect woodruff keys for wear or looseness.
10. If any one of the following parts is damaged, it will be necessary to replace the complete pump assembly — pump gears, body, cover, or front drive gear bushing in pump body.
11. Check for freedom of relief valve in bore, and the spring for weakness.
12. Clean all parts and make a list of those to be replaced.

Inspection of Governor and Rear Pump—

1. Inspect pump gears for damaged teeth.
2. Inspect cover and gear pockets in body for scores.
3. Inspect governor ring lands and rings for freedom in grooves. If lands are damaged or worn thin, replace the complete governor.
4. Inspect both plungers for free movement.
5. If the G-1 plunger still sticks after the governor is cleaned, replace the gov-



1 FRONT VALVE BODY PLATE
2 VALVE BODY SPACER PLATE
3 OUTER VALVE BODY FRONT PLATE
4 DETENT PLUG
5 COMPENSATOR VALVE
6 OUTER VALVE BODY
7 COMPENSATOR AUXILIARY PLUG
8 AUXILIARY PLUG PIN
9 DOUBLE TRANSITION VALVE
10 T VALVE
11 THROTTLE VALVE SPRING
12 THROTTLE VALVE
13 MANUAL CONTROL VALVE
14 DETENT BALL
15 DETENT SPRING
16 DETENT BALL RETAINER
17 FRONT VALVE BODY
18 2-3 REG. PLUG
19 1-2 REG. PLUG
20 3-4 REG. PLUG
21 2-3 REG. PLUG SPRING
22 2-3 VALVE SPRING
23 1-2 REG. PLUG SPRING
24 3-4 VALVE SPRING
25 2-3 SHIFTER VALVE
26 1-2 SHIFTER VALVE
27 3-4 SHIFTER VALVE
28 INNER VALVE BODY
29 GOVERNOR PLUGS
30 INNER VALVE BODY REAR PLATE
31 VALVE BODY REAR COVER

Fig. 84 Control valve disassembled, 1946-51

ernor assembly. If only the G-2 plunger sticks, replace the G-2 plunger and bushing.

6. Inspect governor oil delivery sleeve for ring scores.

7. Check governor plug for freedom in its bore.

8. Clean all parts and make a list of those to be replaced.

Inspection of Front Servo—Fig. 82.

1. Inspect servo body for scores and obstructed passages.

2. Inspect servo piston for scores, broken rings, freedom of rings in grooves, and obstructed passages.

3. Inspect front band release cylinder for scores.

4. Inspect front band release piston for scores, broken ring, and freedom of ring in groove.

5. Inspect 4 to 3 valve for obstructed orifice or scores.

6. Inspect front servo springs for distortion or collapsed coils.

7. Clean all parts and make a list of those to be replaced.

Inspection of Rear Servo—Fig. 83.

1. Inspect servo body for scores and obstructed passages.

2. Inspect actuating lever for free operation and worn socket.

3. Inspect booster piston for scores, broken rings, and freedom of rings in grooves.

4. Inspect accumulator body for scores or obstructed passages. Be sure check valve is not broken and the check valve plunger is free.

5. Inspect accumulator piston for scores, damaged rings, freedom of rings in grooves, or obstructed passage in stem.

6. Inspect compensator piston for scores, damaged ring, and freedom of ring in groove.

7. Inspect all servo springs for damage, distortion or collapsed coils.

8. Clean all parts and make a list of those to be replaced.

Inspection of Control Valve—Fig. 84. Before inspecting the control body and valves, thoroughly clean them in clean gasoline or other cleaning fluid.

Valves can be assumed to be free in their operating position if they will fall of their own weight in their respective bores when the valve body is shaken slightly. Do not drop valves. All governor plugs are interchangeable. Likewise, the 2 to 3 and 3 to 4 shifter valves are interchangeable. Therefore, if it is found that a shifter valve or governor plug does not slide freely in one bore of the valve body, attempt correcting by trying it to a different bore.

1. Inspect all valves carefully to see that they are free from burrs and not damaged in any way. Burrs can be re-

moved by carefully using fine crocus cloth. This type of valve has sharp corners to prevent dirt from wedging between valve and body; therefore, when removing burrs, do not round off square edges.

2. With valves and body clean and dry, check each shifter valve, plug, and regulator plug for free movement in their respective bores and operating positions. The manual control valve is the only valve furnished separately. If it becomes necessary to replace one of the other valves or one of the bodies (inner or outer) a complete inner valve body with front valve body may be replaced, or a complete outer valve body less the manual control valve may be replaced. The spacer plate between the inner and outer body is furnished separately.

3. Check the fit of the throttle valve inside lever and shaft in the hub in the inside detent control lever on the outer valve body.

Inspection of Torus Cover Check Valve—

1. Inspect the bearing surface of the check valve for scores.

2. Inspect the inside bearing diameter of valve for scores.

3. Check movement of valve over hub of driven torus member.

Inspection of Torus Cover—

1. Inspect inner and outer diameter of torus cover oil seal hub for scores.

2. Inspect grooved gasket surface for nicks or burrs. Two continuous ridges should appear on the sealing surface.

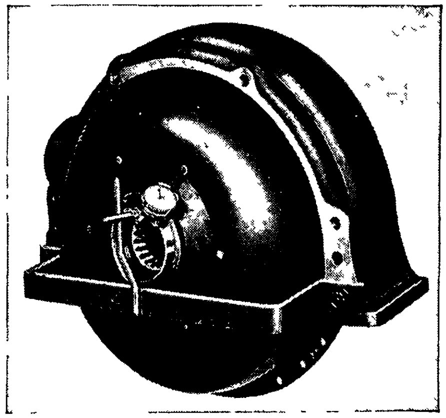


Fig. 85 Checking run-out of torus cover

3. Inspect the splines of hub for wear or damage.

4. Check the torus cover for run-out by assembling the torus cover to the flywheel, using four bolts evenly spaced. Assemble a dial indicator to a tool of the type shown in Fig. 85. Rotate the cover and observe the amount of run-out. If it exceeds .005", and flywheel run-out (see below) does not exceed .005", replace torus cover.

Inspection of Flywheel — Inspect the sealing surface which bears against the torus cover-to-flywheel gasket for nicks or burrs. Inspect the flywheel gear teeth for damage. Check the flywheel run-out with a dial indicator mounted so the stem will contact the sealing surface just inside the row of torus cover bolt holes. Flywheel run-out should not exceed .005" total indicator reading.

Inspection of Reverse Shifter Bracket and Crank (1946-50)—

1. Inspect the bracket and crank to see that the crank operates freely in the bracket without binding but does not show signs of unusual wear.

2. Check the crank roller for signs of unusual wear.

3. Inspect the crank pin which carries the roller to see that there are no visible cracks at the point where the pin joins the crank.

4. Clean and inspect the oil passage to the blocker piston.

5. Inspect the blocker piston and its bore in the bracket to see that both are free of scores and burrs. Check the fit of the blocker piston in its bore to insure a non-binding, non-leaking fit. This can be done by placing one finger over the oil hole to the piston, pulling the piston outward, and observing if a slight vacuum is created.

6. Inspect the reverse anchor for broken teeth and for cracks, especially in the areas at the base of the teeth and around the hole for the anchor support bolt.

ASSEMBLING HYDRA-MATIC TRANSMISSION

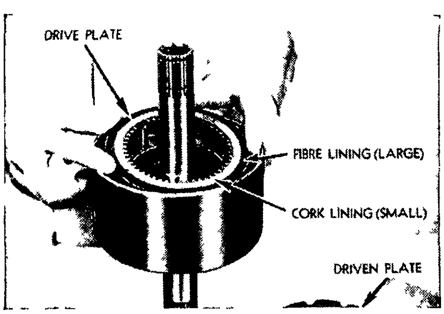
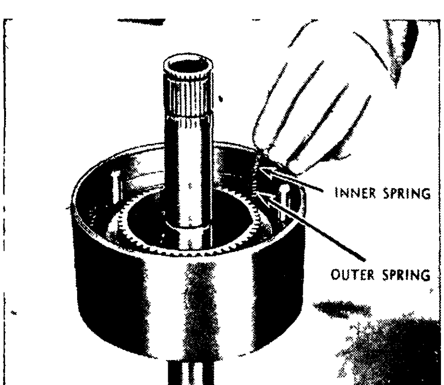


Fig. 86 T assemble front unit, start with c mp siti n clutch plate and finish with a st el plate. Assemble steel plates with squar n tches over drive pins. Apply Hydra-Matic fluid to face of each plate as assembled



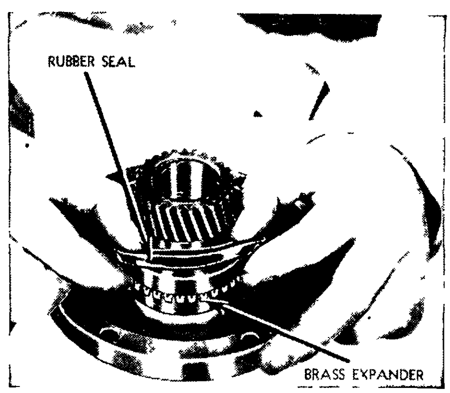


Fig. 88 Install new brass expander into ring groove in clutch drum with expanding lips down. While holding expander in position, work new rubber seal into ring groove with lip down over expander. Work expander well back into position under seal so brass edges are not exposed

Fig. 87 Install clutch release inner and outer springs

Fig. 90 Install piston int clutch drum so it rests n uter rubb r seal. Align square n tches in piston with h les in drum. Guide seal int b re with flat sid f blunt screw driver

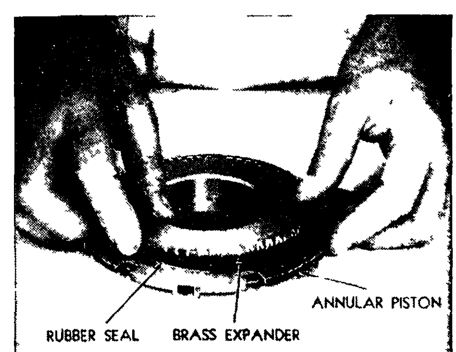


Fig. 89 Place new rubber seal ver piston beyond seal groove. Install new brass expander with lips up. Work rubb r seal well into groove with lip up. See that brass edges of expander are n t exp s d

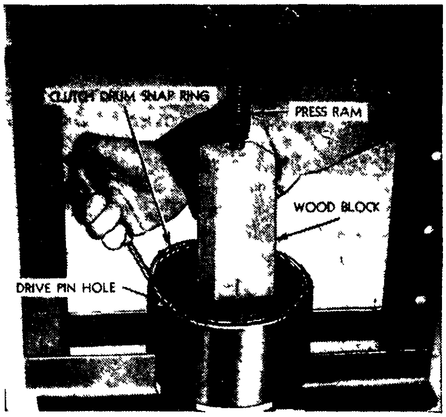


Fig. 91 Install clutch drum and piston over planet carri r into drum, being sure clutch r leas springs enter into recesses of pis- t n. Then lift fr nt unit off planet carrier, place in press and press clutch drum below snap ring gr v . Install snap ring with gap p sitioned between two drive pin h l s. Snap ring must be well seated into gro v to prev nt interference with ledge on drum. R l ase press and remove as- sembly

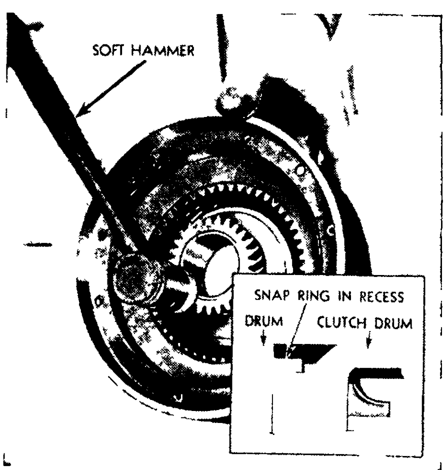


Fig. 92 Tap fr nt face of center gear so clutch drum will seat against snap ring

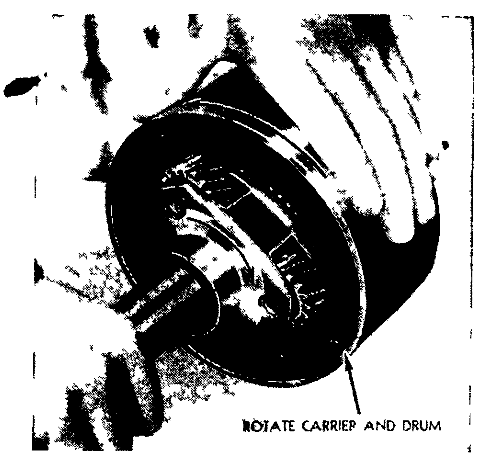


Fig. 93 Insert planet carrier into clutch plat s by r lling drum n b nch while pr ssing carrier int plat s

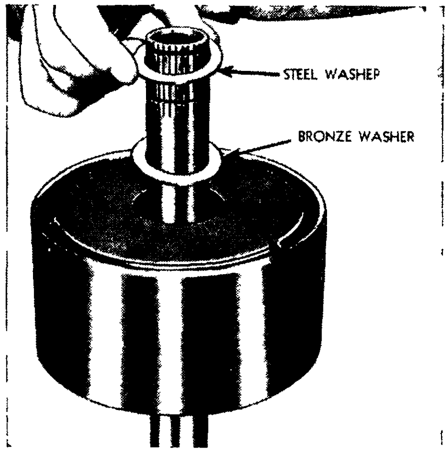


Fig. 94 Install bronze then steel washer over carrier. Locating lug on steel washer must fit over flat portion of planet carrier. Install snap ring over carrier into groove above steel washer

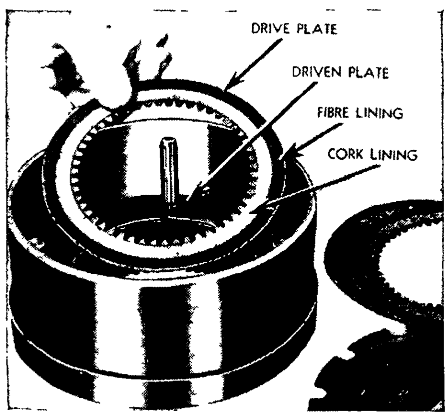


Fig. 95 To assemble rear unit, start with a composition clutch plate and finish with a steel plate. Driven (steel) plates are as- sembled with square notches over drive pins. Apply Hydra-Matic fluid to each plate as assembled

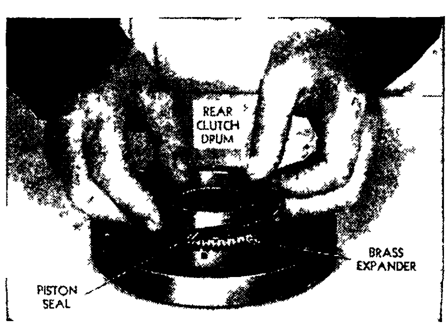


Fig. 96 Install new rubber seal v r brass expander in same mann r as f r fr nt unit clutch drum xc pt that the lips f s al and xpander must fac d wn. Install new rub- ber s al and brass xpander in pist n with lips up

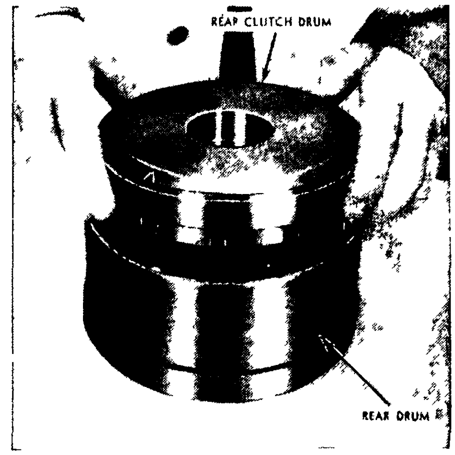


Fig. 97 Install rear clutch drum and pist n over drive pins int drum.

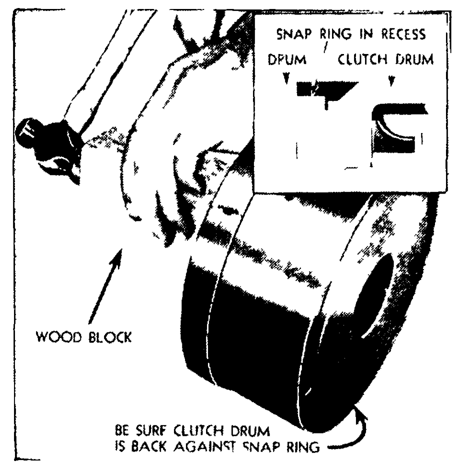


Fig. 98 After installing clutch drum snap ring, tap clutch drum rear thrust fac until drum seats against snap ring

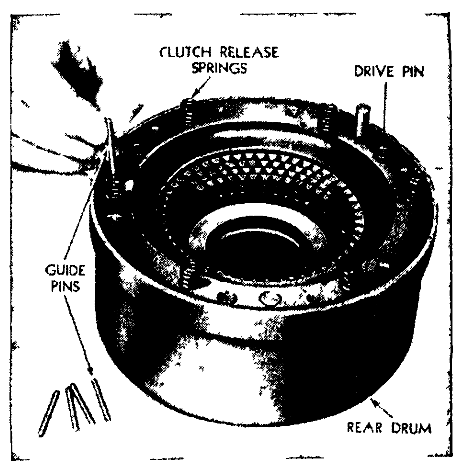


Fig. 99 Install inn r and uter clutch re- lease springs into recess s in pist n. Then install spring guide pins

Fig. 100 Assemble internal gear to rear drum, locating n dowel, and install retaining screws

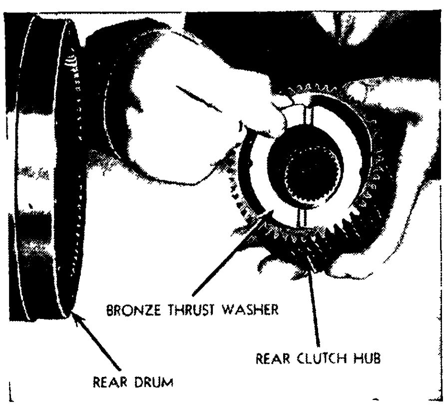


Fig. 101 Install front bronze thrust washer into d p c unt rbore in rear clutch hub and r tain with vaseline

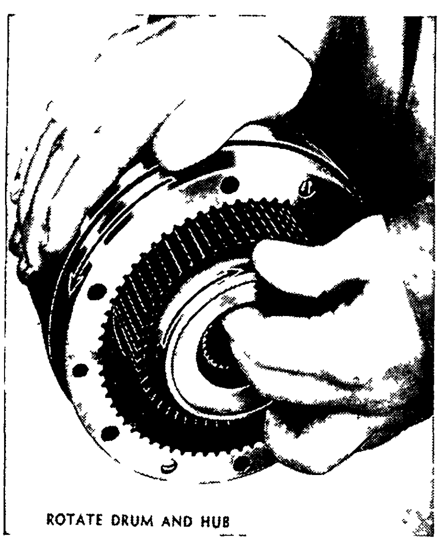


Fig. 102 Install rear clutch hub and thrust washer int clutch driv plat s. Rotat hub and drum on bench t mesh splines with teeth f plat s

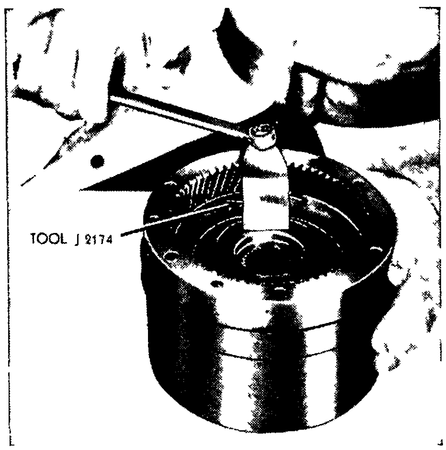


Fig. 103 Install rear clutch hub holding tool to hold hub in place. Use a reverse drive flange attaching bolt to hold tool

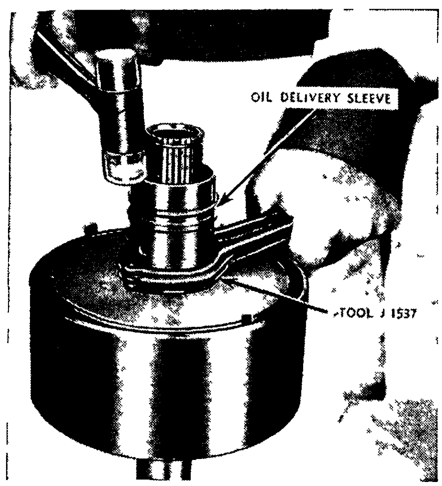


Fig. 104 Install oil delivery sleeve with long bearing up. Use ring compressor to compress exposed rings. Install snap ring into second groove on planet carrier.

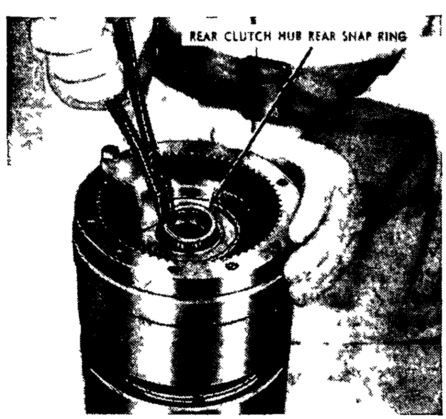


Fig. 105 C mpress xp sed il deliv ry sle ve rings, install rear drum n plan t carrier, and install r ar clutch hub snap ring. N t —B th the fr nt drum and r ar drum sh uld be free t r tate under slight f rce. If either drum binds, disassembl the unit and c rrect th trouble

Fig. 106 To assemble the rev rse unit, install thrust washers as sh wn, using vaseline to retain in place. Plac this assembly over out-put shaft. Do not disl cate washers

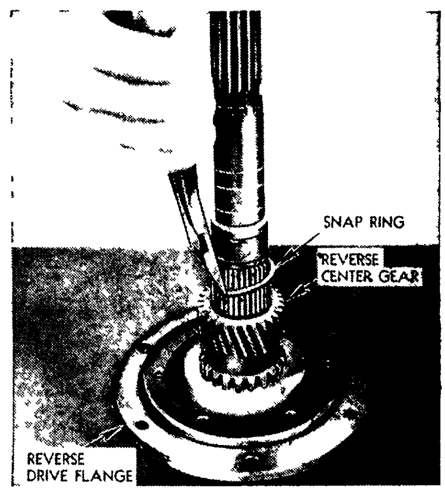


Fig. 107 Install reverse cent r gear snap ring (this ring is slightly larg r than oth r snap rings used in transmissi n). Install reverse planet carrier over output shaft with bronze oil pump driver g ar d wn, meshing pinions with revers c nter gear. Assemble reverse internal g ar on gear support and install large snap ring

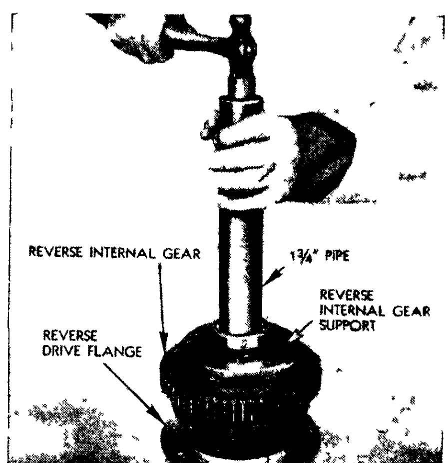


Fig. 108 Install ball bearing int c unterbor f int rnal g ar supp rt

Fig. 109 Install open type snap ring in gr ov f utput shaft behind inner race of ball bearing

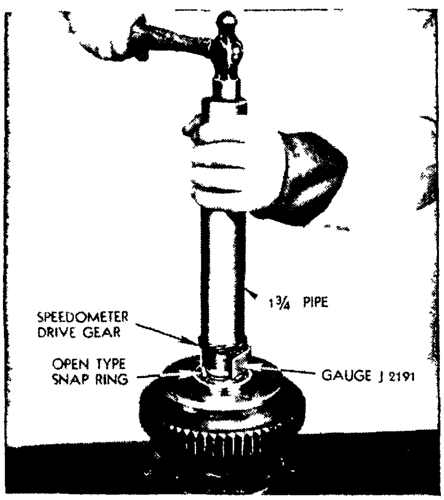


Fig. 110 Install speedometer drive gear, using spacer gauge shown

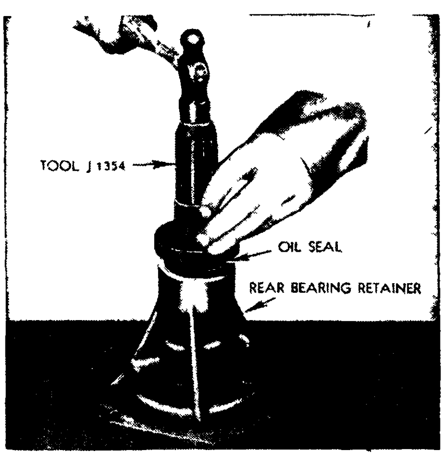


Fig. 111 Install rear bearing retainer seal. Slide retainer v r output shaft and line up attaching bolts in retain r with b lt holes in reverse internal g ar support. Tap h us-ing in plac . Dip threads f attaching b lts with c pper wash rs in s aling c mp und, start b lts and tighten finger tight. Final tight ning is d ne with retain r in case. Install speedometer driven gear and sleev

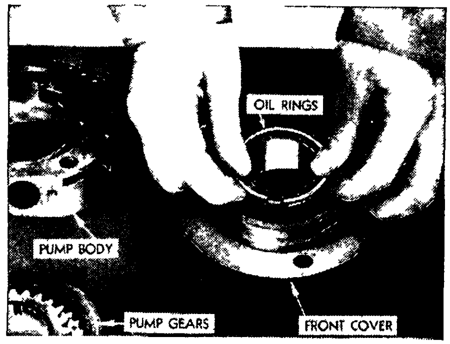


Fig. 112 To assemble front pump and drive gear, first check new ring gap in torus cover before installing rings on pump cover—gap should be .001 to .007″

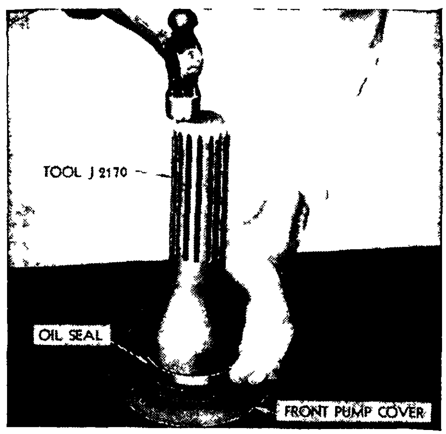


Fig. 113 Install new seal in pump cover with step side up. Then drive seal in place. Apply sealing compound around edge of cover and seal

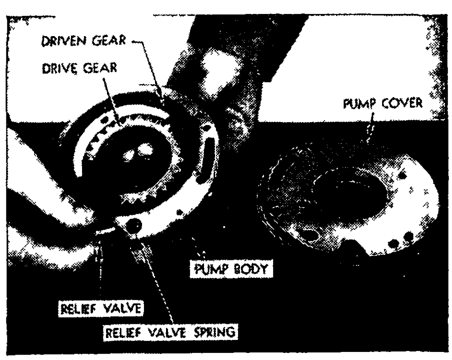


Fig. 114 Lubricate pump gears with Hydra-Matic fluid. Install gears in gear pockets, being sure Prussian blue mark previously made on gear is facing up

Fig. 118 Install G-2 plunger attaching screws. Then while holding G-2 plung r in, install plung r stop with two small h les up. B sure st p d s n t extend ab v surfac f gov rn r b dy. P siti n g vern r n drive flange with locating marks aligned. Tight n b lts t 6 to 8 p unds t rqu . In-stall g v rn r sl ev plug

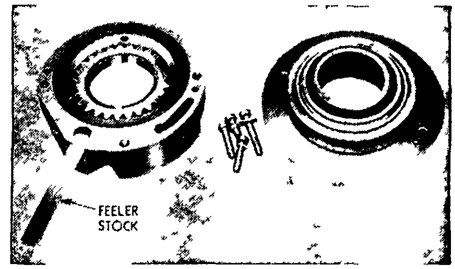


Fig. 115 Install relief valve and spring in pump body. Press down n valve and in-sert feeler stock in slot to h ld valv d wn. Place cover on pump b dy

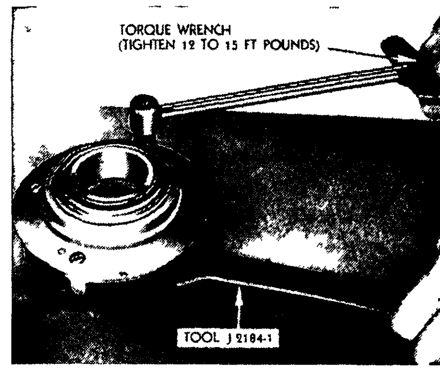


Fig. 116 Apply sealing c mp und under screw heads and fasten c ver t pump. Re-move feeler stock, turn pump ver and in-stall other screws. Assemble pump ver front drive gear, aligning k ys t keyways

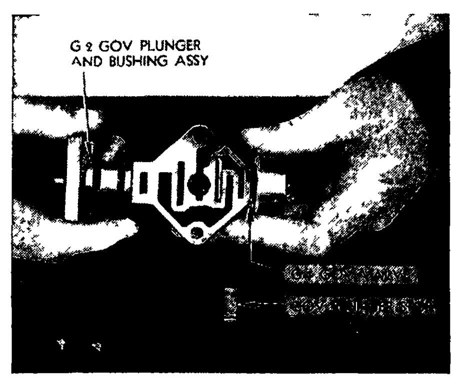


Fig. 117 To assemble g vern r and rear pump, install pump driven gear over shaft in body and install cover. Install G-2 governor plunger and bushing in g vern r body, with slot in bushing up

Fig. 119 To ass mble front servo, install 4 to 3 valve and insert spring retainer. Install screw plug over 4 to 3 valve. Install dowel pin if previously removed

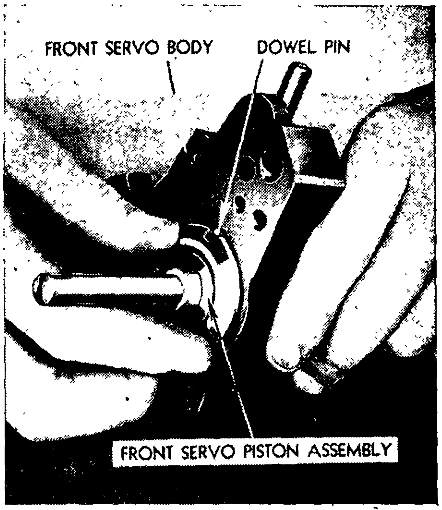


Fig. 120 Install servo piston

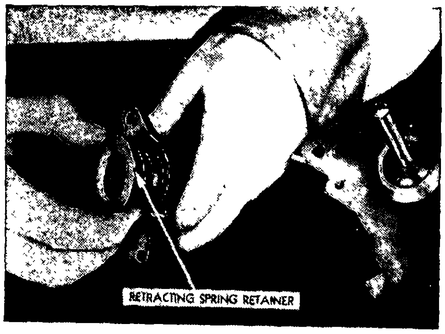


Fig. 121 Install front band rel ase pist n into cylinder, and the booster spring ver band release piston. Place retracting spring retainer over piston stem on b oster spring

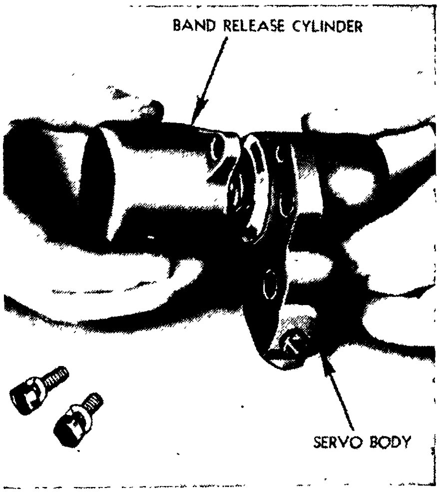


Fig. 122 Attach band release cylinder to servo body

Fig. 123 To assemble rear servo, install piston into servo body

Fig. 124 Install booster spring in b ster piston, and accumulator pist n in its b dy. Install accumulator apply spring ver rod with small tapered end s ating against shoulder

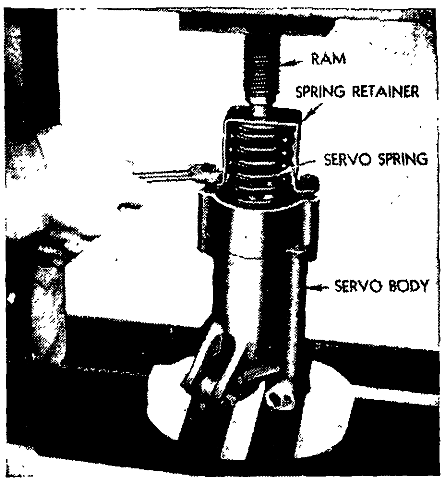


Fig. 125 Assembl accumulat r parts int serv body, place in press and tighten retain r scr ws. Us extreme care to av id breaking il seal ring n c mp nsat r pis- t n. T st perati n of servo by applying air pressure in r ar band r l as passag

ASSEMBLING TRANSMISSION

Position the front band over the front unit drum so the short anchor end will fit over the adjusting screw when the units are placed in the case. Hook a suitable spring or wire on the band to hold it on the drum.

Install the front and rear units in the case by lowering the front end of the planet carrier into the case first. Make sure the single hole in the oil delivery sleeve is centered between the center bearing cap bolt holes and is facing up.

Remove the spring and position the anchor end of the band over the adjusting screw. Install the rear band on the rear drum and position the anchor end of the band over the adjusting screw.

Position the center bearing cap over the oil delivery sleeve with the dowel registering with the single dowel hole in the sleeve. Lightly tap the bearing cap in place. Install a new center bearing cap lock plate under the attaching bolts and tighten the bolts to 40-50 foot pounds torque. Bend lock plate up around bolts. Do not use a screwdriver to pry up the corners of the lock plate as the lapped edges of the transmission case may be damaged.

Install the drum spacing tool (see Fig. 27) between the center bearing cap and the rear clutch drum to keep the drum from moving forward. Remove the holding tool from the rear drum. Position the rear clutch hub thrust washer in the counterbore of the hub, Fig. 126, and retain it with vaseline.

Install the mainshaft through the planet carrier from the rear. If the mainshaft did not have correct end clearance prior to disassembly, select a washer of suitable thickness to bring the end clearance within limits of .004 to .015". Washers of several thicknesses are available for this purpose. Install the washer in the counterbore of the output shaft, Fig. 127, and retain it with vaseline.

Position reverse assembly into rear end of transmission case, Fig. 128, so that mounting bolt holes are in line. Revolve output shaft to facilitate meshing the gears.

Position reverse anchor in case and install reverse anchor support bolt and lock, Fig. 129. Do not tighten bolt. Just start the rear bearing retainer attaching

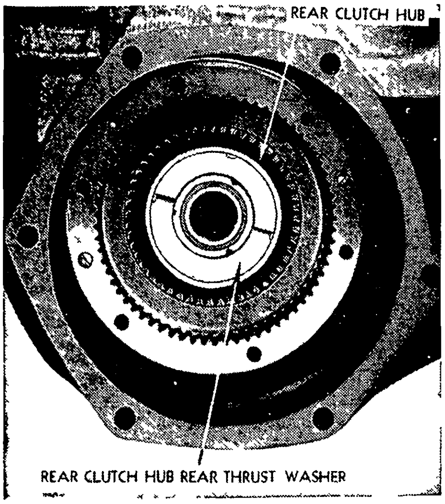


Fig. 126 Installing thrust washer in rear clutch hub

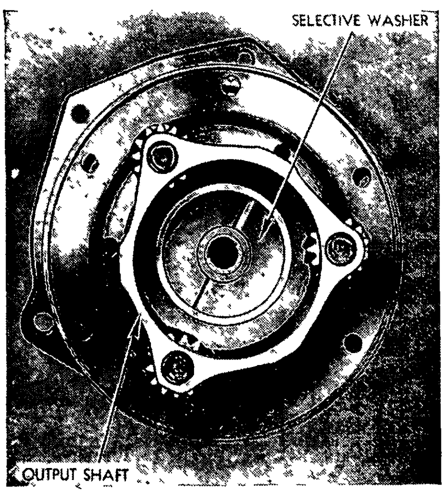


Fig. 127 Installing selective washer

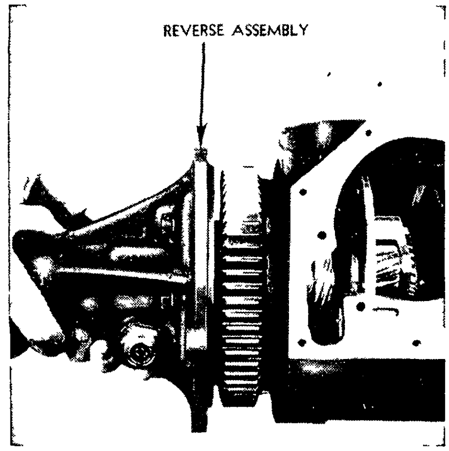


Fig. 128 Installing reverse assembly

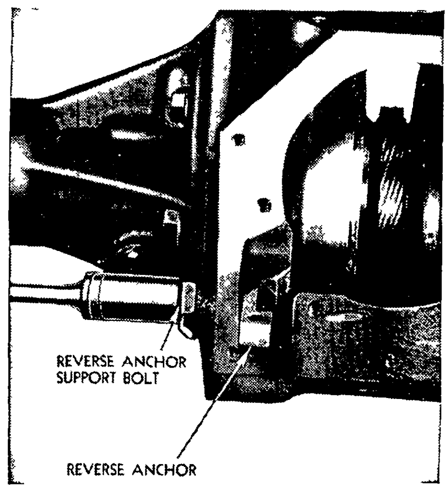


Fig. 129 Installing reverse anchor

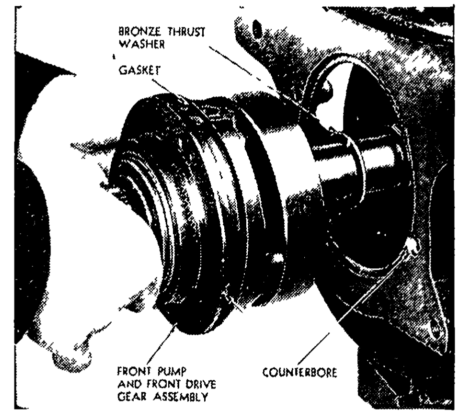


Fig. 130 Installing front pump and drive gear

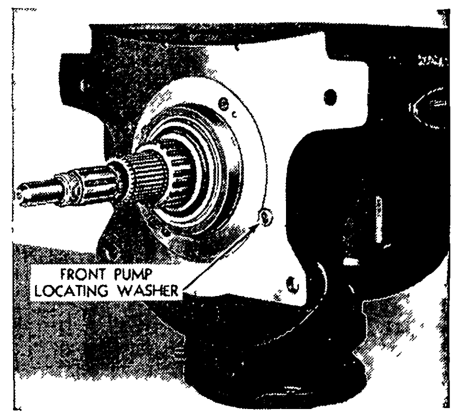


Fig. 131 Pump cover locating wash r installed

bolts. Align the holes in the reverse drive flange and rear drum and install the bolts, tightening them to 10-13 foot pounds torque.

Push or tap rear bearing retainer into case, then tighten mounting bolts and reverse anchor bolt to 28-33 foot pounds torque. Turn up the reverse anchor support bolt lock.

Tighten the rear bearing retainer bolts to 28-33 foot pounds torque. Test for freedom of operation by turning the mainshaft, output shaft and front and rear drums.

To install the front pump and front drive gear, position the bronze thrust washer over the planet carrier, Fig. 130. Install the pump cover gasket and install the pump and drive gear. Align the locating counterbore in pump cover with counterbore in case. Install pump cover locating washer, Fig. 131. Install two pump attaching bolts with large flat copper washers finger tight. These bolts will be tightened after front servo is installed.

Install the bronze, then steel thrust washer over the planet carrier, against front end of front drive gear. These washers were tied together during disassembly. Install the snap ring holding the thrust washers in place. Install open type snap ring in groove in mainshaft.

Check the mainshaft end clearance as described when the transmission was disassembled. If the end clearance is not within limits of .004 to .015", disassemble and install the correct selective washer. After checking clearance, remove special tool from between front clutch drum and center bearing cap, and the dial indicator.

To install the governor and rear pump, position the large round governor weight to the front of the transmission and locate one reverse drive flange attaching bolt up to provide clearance for the pump and governor to slide into the transmission. After sliding into place, install and tighten the attaching bolts to 15-18 foot pounds torque.

To install the control valve, place three oil delivery pipes into holes in governor oil delivery sleeve and pull oil delivery sleeve out 1/8". Then with inside detent control lever in LO position, push control valve onto oil delivery pipes. Lower the control valve into position and push delivery sleeve in to bring control valve against case. Install the attaching bolts and tighten to 6-8 foot pounds torque. Make sure governor oil delivery sleeve plug is in place. Check the governor run-out as described when the transmission was disassembled.

To install the reverse shifter bracket and crank, position the retracting spring and roller on the bracket, Fig 132. Assemble the bracket and shims to the transmission, Fig. 133. Install attaching bolts and tighten to 15-18 foot pounds torque.

Check backlash between reverse internal gear and anchor as follows: Install gauge as shown in Fig. 134. Place the inside detent control lever in reverse position. Hold reverse anchor against bolt with screw driver to prevent float. Rock reverse gear and take reading on dial indicator. Steel shims to be either removed or installed to obtain correct backlash of .016" to .049". To increase backlash add shims; to decrease remove shims.

To install the front and rear servos, slip in the front pump delivery pipe in the front pump body. Insert the plain end of the rear pump discharge pipe into the hole in the rear pump. Position the front servo with piston stem in socket on end of front band. Place servo on front pump delivery pipe. Enter rear pump discharge pipe into brass fitting in servo. Lower servo in case. Enter the front servo attaching bolts only 2 or 3 threads.

Place the rear servo in position, engaging rear band strut with actuating lever while entering oil transfer pipe

from front servo. Enter the rear servo attaching bolts, then tighten all four servo attaching bolts to 23-28 foot pounds torque. Tighten the coupling end of the rear pump discharge pipe in front servo. Install the front pump intake pipe to the front pump, using a new gasket and attaching bolt locks, Fig. 135. Tighten bolts to 10-12 foot pounds torque and bend locks against flats of bolts. Tighten two front pump attaching bolts to 10-13 foot pounds torque. Note—Cover should protrude .003 to .015" out of case. If it protrudes less than .003", add a pump cover gasket.

To adjust the front band, remove the pipe plug from the front servo. Loosen the "hex" adjusting screw of the gauge, Fig. 136, until about ⅛" of the threads are exposed above the gauge body. Install the gauge, tightening by hand only. Tighten the "hex" adjusting screw with fingers until the stem of gauge is felt just to touch piston in front servo. While tightening screw be sure band is lined up over drum.

Tighten the "hex" adjusting screw with a wrench six complete turns from the point where it was felt by hand that it just touched the piston. Then tighten the front band adjusting screw until the knurled washer on top of the band adjusting gauge is just free to turn. Hold the band adjusting screw and tighten the lock nut to 40-50 foot pounds torque. Finally, loosen the "hex" adjusting sorew at least six full turns and remove gauge. Install and tighten the pipe plug.

To adjust the rear band, center it on the drum and tighten the adjusting screw until the actuating lever contacts the face of the gauge shown in Fig. 137. The gauge shown is for Pontiac units so be sure to use the proper gauge for other car company transmissions. Caution—Do not go beyond the adjustment. If adjusting screw is accidentally turned beyond adjustment, loosen two or three turns and repeat adjustment. Hold the adjusting screw and tighten the lock nut to 40-50 foot pounds torque.

To install the pressure regulator and pressure line plug, place a new gasket over the plug. Then with the pressure regulator valve and guide in the spring, locate the valve on the seat in the front pump. Apply pressure on the regulator plug and tighten in transmission case to 40-50 foot pounds torque. Apply sealing compound to the threads of the oil pressure line plug and install the plug between the band adjusting screws.

To install the side cover and outer shift lever, place a new gasket on the side cover and retain in place with vaseline. Position the side cover over the manual shaft. Install the cover attaching bolts with copper washers finger tight. Shift cover to centralize manual shaft in hole and tighten bolts to 10-12 foot pounds torque.

Install the outer shift lever and tighten the clamp bolt to 10-13 foot pounds torque. The throttle control lever, which was removed while the transmission was in the car, should not be installed until after the unit is installed. This will prevent accidentally bending the lever.

To install the oil screen and pan, slide the oil screen over the front pump intake pipe and position over rear pump intake pipe. With a new gasket placed on the transmission case install the pan and tighten the pan bolts to 10-13 foot pounds torque. Soak a new gasket in water until pliable and install with drain plug, tightening plug 35-45 lbs. ft.

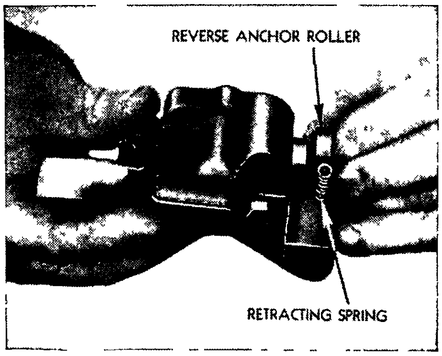


Fig. 132 Assembling spring and roller on reverse shifter bracket

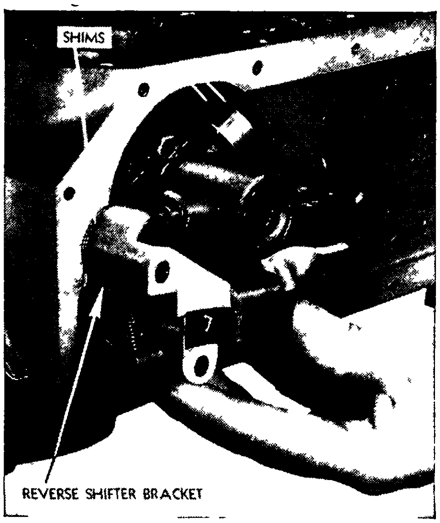


Fig. 133 Installing reverse shifter bracket and crank assembly

To install the rear flywheel housing and torus members, position a new gasket against the face of the transmission. Install the rear flywheel housing and tighten the attaching bolts to 40-50 foot pounds torque. Install the torus cover on the splines of the front drive gear. Push cover on evenly, without rocking, to prevent damage to oil seal and rings. Install the drive torus on the splines of the front planet carrier and install the snap ring.

Move shift lever (inner) into reverse position. Install a new mainshaft nut lock plate with ear over flat on torus hub and install mainshaft nut, tightening it to 15-20 foot pounds torque. Bend lock plate up against the nut, and install oil level indicator.

EXTERNAL ADJUSTMENT OF HYDRA-MATIC BANDS

Caution—Do not attempt to adjust bands externally without a tachometer and the tool shown in Fig. 138. If this equipment is not available, remove the pan and adjust as described previously.

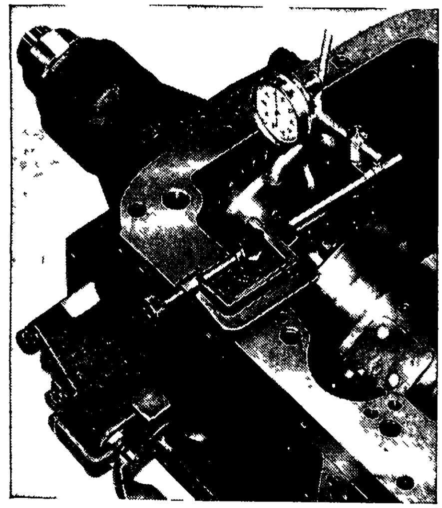


Fig. 134 Checking backlash betw n reverse internal gear and anchor

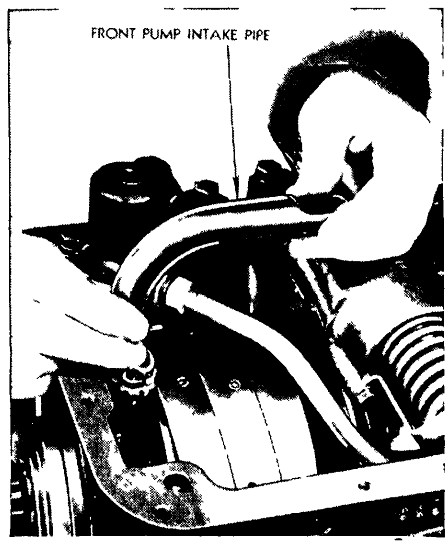


Fig. 135 Installing front pump intak pip

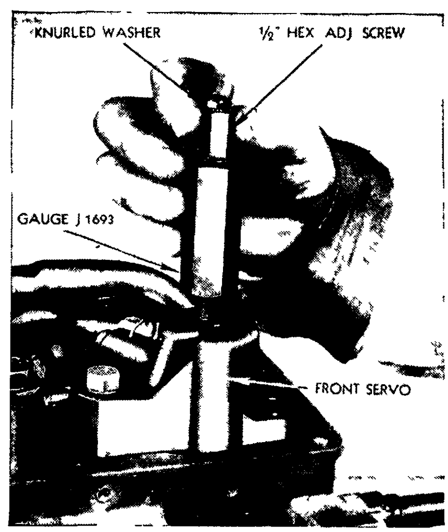


Fig. 136 Adjusting front band

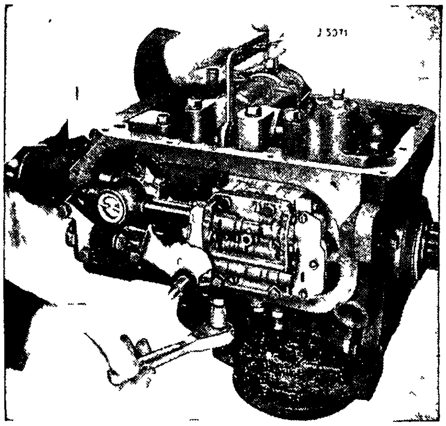


Fig. 137 Adjusting rear band

1. Set hand brake firmly and block front wheels to prevent car running forward during adjustment.
2. Remove accelerator pedal, floor mat and adjusting hole cover.
3. Start engine and allow it to run until temperature is normal (choke and fast idle off) before proceeding.
4. Connect tachometer to engine and set to correspond to distributor cam.
5. Position control lever in DR position.

NOTE—Due to changes in 1950 transmission, this adjusting procedure should be carried out with the selector lever in the "LO" range position.

6. Adjust carburetor idle screw to give 700 RPM.

FRONT BAND—

1. Using band adjusting tool, Fig. 138, loosen front band adjusting screw lock nut.
2. Loosen band adjusting screw until engine speed increases to 900-1000 RPM (front drum now spinning freely).
3. Tighten band adjusting screw slowly until engine returns to 700 RPM (front drum now stopped).
4. Loosen band adjusting screw until engine speed increases and tighten again slowly until engine speed returns to 700 RPM. NOTE—The object in loosening and retightening the screw is to locate the exact point at which the band stops the drum from spinning. At this point wait 30 seconds. If engine speed increases, tighten screw 1/10 of a turn. Wait 30 seconds and if engine speed again increases, tighten screw 1/10 of a turn more. Repeat this procedure until engine speed remains at 700 RPM for at least 30 seconds.
5. Set counter on tool to 00.
6. While holding lock nut stationary with long handle of tool, tighten adjusting screw exactly 5½ turns with short handle of tool (counter will read 5.5).
7. Hold adjusting screw stationary with short handle and tighten lock nut with long handle.

NOTE — In operation 2 above under *Front Band,* if engine fails to increase speed to 900-1000 RPM, this is an indication that the band is slipping badly under normal driving conditions. The bottom pan should then be dropped and

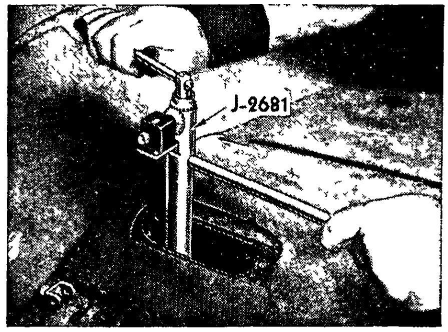


Fig. 138 Adjusting bands by external method

the bands and drums inspected for damage. If no apparent damage is evident, adjust both bands by the internal method. It will not then be necessary to reset the bands externally after the pan is installed.

REAR BAND—Repeat operations 1, 2, 3, 4 and 5 under heading *Front Band,* and proceed as follows:

1. Position selector lever in N position.
2. While holding lock nut stationary with long handle of tool, tighten band adjusting screw exactly two turns with short handle (counter will read 2.0).
3. Position selector lever in DR position.
4. Hold adjusting screw stationary with short handle and tighten lock nut with long handle.
5. Reset engine idle to 375 RPM (selector lever in N position).
6. Turn off ignition.
7. Install adjusting hole cover, floor mat and accelerator pedal.

FRICTION TYPE REVERSE, 1951-52

Starting with 1951 production, the Hydra-Matic transmission is equipped with a cone clutch reverse mechanism which makes the shift into reverse much faster. This feature makes it possible to "rock" the car in order to get out of mud, snow or sand. Shifting into reverse can be accomplished while the car is moving forward at speeds under 10 mph. A reverse inhibitor prevents reverse shifts above 10 mph.

OPERATION OF REVERSE CONE

When the selector lever is moved to the reverse position, oil is directed from the valve body through the reverse clutch oil pipe, through the case, and then into the reverse assembly. Oil is retained in the reverse assembly with two seals; an inner seal on the rear bearing retainer and an outer seal on the cone clutch piston, Fig. 139.

While under pressure, oil pushes the cone clutch piston forward, engaging the internal surface of the reverse cone. This action forces the entire reverse cone forward, causing the outside surface of the reverse cone to contact the stationary cone, thereby holding the reverse internal gear by friction.

When the selector lever is moved to any other position, the cone clutch piston releases. When pressure is cut off, the six clutch piston release springs disengage the piston. When the piston is applied, there is some float in the reverse internal gear. To get a release, the reverse internal gear must be centralized. This is obtained through the action of the reverse clutch release spring installed on the inside of the reverse internal gear.

Teeth cut on the outside of the internal gear are used only for parking.

REMOVING REVERSE ASSEMBLY

The removal operation of the reverse bearing retainer and reverse unit can be done with the transmission installed in the car. The procedure is as follows:

1. With oil pan, front and rear servos, governor and control valve assembly removed, take out the six reverse center gear and drive flange attaching bolts. Insert a screwdriver between the front clutch and center bearing cap to hold the front planet unit forward. Tool No. J-2173 may also be used for this purpose.
2. Remove the rear bearing retainer-to-transmission attaching bolts and the parking brake pawl support bolt.
3. Remove speedometer driven gear and sleeve assembly from rear bearing retainer.
4. Remove snap ring on output shaft inside of rear bearing retainer at ball bearing. This snap ring is smaller than other snap rings used in the transmission.
5. With output shaft standing on carrier end, remove bearing retainer from output shaft. It may be necessary to tap out shaft with rawhide or plastic hammer while holding rear bearing retainer to separate units.
6. Remove reverse internal gear and stationary cone from rear bearing retainer by compressing stationary cone by hand, Fig. 140.
7. Remove snap ring locating ball bearing in rear bearing retainer with a screwdriver. Snap ring will be damaged during removal.
8. Remove ball bearing from rear bearing retainer. It may be necessary to tap bearing toward rear of bearing retainer.
9. With special tool J-4670, Fig. 141, compress reverse cone clutch release coil springs and remove large snap ring.
10. Remove tool and coil spring retainer.
11. Remove the six coil springs.
12. Remove reverse piston by pulling straight out. Do not try to turn piston since it is located by four dowel pins. It may be necessary to apply air pressure behind piston to aid in removal. Apply pressure in small hole at "A" in Fig. 142.
13. Remove outer oil seal from reverse piston, Fig. 143.
14. Remove reverse piston inner oil seal from hub on rear bearing retainer.
15. Remove large bronze thrust washer from reverse internal gear.
16. Remove reverse stationary cone from reverse internal gear cone by using large snap ring pliers to expand cone, Fig. 144. Do not expand cone more than absolutely necessary when removing.
17. Remove reverse clutch release flat spring and spring retainer from re-

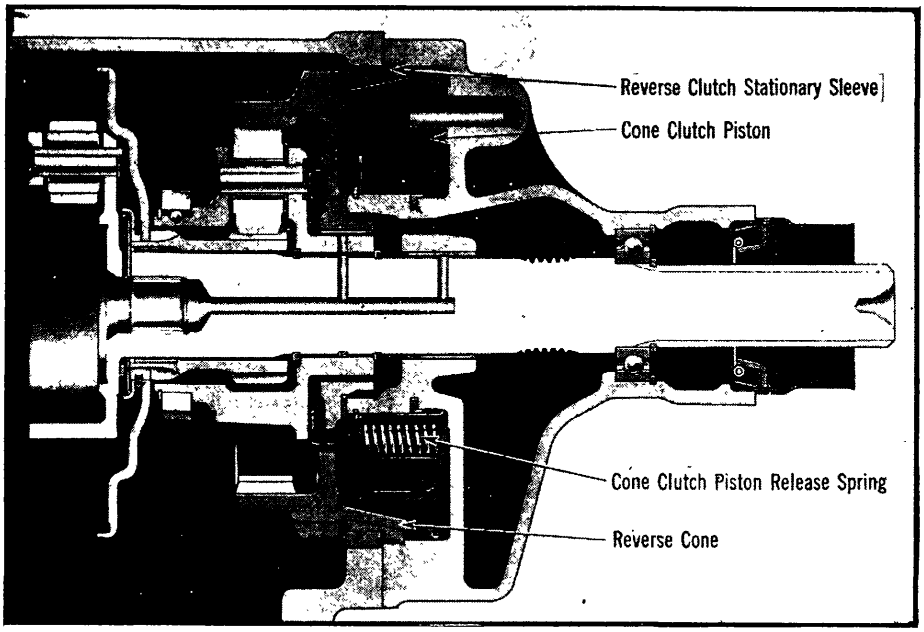


Fig. 139 Friction type reverse mechanism. 1951-52

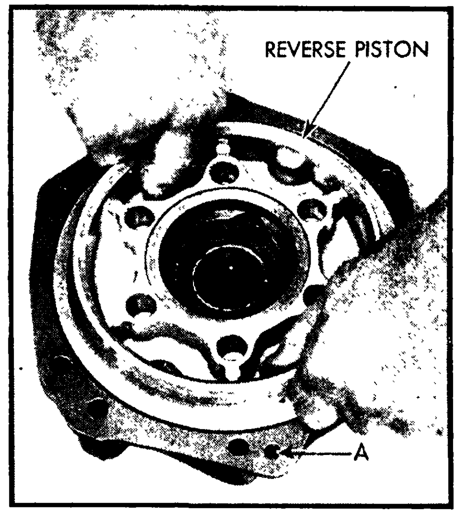


Fig. 142 Removing reverse piston. If piston cann t b removed by hand, apply air pressure at hole "A". 1951-52

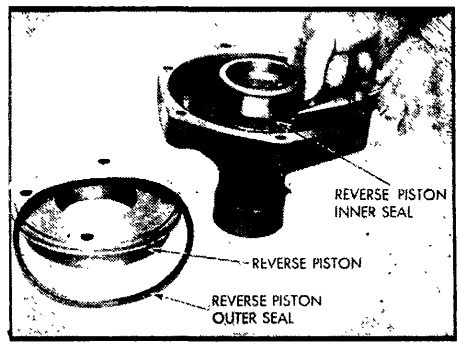


Fig. 143 Removing revers piston inner oil seal. 1951-52

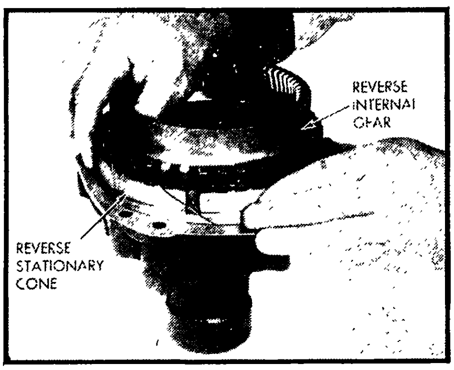


Fig. 140 Rem ving reverse internal gear and stati nary cone. 1951-52

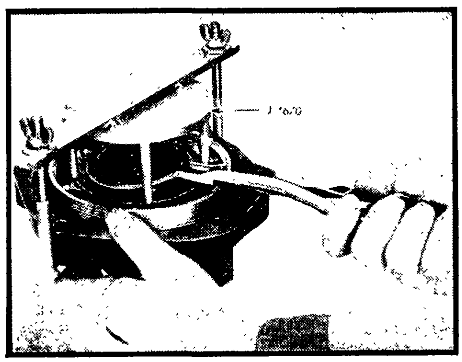


Fig. 141 Special compressor tool for disassembling rear bearing retainer. 1951-52

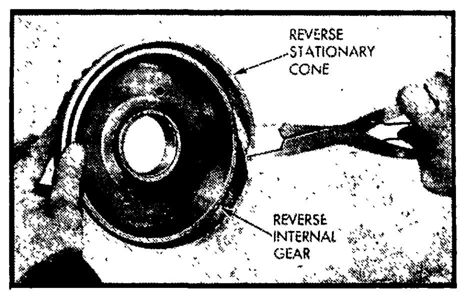


Fig. 144 Removing rev rs stationary cone. 1951-52

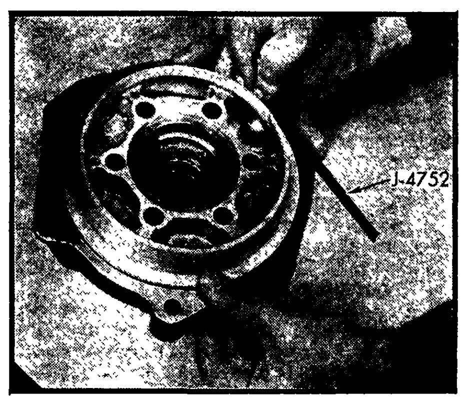


Fig. 145 Installing r - v rs c n piston. 1951-52

verse internal gear by lifting straight out.

18. Remove snap ring that holds reverse planet carrier to output shaft.
19. Remove reverse planet carrier from output shaft.
20. Remove reverse planet carrier locating snap ring from output shaft, sun gear and drive flange from output shaft, and steel and bronze thrust washers from output shaft.

INSPECTING REVERSE ASSEMBLY

Clean all parts with a good clean solvent and thoroughly inspect each part to determine what parts should be replaced. It is very important to distinguish between parts that are simply "worn-in" and those parts worn to the extent that they affect operation of the unit. Only worn, broken or damaged parts should be replaced.

1. Inspect ball bearings by first thoroughly cleaning and oiling. Then rotate slowly by hand, feeling for roughness. Do not spin bearing by hand.
2. Inspect reverse internal gear for damaged parking teeth and scored, burned or damaged surfaces.
3. Inspect reverse planet carrier for worn or damaged teeth and worn roller bearings.
4. Inspect splines of reverse planet carrier for damage.
5. Inspect bronze oil pump drive gear for damage or excessive wear. See that bronze gear is tight on carrier and that pump drive gear ball is in place. If the gap in the ring is not over the ball, move the ring around until the ball can be seen.
6. Inspect reverse center gear and flange assembly for damaged teeth or worn bushing. If replacement is necessary, replace assembly. The center gear is not furnished separately.
7. Inspect output shaft for scored thrust and bearing surfaces.
8. Inspect output shaft splines for nicks and burrs.
9. Inspect output shaft speedometer drive gear surface for wear or damage.
10. Inspect steel and bronze thrust

washers for excessive wear
11 Inspect internal gear thrust washer for wear or scoring
12 Inspect reverse clutch release spring and retainer for signs of damage or burning Spring is used to centralize reverse internal gear cone when clutch is released The reverse stationary cone is held stationary by a key which indexes with a slot in the case There is a dimple in the key and a corresponding dimple on the stationary cone
13 Inspect stationary cone for burning or excessive wear
14 Inspect piston coil springs for distorted or collapsed coils Free length of these spring is $1\frac{11}{32}$'
15 Inspect reverse piston for burning on cone surface
16 Inspect reverse piston for scores Be sure oil seal grooves are thoroughly clean
17 Inspect four reverse piston dowel pins for scoring, looseness or distortion
18 Inspect inner and outer piston seal operating surfaces for scoring or roughness
19 Inspect rear bearing retainer bushing for excessive wear and see that oil holes in retainer are open
20 Inspect mainshaft for damaged gear teeth, thrust and bearing surfaces
21 Clean all parts again after inspections just prior to assembly

ASSEMBLING REVERSE MECHANISM

1. Hold reverse center gear in the left hand with the drive flange up Install the steel thrust washer and then the bronze thrust washer in the recess of the drive flange
2 Still holding the reverse center gear in the left hand, pick up the output shaft with the right hand and insert the output shaft end through drive flange and center gear until carrier bottoms on the two thrust washers
3 Holding drive flange and center gear tightly against planet carrier to keep thrust washers from moving out of position, set the output shaft and planet carrier on the repair bench on the planet carrier end
4 Install reverse planet carrier locating snap ring Do not pick up this unit until assembly has been completed, otherwise thrust washers will slip out of position
5 Install reverse planet carrier over output shaft with bronze drive gear down, meshing pinions with sun gear Be sure the unit is bottomed against the reverse planet carrier snap ring
6 Install snap ring on output to position reverse planet carrier
7 Install reverse clutch wave spring and retainer on reverse internal gear, on the internal gear side Retainer tangs should enter holes in gear If retainer does not center, it should be replaced
8 Install reverse stationary cone on the reverse internal gear cone The stationary cone should not be spread more than is necessary to make the installation
9 Install the large bronze thrust washer over collar of reverse internal gear and retain with vaseline or petrolatum
10 Apply a light coat of Hydra-Matic fluid over the outer surface of the reverse cone piston inner seal and install the seal with the lip down on rear bearing retainer hub Work seal well into groove After the seal has been installed, install the piston (less outer seal) over the inner seal to determine if the seal is properly seated Remove the piston and inspect the inner seal
11 Install the outer seal on the reverse cone piston with seal lip toward flat side of piston and work seal well into piston flange groove
12 Apply Hydra-Matic fluid to surface of outer seal and place reverse cone piston on rear bearing retainer so that dowel pin holes are on underside of piston Do not align with four dowel pins in rear bearing retainer
13 Install Positioning Tool J-4752, Fig 146, in rear bearing retainer between piston outer seal and inner surface of bearing retainer Do not permit tool to slip below ledge on inner surface of bearing retainer Firmly seat feeler stock against ledge as shown, Fig 145 Hold ends of installing blade to keep blade from snapping up

CAUTION—Use extreme care when installing to prevent damage to seal Rotate piston until dowel pin holes on underside of piston align with dowel pins in rear bearing retainer Push piston into place until bottom seats in retainer To make sure piston is fully seated, lay a straight edge across face of piston and measure from straight edge to face of rear bearing retainer This measurement should be $\frac{3}{8}$" to $\frac{13}{32}$"

14 Install six reverse clutch release coil springs
15 Install reverse clutch coil spring retainer and compress springs with tool shown in Fig 141
16 Install large snap ring holding spring retainer in place and after ring is properly seated, remove the Compressor Tool
17 Install ball bearing in rear bearing retainer Tap bearing gently to be sure it is fully and squarely seated
18 Install large type snap ring in rear bearing retainer This snap ring locates bearing in retainer
19 Install reverse internal gear and stationary cone into rear bearing retainer compressing stationary cone by hand Position keyway of stationary cone so it will line up with keyway in transmission case when installed
20 With output shaft standing on planet carrier end, place rear bearing retainer over output shaft and mesh carrier gears with internal gears Use extreme care to prevent damage to bushing and ball bearing in rear bearing retainer
21 Install snap ring on output shaft, locking rear bearing retainer to output shaft
22 Install speedometer drive gear in rear bearing retainer
23 Install gasket on rear bearing retainer
24 Install stationary cone to-case lock key, using vaseline or petrolatum to hold key in place
25 Install mainshaft and reverse assembly into rear end of transmission case, aligning stationary cone lock key into machined keyway in case Then align rear bearing retainer bolt holes to case and install attaching bolts and lockwashers

1952 HYDRA-MATIC

Although it is fundamentally the same as it has been in the past the 1952 Hydra-Matic features a new front pump of the vane type which regulates its output to the requirements of the transmission hydraulic system And to provide for the new dual range feature, certain other changes were made, changes which are described below

FRONT PUMP—The new pump consists of the pump body, cover, slide rotor, seven vanes, two guide rings and a priming spring

The output of the pump is determined by the position of the slide, Figs 146 and 147 When the slide is up, the pump delivers maximum output, when the slide is centered the output is zero, when the slide is down the pump acts as a relief valve for excessive rear pump output The latter condition could develop when the car is being towed and the front pump is not operating

The front pump intake pipe now assembles through an oil seal ring in the front pump housing rather than being bolted on as was the case formerly

OIL SCREEN—The oil screen has been redesigned to meet the requirements of the new front pump The new screen is smaller and has a stronger intake pipe fitting that insures a better seal between the screen and intake pipe

GOVERNOR OIL DELIVERY PIPE—In order to provide for greater oil flow to the governor, the pipe that was used to feed the governor has been redesigned and relocated The new pipe is larger and is assembled between the front servo and the case near the parking brake bracket assembly Oil feeding the governor now by-passes the control valve assembly by flowing directly from the front servo through the governor oil delivery pipe and case into the parking brake bracket assembly to the governor

PARKING BRAKE BRACKET — The 1952 parking brake bracket assembly is essentially the same as in 1951 However, due to the routing of the main line oil through the oil delivery pipe as mentioned above, the governor feed passage in the parking brake bracket body indexes with a passage in the case As a result, the previous oil delivery pipe (middle pipe of three pipes) is no longer required

Another change in the parking brake bracket assembly is the use of a recessed pin to hold the parking blocker piston release spring in position Thus, the parking blocker piston and spring on the 1952 assembly are similar to the reverse blocker piston and spring which is still the same as in 1951.

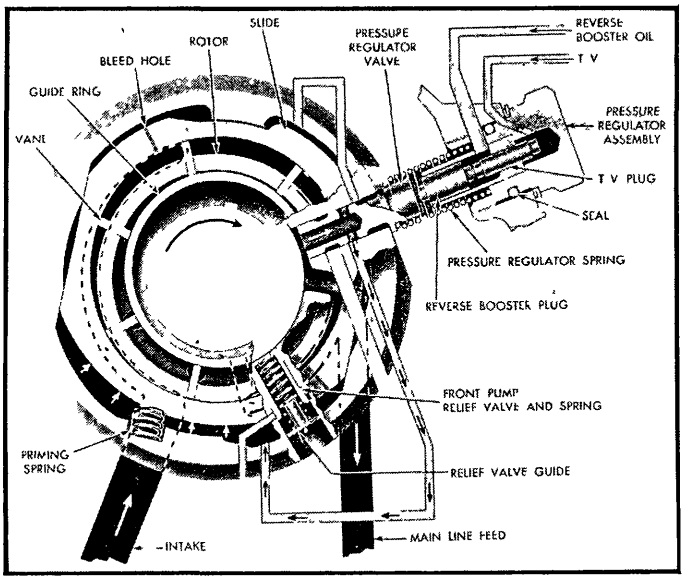


Fig. 146 1952 Front pump. With slide up as shown, pump delivers maximum output

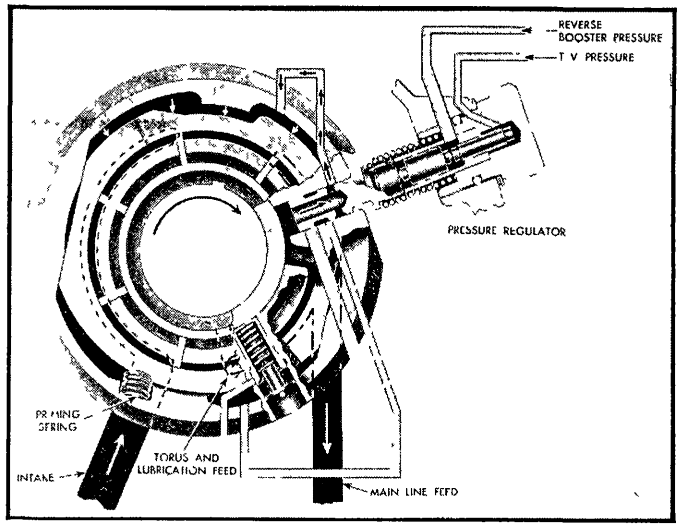


Fig. 147 1952 Front pump. With slid down as shown, pump output is reduc d

REAR PUMP DISCHARGE PIPE—The new rear pump discharge pipe does not have a bleed hole as in past models. The bleed hole is now located in the rear pump check valve seat fitting.

PRESSURE REGULATOR —The pressure regulator valve for 1952 is of new design to conform with the new front pump. The pressure regulator assembly includes a TV plug to provide modulated main line pressure and a reverse booster plug to provide increased pressure when operating in reverse.

MAIN LINE EXHAUST VALVE — A new feature of the 1952 Hydra-Matic is a main line pressure exhaust valve which is installed in the transmission case under the front servo. The purpose of this valve is to exhaust main line pressure very rapidly when the car is parked and the engine is shut off, permitting the parking pawl to engage immediately.

CONTROL VALVE ASSEMBLY — The control valve assembly for 1952 has been changed in order to accommodate the new three-speed drive range. It also provides full throttle downshifts within set speed ranges regardless of which forward range the selector lever is in.

The names of some of the valves have been changed to correspond to the purpose they have in the new design, Fig. 148. The 2-3 regulator plug is now called the 3-2 detent plug and the previous 1-2 governor plug is now called the 2-1 detent plug. These valves play an important part in controlling the 3-2 and 2-1 forced downshift. In addition, LO range pressure is directed onto the 2-1 detent plug to move the shift valve giving a second speed start in LO range.

Most important of the new valves are the 3-2 timing valve and the TV regulator valve. The purpose of the 3-2 timing valve is to delay the application of the rear band on a 3-2 forced downshift, thus providing a smoother shift. The TV regulator valve is controlled by TV pressure and spring force. When TV pressure reaches a certain value it opens the TV regulator valve and allows regulated TV pressure to act on the TV plug in the front pump pressure regulator and on the shifter valves to help time the shifts. Thus, on light throttle upshifts there will be no TV pressure to delay shifts, while on heavy throttle upshifts TV regulated pressure will be used to improve the shifts.

Other valve body changes are the 3-4 lockout valve which locks out fourth speed when the selector lever is in the right hand drive position, a spring-loaded ball check valve in the throttle pressure passage in the front valve body, a 2-3 auxiliary valve between the 2-3 shift valve and governor plug, and the elimination of the front servo exhaust valve assembly.

FRONT SERVO—The front servo for 1952 has been redesigned in order to give a greater holding force to the front band under closed throttle conditions. This increased holding force will be effective any time the band is applied but is provided primarily to insure adequate holding force when the transmission is operating as a brake in third gear.

In order to provide this feature the front servo has been redesigned to utilize an additional front servo apply piston and include an over-run control valve. In first, third and reverse, a spring behind the over-run control valve positions it as shown in Fig. 149. In this position, the over-run control valve directs front servo apply oil behind the larger diameter apply piston.

In second or fourth gear, oil directed to the front servo release piston is also directed to the end of the over-run control valve, forcing it back against the spring as shown in Fig. 150. In this position the valve cuts off the supply of oil to the new apply piston and allows the oil that was behind this piston to be exhausted so that front servo release oil can move the piston to the released position.

The compensator piston and 3-4 downshift valve operate the same as in 1951.

REAR SERVO—The rear servo has been redesigned to allow faster rear band application in LO range. This results in better "car-rocking" by speeding up the low and reverse engagement.

The more rapid rear band application in LO is provided by directing LO range oil pressure against the rear servo exhaust valve, Fig. 151. This moves the exhaust valve over, against spring pressure, and opens a passage which rapidly exhausts rear servo release pressure. In drive range the rear servo exhaust valve is inoperative and the accumulator check valve continues to operate as it has on past models.

FRONT & REAR UNITS—The annular pistons in both the front and rear units are smaller than in past transmissions. This necessitates smaller annular piston outer seals and smaller diameters in the clutch drums. The inner seals have not been changed. The outer diameter of the rear unit drum (area band contacts) is slightly larger on the 1952 transmission.

The rear band is of new construction, having a bonded lining. A release spring is also used on the 1952 rear band to prevent the possibility of chatter when operating in third speed.

The changes in front and rear units and rear band have no effect on overhaul procedures.

TORUS COVER—The 1952 torus cover is the same as previous models except for the new dampener hub, which can be identified by a painted "O" stenciled on the cover.

DISASSEMBLY OF UNITS FROM CASE

Disassembly of the units from the transmission case is practically the same as in 1951. There are a few changes which should be noted:

1. The front pump intake pipe is a slip

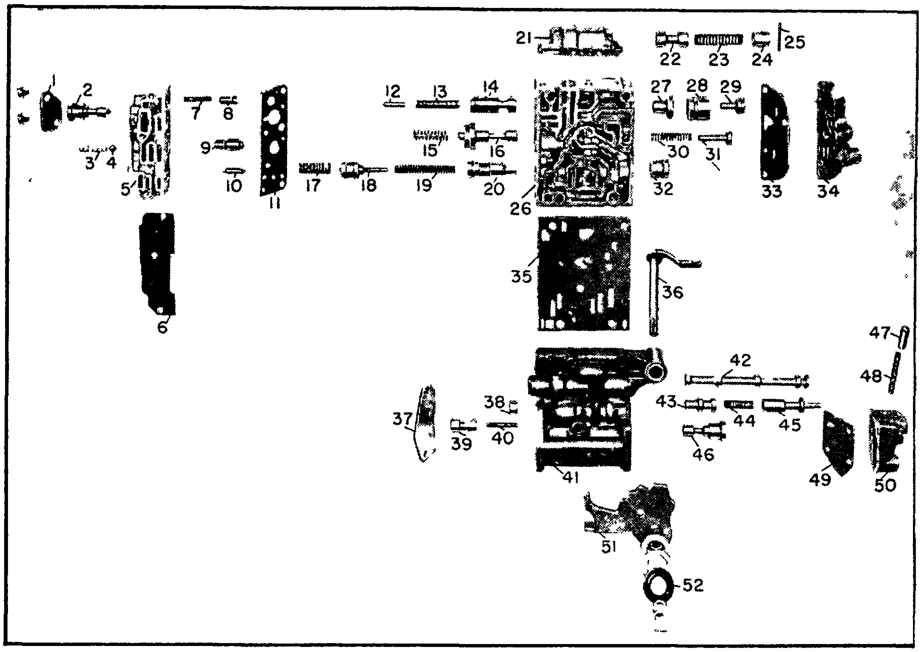


Fig. 148 1952 CONTROL VALVE ASSEMBLY

1. 3-2 detent plug plate
2. 3-2 detent plug
3. "T" il ball check valve spring*
4. "T" il ball check valve*
5. Fr nt valve body
6. Fr nt valve body plate
7. TV r gulat r valve spring
8. TV regulat r valve
9. 1-2 r gulator plug
10. 3-4 regulator plug
11. Fr nt valve body separator plate
12. 2-3 shift valve spring guide pin
13. 2-3 shift valve spring
14. 2-3 shift valve
15. 1-2 regulator plug spring
16. 1-2 shift valve
17. 3-4 shift valve spring
18. 3-4 l ck ut valve assembly
19. 3-4 auxiliary shift spring
20. 3-4 shift valve
21. 3-2 timing valve body
22. 3-2 timing valve
23. 3-2 timing valve spring
24. 3-2 timing valve plug
25. 3-2 timing valve plug retainer pin
26. Inn r valve body
27. 2-3 auxiliary valve
28. 2-3 governor sleeve
29. 2-3 governor plug
30. 2-1 detent plug spring
31. 2-1 detent plug
32. 3-4 governor plug
33. Rear valve body spacer plate
34. Rear valve body
35. Valve body spacer plate
36. Inner throttle lever
37. Outer valve body front plate
38. Detent plug
39. Compensator valve
40. Compensator valve spring
41. Outer valve body
42. Manual control valve
43. Throttle valve
44. Throttle valve spring
45. T valve
46. Double transition valve
47. Detent plunger
48. Detent plunger spring
49. Detent plunger retainer plate
50. Detent plunger retainer
51. Manual shaft and detent control lever
52. Rubber seals and washers

*Not used on early production 1952 models

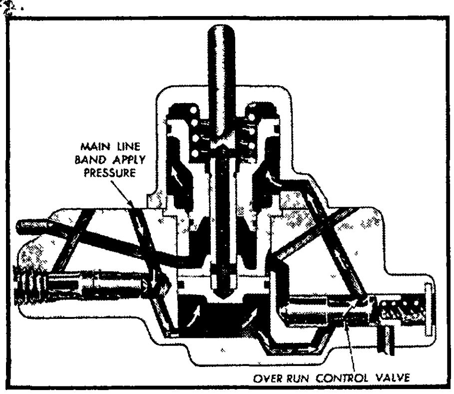


Fig. 149 Front serv in appli d p siti n. 1952

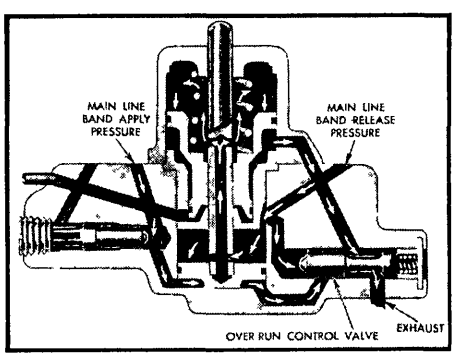


Fig. 150 Fr nt serv in r l as d p siti n. 1952

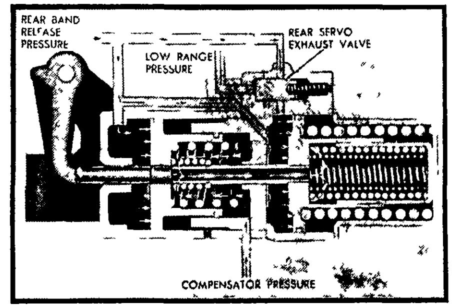


Fig. 151 Schematic vi w of rear serv . 1952

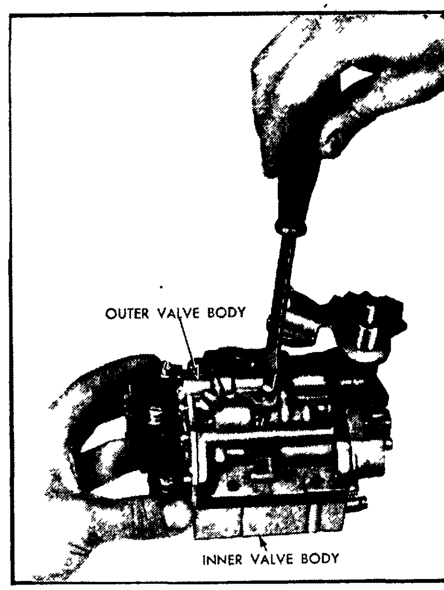


Fig. 152 Separating inner and outer valve b dy. 1952

fit in the front pump which makes it much easier to remove.

2. Before removing servos, the governor oil delivery pipe must be removed from the front servo and case by prying the ends out with a screwdriver.
3. After the rear servo is removed, remove rear band release spring from between struts of rear band.

CONTROL VALVE ASSEMBLY

DISASSEMBLY—Move the inside detent control lever slowly counterclockwise to remove detent tension spring and plunger. Remove manual shaft rubber seal and outer and inner shaft seal washers from shaft. Then disassemble the control valve as shown in Figs. 152 to 159. NOTE: Do not remove compensator stop pin from outer valve body.

INSPECTION — Before inspecting the valve bodies and valves, they should be thoroughly cleaned with clean cleaning fluid.

Inspect all valves carefully to see that they are free from burrs and not damaged in any way. Burrs can be removed by carefully using fine corcus cloth. This type of valve has sharp corners to prevent dirt from wedging between valve and body. Therefore, when removing burrs, do not round off square edges.

With the parts clean and dry, check each shifter valve, governor plug, and

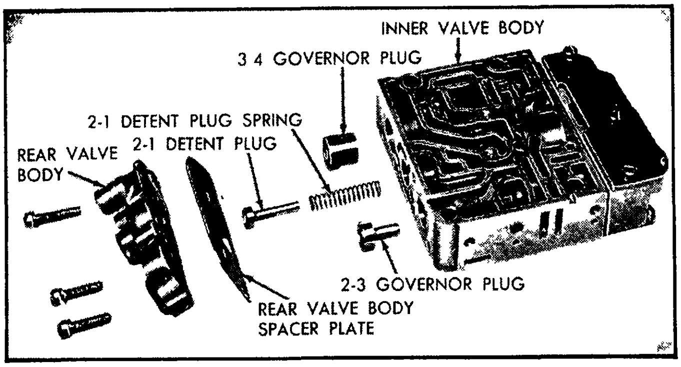


Fig. 155 Layout of governor plugs, 1-2 detent plug and spring. 1952

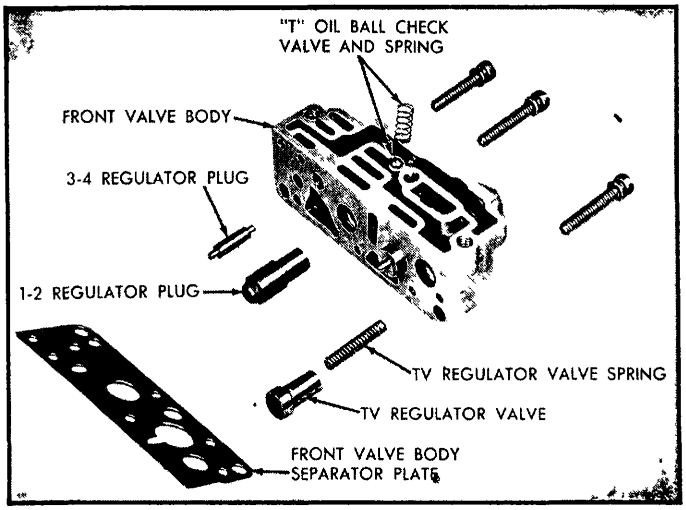


Fig. 156 Layout of regulator plugs, TV regulator valve and spring. 1952

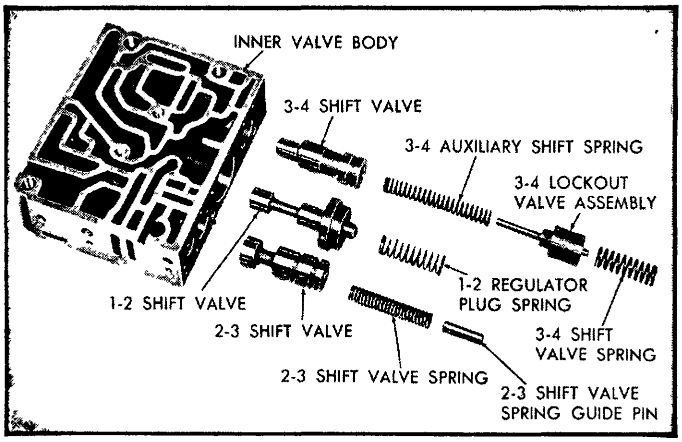


Fig. 158 Layout of shift valves and springs. 1952

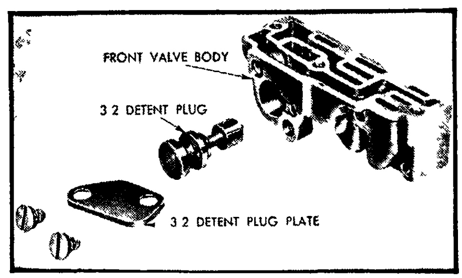


Fig. 157 Locati n f 3-2 detent plug. 1952

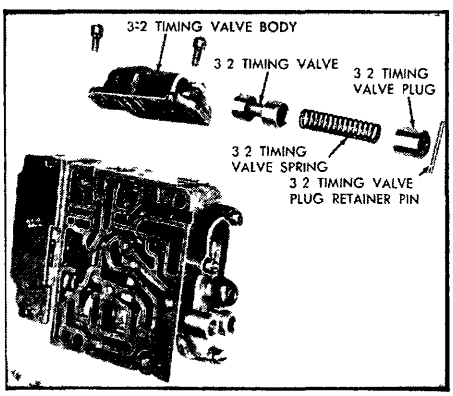


Fig. 153 Disassembly of timing valve body. 1952

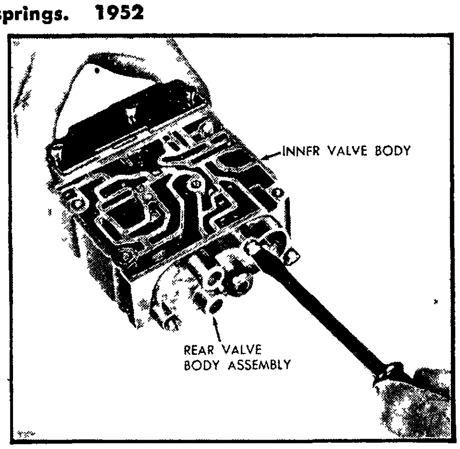


Fig. 154 Removing rear valve body. 1952

regulator plug for free movement in their respective bores and operating positions. NOTE: Valves can be assumed to be free in their operating positions if they will fall of their own weight in their respective bores when valve body is shaken slightly. Do not drop valves.

The manual control valve is the only valve furnished separately. If it becomes necessary to replace one of the other valves or one of the bodies (inner or outer) the complete control valve assembly should be replaced.

Check fit of throttle valve inside lever and shaft in hub of inside detent control lever on outer valve body. If shaft binds in hub, is excessively worn, or if oil seal is missing or damaged, it will be necessary to replace defective parts.

REASSEMBLY — Before reassembling the control valve assembly, make sure springs can be accurately identified for correct assembly by comparing them with Fig. 160. Then reassemble the control valve in the reverse order of disassembly.

FRONT PUMP

DISASSEMBLY—

1. Remove front pump and front drive gear from transmission together. Remove drive gear and cover gasket, and four pump cover-to-body attaching screws.
2. Lift pump *body from cover*. NOTE: Never lift *cover from body* as internal parts may fall from assembly.
3. Remove front pump relief valve guide from the body by pressing on the guide with a blunt screwdriver and slipping the pin from the body. Hold the guide with finger pressure to prevent it from popping out too fast. Remove guide, spring and valve, Fig. 161. The valve can be removed with snap ring pliers.
4. Remove "O" seal ring from pump body intake port with a jack knife or similar instrument, Fig. 162. This seal should always be replaced since the slightest damage will affect front pump operation.
5. Mark face of rotor with pencil or prussian blue so it will be returned to its same position.
6. Remove guide rings, rotor and seven vanes, Fig. 163.
7. Remove slide and priming spring by first lifting out end opposite spring, Fig. 164.

INSPECTION—The entire unit should be inspected for dirt and scoring. Check the slide to be sure the two bleed holes are open and free of dirt; a piece of tag wire should be pushed through the holes to insure that they are open. Check vanes to be sure that they are not scored

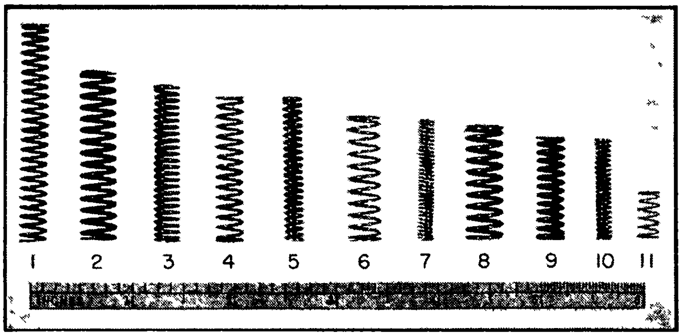


Fig. 160 COMPARISON OF SPRINGS IN VALVE BODY. 1952

1. 3-4 auxiliary shift
2. Timing valve
3. 2-3 shift valve
4. 2-1 detent plug
5. Detent
6. 1-2 regulator plug
7. Compensator valve
8. 3-4 shift valve
9. Throttle valve
10. TV regulator valve
11. "T" oil ball check valve

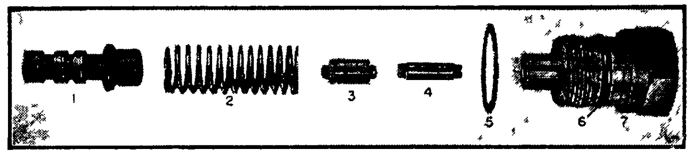


Fig. 165 LAYOUT OF PRESSURE REGULATOR. 1952

1. Pressure regulator valve
2. Pressure regulator spring
3. Reverse booster plug
4. TV pressure plug
5. Pressure regulator plug gasket
6. Pressure regulator plug seal
7. Pressure regulator plug

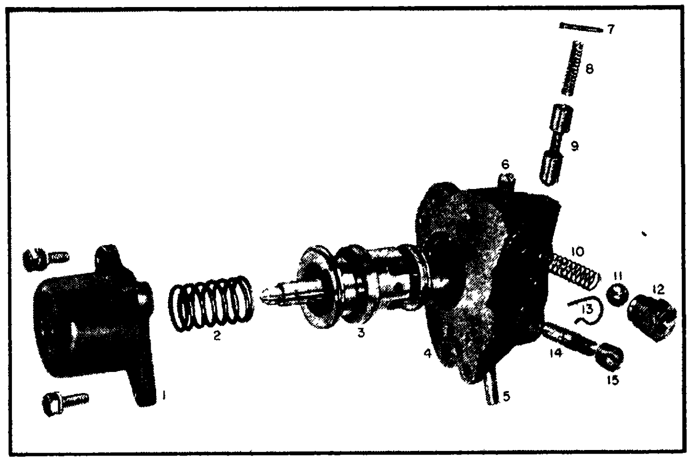


Fig. 166 LAYOUT OF FRONT SERVO. 1952

1. Release cylinder
2. Front servo spring
3. Servo piston assembly
4. Servo body
5. Compensator pipe
6. 1/8" pipe plug
7. Over-run control valv pin
8. Over-run control valv spring
9. Over-run control valv
10. Rear pump check valv spring
11. Rear pump check valv
12. Rear pump check valv s at
13. 4-3 valve retainer spring
14. 4-3 valve
15. Plug

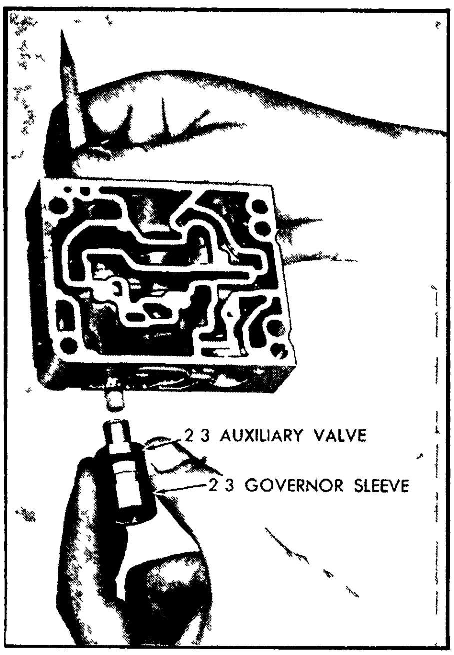


Fig. 159 Removing 2-3 governor sleev and auxiliary valve. 1952

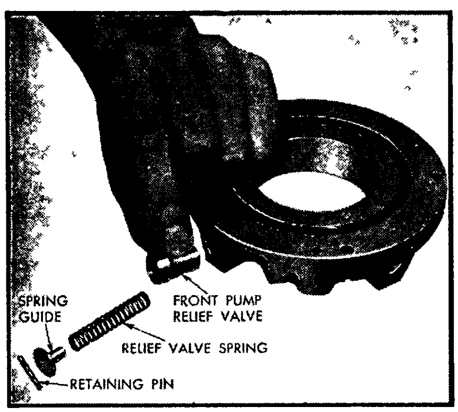


Fig. 161 Removing front pump relief valve, spring and guide. 1952

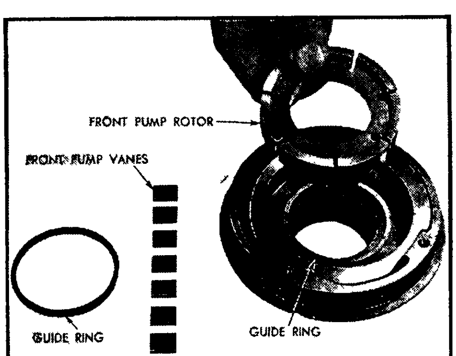


Fig. 163 R m ving fr nt pump r tor. 1952

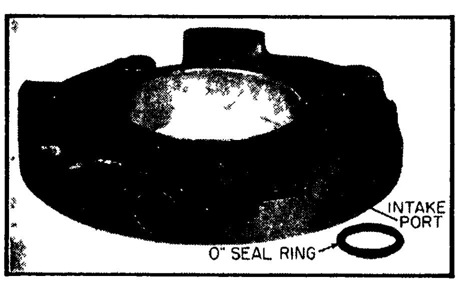


Fig. 162 L cati n f fr nt pump intak pip "O" s al ring. 1952

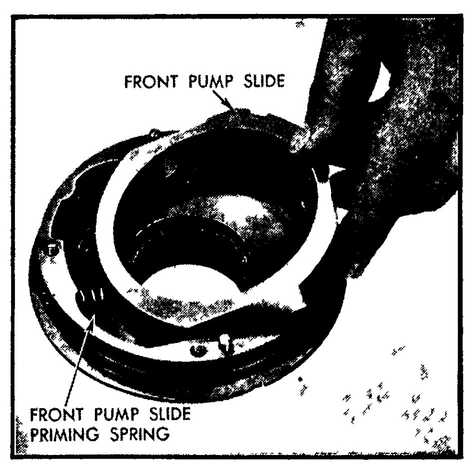


Fig. 164 R m ving fr nt pump slid . 1952

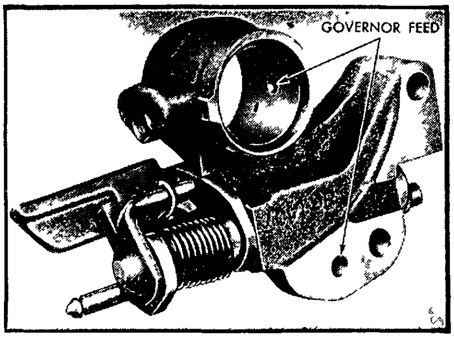


Fig. 167 Location of govern r f d passages. 1952

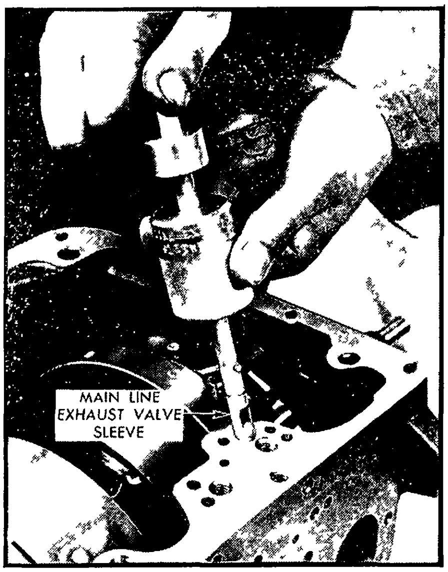


Fig. 168 Removing main line xhaust valve sleeve. 1952

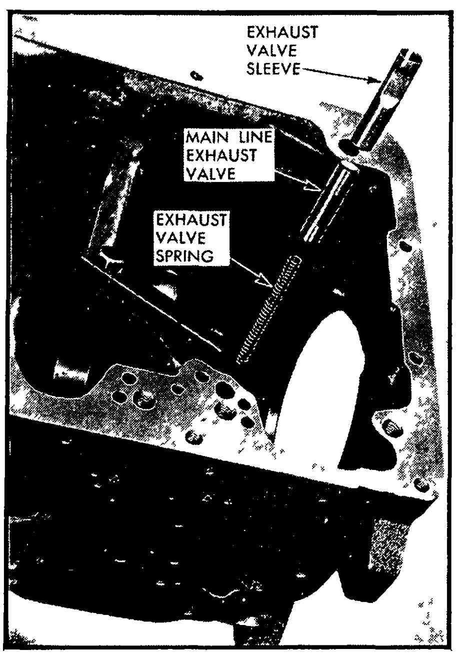


Fig. 169 Assembly of main lin xhaust valv . 1952

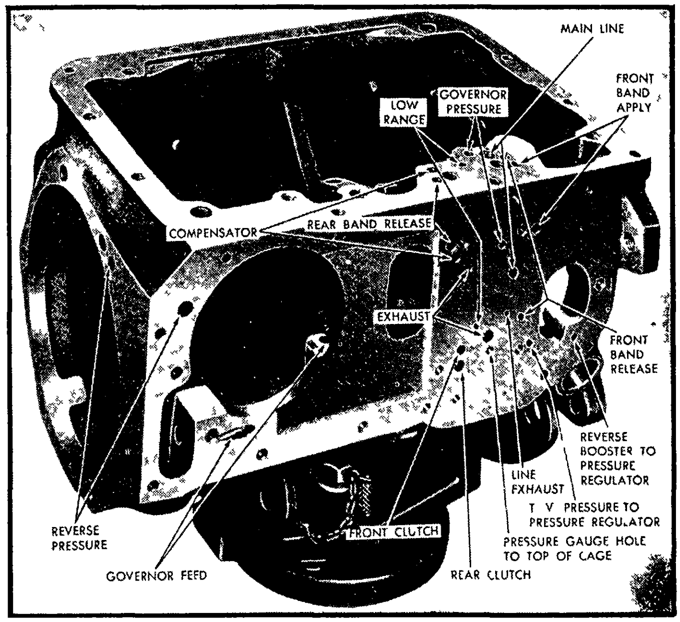


Fig. 170 Identification of oil passages in case. 1952

or burred. Be sure slide is free in pump cover; it should not bind under any circumstances. Check freeness of pressure regulator valve in pump body bore. Check freeness of vanes in rotor slots. Check freeness of oil seal ring in its groove and see that it is not broken. Check pump bushing for scores or flaking; slight wear is permissible. Check woodruff key slot in rotor for burrs or wear. Inspect oil passages for obstructions. Check freedom of relief valve in pump body bore.

REASSEMBLY—Reverse the order of the disassembly procedure to reassemble the pump, noting the following:

Be sure the priming spring is located properly by moving the slide against it until slide bottoms against lower stop in cover.

Check the edges of the vanes for wear pattern. One edge will be polished for its full length; this edge should face the slide. The opposite edge will be polished only where it contacts the guide rings.

When installing the second guide ring, center the rotor in the slide so the ring will go in easier.

Total clearance between vanes and slide with guide rings installed should not be more than .003". Check with a feeler gauge between each vane and inside diameter of slide. With vanes contacting slide on one side, clearance should not exceed .003" on opposite side. If clearance is excessive, pump must be replaced.

With pump completely assembled, move rotor by hand to be sure rotor, vanes and slide are free. Be sure priming spring will return slide after spring is compressed.

Pump should be assembled to front drive gear before they are installed in transmission. Be sure pump assembles to drive gear freely. Do not force pump onto drive gear.

PRESSURE REGULATOR ASSEMBLY

The 1952 pressure regulator, Fig. 165, is disassembled as in 1951. However, it should be inspected as follows: Inspect the reverse booster plug and TV pressure plug for nicks or scores and free movement in the regulator plug.

Inspect regulator valve for nicks or scores and free movement in pump body. Check drilled passages in valve to see that they are not obstructed.

Check pressure regulator spring for distortion or collapsed coils. Free length should be approximately 2$\frac{11}{64}$".

Inspect drilled passages in pressure regulator plug and remove any foreign matter.

Inspect neoprene seal and gasket on pressure regulator plug. Replace seal if there is the slightest doubt about its condition.

FRONT SERVO

DISASSEMBLY—Fig. 166.

1. Remove two release cylinder-to-servo body capscrews and washers.
2. Remove release cylinder and front servo spring.
3. Remove servo piston assembly.
4. Remove pipe plug and retainer spring holding 4-3 valve in place and remove valve.
5. Remove rear pump check valve seat, ball and spring.
6. Round off end of over-run control valve pin with file and pull pin with pliers. Keep finger over port while removing pin to prevent loss of spring.
7. Remove over-run control valve spring and valve.
8. Remove compensator pipe from front servo if loose.
9. Remove ⅛" pipe plug from servo body.

INSPECTION—

1. Check face of servo body for roughness or scoring.
2. Check servo body for clogged or interconnected passages.
3. Inspect front band release cylinder for scores.
4. Check front band release piston and

apply piston assembly for scores, broken rings and freedom of rings in grooves, and see that oil passages are clear.

5. Check 4-3 valve for freedom in bore and obstructed orifice.
6. Inspect front servo spring for distortion or collapsed coils. The free length should be approximately $1\frac{33}{64}$".
7. Inspect rear pump check valve seat, ball and spring for damage.
8. Be sure bleed hole (shallow drilled hole) in rear pump check valve seat is open.
9. Be sure over-run control valve is free in its bore and is not scored.
10. Check free length of over-run control valve spring, which should be approximately $1\frac{9}{64}$".
11. Check to see that compensator piston works freely in its bore within the servo piston assembly.
12. Be sure the two steel plugs are staked in place, sealing oil passages in servo body.
13. Be sure servo piston locating pin is snugly in place and protrudes just below servo body face.

REASSEMBLY—Reverse the disassembly procedure to reassemble the servo. After installing the over-run control valve, spring and stop pin, be sure to peen the end of the pin to stake it in place.

REAR SERVO

Disassembly of the rear servo is fundamentally the same as for 1951. However, a gasket is used between the accumulator body and servo body. When the accumulator body is removed, the rear servo exhaust valve and spring will be found in the accumulator body.

PARKING BRAKE BRACKET

In general the 1952 parking brake bracket is disassembled the same as in the past. The parking blocker piston can be removed by using needle nose pliers to remove the stop pin while holding a finger over the blocker piston spring.

When checking the parking brake bracket parts be sure to check the following new points for 1952 in addition to the parts to be inspected in 1951.

1. Check governor feed passages by inserting tag wire, Fig. 167.
2. Be sure center hole in governor oil delivery sleeve is plugged and that the plug is firmly staked in place.
3. Check blocker piston springs. Parking blocker piston spring should have free length of approximately $1\frac{1}{16}$", and reverse blocker piston spring should be approximately $\frac{15}{16}$".

NOTE—When assembling the parking brake bracket, be sure to insert the stop pin retainer behind the parking blocker piston spring. This pin is not peened over since it will be held in place by the retainer on the parking bracket mounting bolt.

MAIN LINE EXHAUST VALVE

DISASSEMBLY—Remove the line exhaust valve sleeve from the case using Tool J-5177, Fig. 168. (This can be taken out only after the front servo has been removed.)

Remove the line exhaust valve by pushing it down into the case against spring pressure with welding rod or a slim screwdriver and then releasing it quickly so the spring will push it out. Remove the spring by hooking it with a piece of wire.

INSPECTION — Inspect the valve for nicks or score marks. The valve should be free in the bore in the case. Inspect the sleeve for damage. Check the valve spring for distortion or collapsed coils. Free length should be approximately $2\frac{27}{64}$".

REASSEMBLY—Install the line exhaust valve spring and valve in bore, Fig. 169. Using a piece of welding rod or similar tool, work valve up and down several times against spring pressure to make certain the spring has bottomed in the valve bore.

Install the valve sleeve by tapping it gently with a soft hammer. The relieved side of the sleeve should be toward the front servo to provide clearance for the front servo-to-case attaching bolt.

The sleeve should botton on a shoulder in the bore with the edge of the sleeve just inside of being flush with the case. It is possible to force the sleeve deeper than the bottoming shoulder but this condition would impair the valve operation.

TRANSMISSION CASE

The 1952 case has been modified slightly to provide oil passages for the new features and the new main line pressure exhaust valve. Identification of the oil passages in the case is shown in Fig. 170.

UNIVERSALS

IN SERVICING UNIVERSAL JOINTS, it is important to bear in mind that the complete assembly of propeller shaft and universal joints is accurately balanced at the factory. Usually an arrow is stamped on the splined joint and lined up with another arrow on the propeller shaft, Fig. 1, so that the parts may be assembled in the same balanced position. Before disassembly, look for these arrows and if there are none, punch-mark the parts. Failure to take this precaution will produce rough car operation which results in rapid wear and failure of parts, and place an unbalanced load on the transmission, clutch, engine and rear axle.

BUICK

RING & TRUNNION JOINT

Fig. 2. To remove the joint, disconnect the torque tube from the torque ball. Then take out the rear axle, propeller shaft and torque tube. When this is done, remove the bolt which fastens the front yoke to the transmission mainshaft, and slide off the joint.

To disassemble the joint, remove the lock rings or dowel pins which hold the bushings in the yokes. Then drive the bushings out with a flat-nosed punch, tapping with a hammer, first on one side, then on the other.

Wash all parts and examine for wear or damage. Make sure there are no grooves or ridges on the trunnion pins, and that the bushings are free from chipped edges or grooves.

Before assembling, oil the bearing surfaces, as grease may not reach the parts

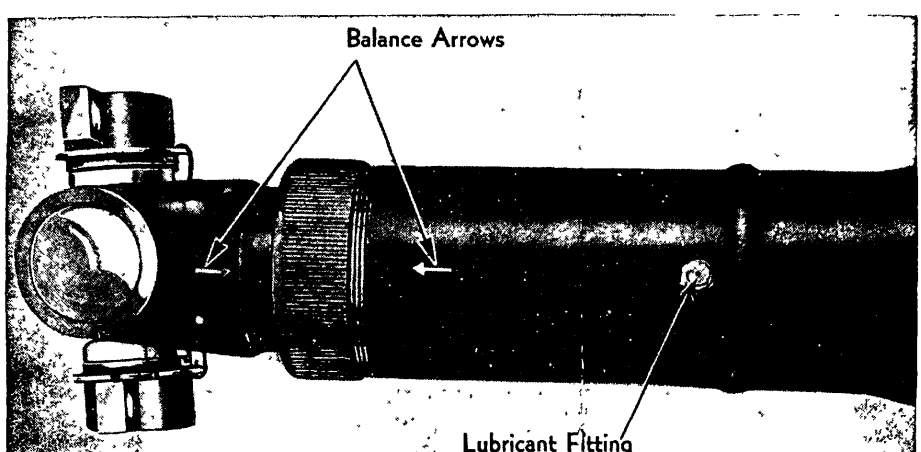


Fig. 1 Sh wing arr ws lined up t maintain c rrect balance f pr pell r shaft and univ rsal

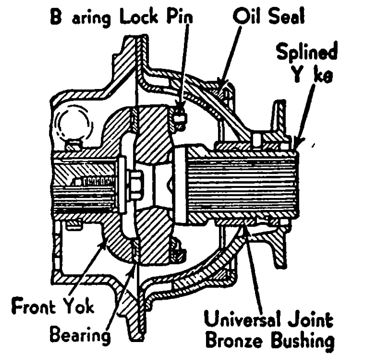


Fig. 2 Buick Ring & Trunnion Joint

for the first few revolutions when the car is put into operation. Use care when installing the bushings to see that they are driven in straight so the edges will not mar the bearing surfaces. A soft-faced hammer should be used for this installation.

When installing the joint to the transmission mainshaft, make sure the fastening bolt is drawn down tight, and that the locating washer is seated in the counterbore in the front yoke. Reinstall the torque ball and retainers, making any necessary adjustment in the manner described below.

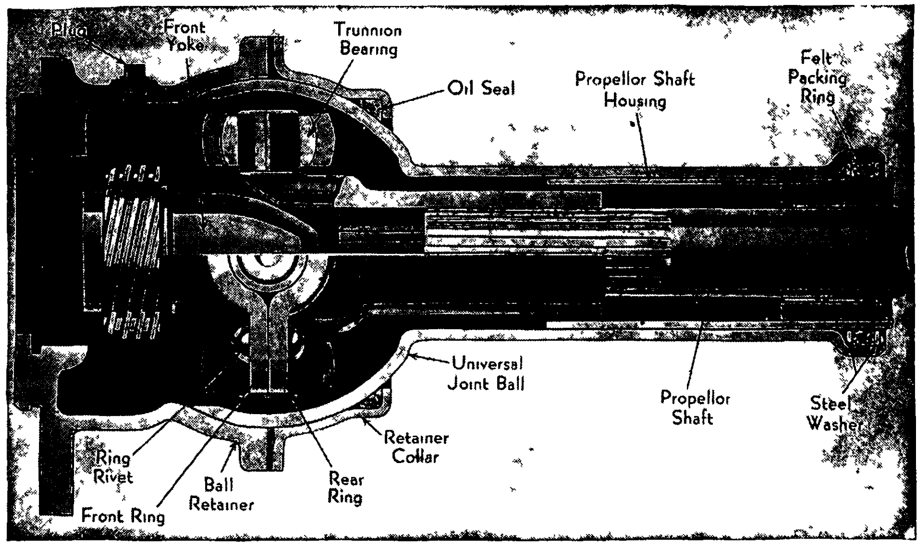


Fig. 3 Chevrolet Split Ring Joint with riveted rings

SERVICE NOTE—Since the torque ball is fitted directly to the rear yoke, universal action is accomplished by the ball sliding between the inner and outer ball retainers. The outer retainer carries a cork oil seal and spring washer that maintains a constant pressure on the cork between the outer retainer and the ball to prevent an oil leak. The spring washer is slightly cupped to afford tension, and it should be installed in the retainer so that a gap occurs between the inside diameter of the cork and the edge of the retainer.

In correcting an oil leak at this point, it is advisable to disconnect the rear axle housing and remove shims between the inner and outer retainers until the ball is a snug fit between the retainers. This adjustment should be made with the cork seal removed, and the ball should be fitted so that it can be moved by hand. When the adjustment is correct, reinstall the cork seal. If there is end play in the ball, it will act as a pump and the cork seal will not stop a leak.

The torque ball is mounted on the yoke sleeve by means of a bronze bushing. On some models, the bushing is secured to the ball by a dowel pin. When the bushing becomes worn to the point where excessive free movement exists between the yoke sleeve and ball, the ball and bushing will have to be replaced as a unit. If the bushing is not secured by a dowel pin, it may be replaced by pressing the worn bushing out and the new one in.

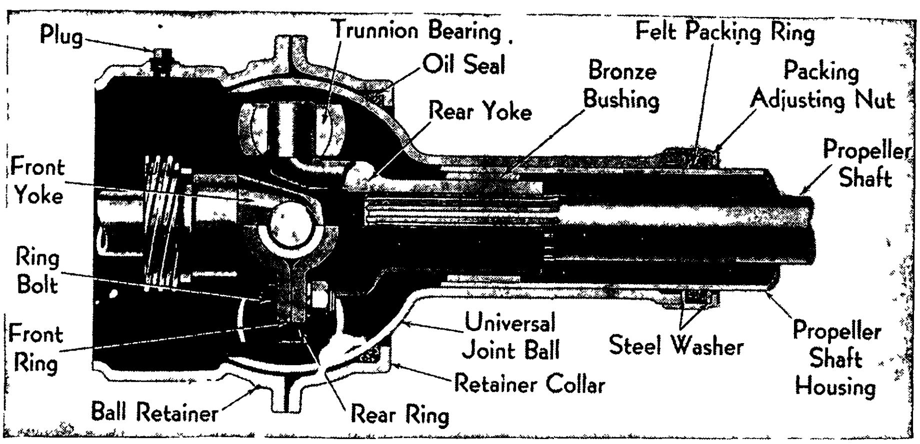


Fig. 4 Chevrolet Split Ring Joint with bolted rings

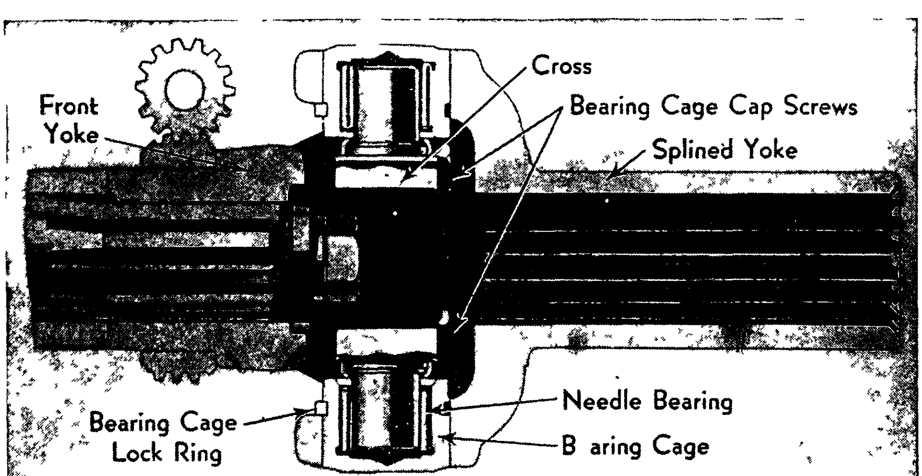


Fig. 5 Ch vr let Cr ss & Y k Joint

CHEVROLET

SPLIT RING JOINT

Figs. 3 and 4. In this design, the trunnion pins are integral with the yokes and a split ring holds the bushings in place around the trunnions. The two halves of the ring are held together by bolts and lock washers on 1935-36 Master models and all 1937-39, Fig. 4. And by rivets on 1935-36 Standard models, Fig. 3.

The joint is entirely enclosed by the universal ball retainer (transmission case) and retainer collar. After the joint is installed, with the collar securely fastened to the transmission case, the universal ball is filled with transmission

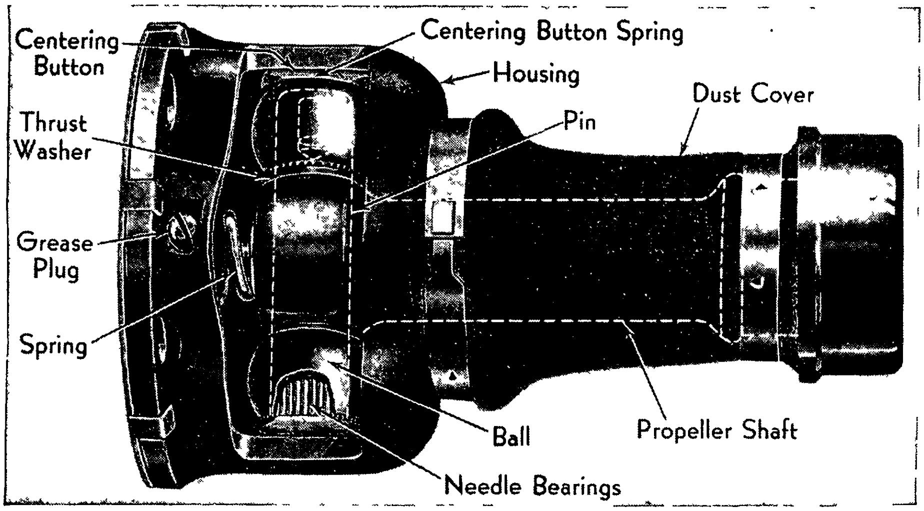


Fig. 6 Detroit Ball & Trunnion Joint

lubricant through the grease plug hole. The joint will then require no further lubrication, the additional lubricant needed being automatically supplied from the transmission.

Due to the riveted construction of the joint shown in Fig. 3, the rear axle must be disconnected and shifted backward in order to remove the joint. After the joint is removed, if there is excessive free movement between the component parts, the entire assembly must be replaced, as no parts are supplied separately.

To remove the bolted ring type joint, Fig. 4, first take out the speedometer driven gear and shaft. Then separate the ball retainer collar from the transmission. Slide the ball back on the propeller shaft. Remove the bolts which fasten the ring halves together, push the rear yoke back on the propeller shaft and take off the trunnion bushings. Disconnect the front yoke from the transmission mainshaft and take off the front yoke. The rear yoke may now be slipped off the propeller shaft.

In assembling the joint, the operations are just the reverse of the foregoing. Care must be taken, however, to see that the bushings are assembled to the yoke with the beveled side toward the inside of the yoke.

SERVICE NOTE—The oil seal at the rear of the universal joint ball is of the adustable type. On 1937-39 models, sealing is accomplished by a composite felt and synthetic rubber, consisting of alternate layers of rubber and felt—two layers of each being used. The synthetic rubber serves as a seal to prevent leakage of transmission lubricant. The felt prevents the entrance of dust and dirt. The oil seal is assembled to the universal joint ball with the rubber side of the seal at the bottom of the counterbore in the end of the ball. Adjustment to compensate for wear is accomplished by turning the sleeve with a suitable wrench until a perfect seal is obtained.

On 1935-36 models, the seal consists of a felt packing ring, Fig. 4, which is pressed against the end of the propeller shaft housing with two steel washers, one on each side of the packing. Adjustment of this type seal is made in the same manner as outlined above.

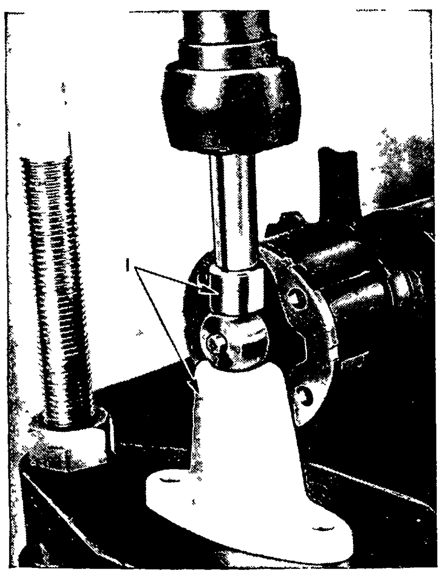


Fig. 7 Showing jig and locating bushing for installing trunnion pin in Detroit Ball & Trunnion Joint

CROSS & YOKE JOINT

Fig. 5. In this design, the cross consists of four integral trunnion pins. The pins are fitted with caged needle bearings, held in place by wire lock rings. The front and rear yokes are splined to the transmission mainshaft and propeller shaft, respectively, in the same manner as the split ring joint used on earlier models. Likewise, the joint is enclosed by the transmission case and the ball retainer collar.

To remove the joint, take out the speedometer driven gear and shaft to prevent stripping the threads on the gear. (On 1941 and later models this is not necessary as the gear is mounted on a spacer between the front yoke and the transmission rear bearing.) Unfasten the ball retainer collar from the transmission and slide the ball back on the propeller shaft housing (torque tube). Unfasten the trunnion bearings from the front yoke, take off the bearings and split the joint. Slip the rear yoke from the propeller shaft. Remove the cap screw and slide the front yoke from the transmission mainshaft.

Release the lock rings from the two remaining bearings and drive the bearings from the yoke, using a drift punch in the center of the cross. After the cross has been driven down to the yoke, raise it again and slip a $\frac{11}{16}$″ flat washer over the bearing. Again drive down the cross until the bearing is free of the yoke. This method prevents cocking the bearing, which would result in damage to both the bearing and yoke.

To assemble, install the front yoke on the transmission mainshaft, being sure the spacer is against the transmission mainshaft bearing. Then, with the locating washer and lock washer in place, tighten the cap screw securely. Thread the cross into the rear yoke. Coat the inside of the bearing cups with light cup grease and assemble the rollers in the bearing cups. Start the bearings into the rear yoke, at the same time fitting the trunnion pins into the bearings. Press each bearing into the yoke just far enough to install the lock ring. Then in-

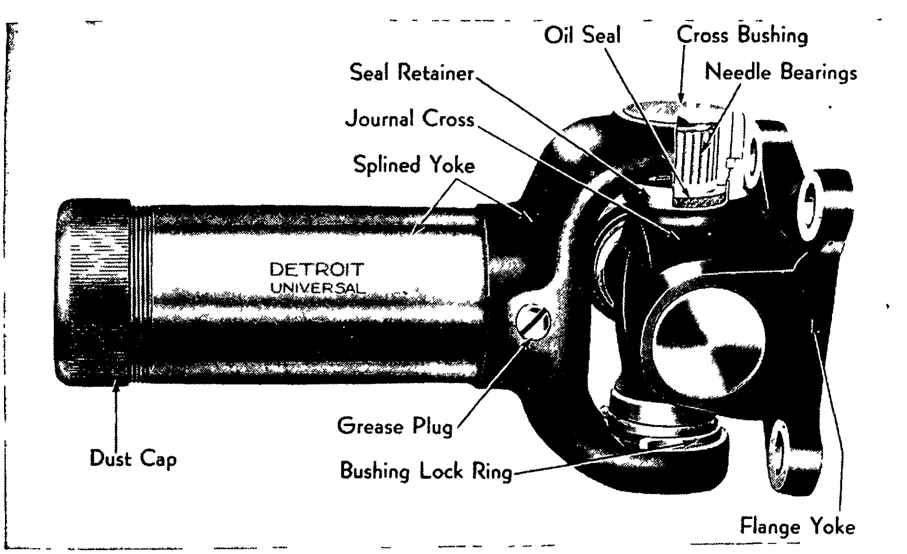


Fig. 8 D tr it Cr ss & Y ke J int

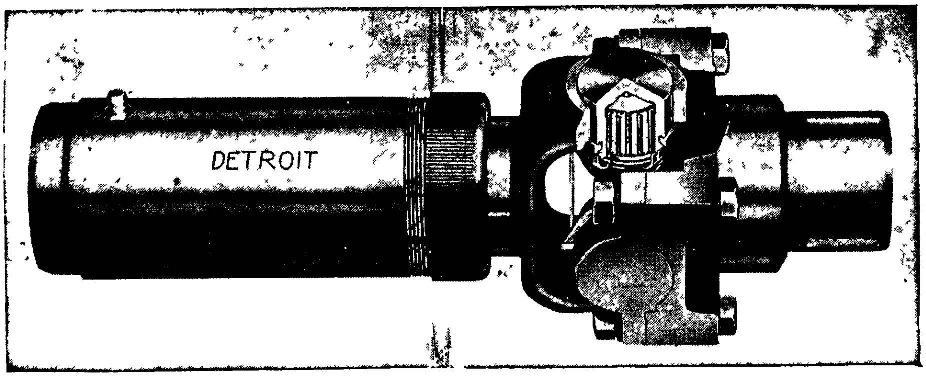


Fig. 9 Detr it Split Yoke J int

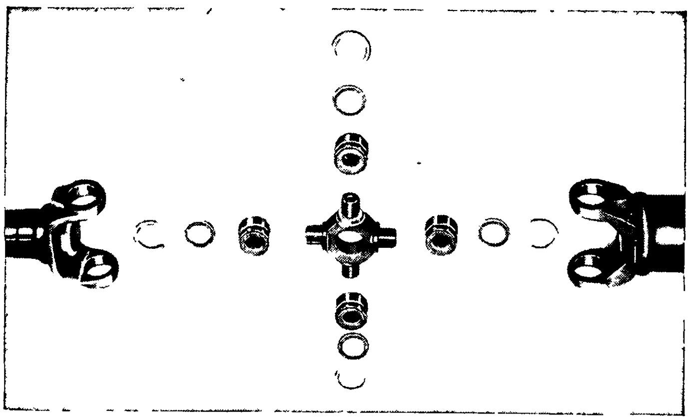


Fig. 10 Mechanics Cr ss & Y k J int

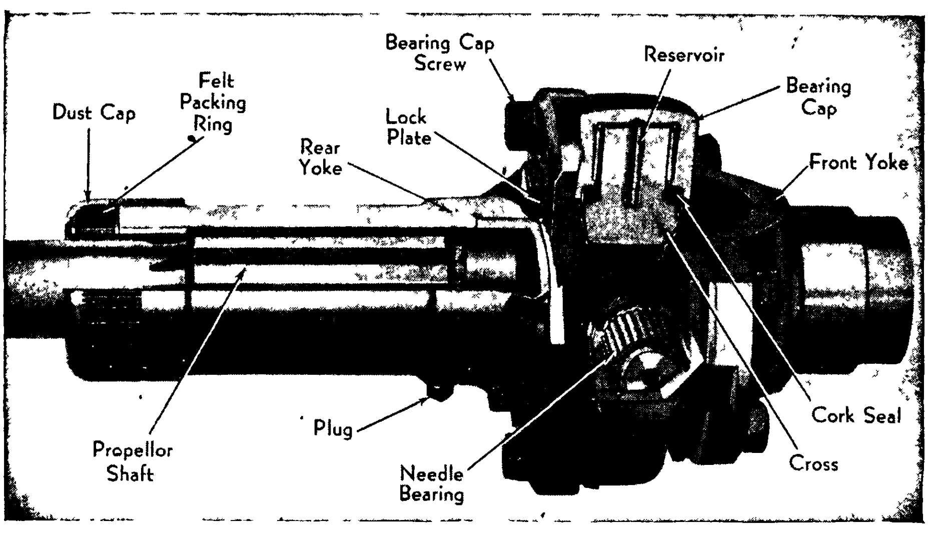


Fig. 11 Mechanics Split Yoke Joint

stall the rear yoke and cross on the propeller shaft splines.

Assemble the rollers in the front yoke bearings and place them on the trunnion pins. Line up the bearings with the front yoke, making sure the pilots on the trunnion pins fit into the opening of the yoke. Install the lock washers and cap screws and tighten securely.

Slide the universal ball and retainer collar forward and fasten the collar to the transmission case. Fill the universal joint housing with transmission lubricant through the speedometer driven gear opening. Then install the speedometer gear and shaft.

DETROIT

BALL & TRUNNION JOINT

Fig. 6. The construction of this type joint permits end movement within itself and does not require a slip joint. One member consists of a cup-shaped forging (universal body) having two opposed U-shaped milled grooves. This is attached to the transmission mainshaft by a companion flange. A pin is pressed through the end of the propeller shaft, and hollow balls rotate on needle bearings on both ends of the pin. Rounded buttons are inserted into the ends of the pin. These balls and buttons fit into the milled grooves in the body and, together with the pin, form the other member.

A tapered coil spring is placed between the propeller shaft and grease cover. When joints of this type are used at both ends of the propeller shaft, springs in both joints limit the endwise movement of the propeller shaft and prevent the balls from bottoming in the grooves.

To disassemble the joint, straighten the clip ends of the metal grease cover and slip the cover from the body. Push the body toward the propeller shaft. Remove the centering buttons and springs from each end of the trunnion pin. Take off the two balls, rollers and thrust washers. Press the trunnion pin out of the end of the propeller shaft.

Clean and inspect all parts for possible damage. If the body is worn, it will be necessary to replace all parts, including balls, thrust washers, centering buttons and rollers.

Assembly can be made in the reverse order. However, since the endwise location of the trunnion pin controls the runout and balance of the propeller shaft, it should be a very tight press fit in the propeller shaft hole. Each end of the pin should protrude the same distance or with a variation of not more than .006", otherwise the balance will be destroyed and cause vibration. A special jig and locating bushing, Fig. 7, will greatly facilitate the removal and accurate balanced installation of the trunnion pin.

If the jig and locating bushing are not available, the measurement may be checked by supporting the propeller shaft on "V" blocks and checking the ends of the trunnion pin with a dial indicator by rotating the shaft and contacting the ends of the pin with the indicator.

SERVICE NOTE—These joints are lubricated when assembled at the factory and, under ordinary conditions, should require no further attention. However, the grease boots should be inspected at regular lubrication periods for damage which may be caused by flying stones, etc. The boots, if damaged, should be replaced before the loss or contamination of the lubricant occurs, which would result in damage to the working parts of the joints.

To lubricate the joints properly, they should be disassembled and all the old grease cleaned out thoroughly. Then the body of the joint should be packed with the exact quantity and type of lubricant specified by the manufacturer of the car on which the joint is being used.

CROSS & YOKE JOINT

Fig. 8. In this type joint, the cross is mounted on needle bearings which pivot the ends of the cross to the two yokes. Capped bushings, held in place by lock rings, hold the needle bearings in the yokes. One yoke is integral with the splined sleeve of the slip yoke, and the other yoke is integral with the companion flange, which is bolted to a mating flange on the transmission.

The bearings are lubricated when assembled and, under normal conditions, should require no further attention. No adjustments are provided to compensate for wear of the parts. The component

parts of the bearings, including bushings, rollers and roller retainers are available for replacement as an assembly only.

To disassemble the joint, remove the lock rings from the grooves in the cross bushings and withdraw the bearing assemblies. The cross may then be wormed out of the yoke, and the seals and retainers removed.

To assemble, place new seals in the retainers and slip them up against the shoulders on the cross. Position the cross in the yokes. Pack the bearings with the recommended grease, slip them in place and install the lock rings. If the splined joint has been disassembled, clean, lubricate and assemble with the balance arrows in line with each other.

SPLIT YOKE JOINT

Fig. 9. This type joint is quite similar to the cross and yoke type described above, the chief difference being that the bearing blocks form part of the front yoke. The cross bearings and bearing blocks are supplied with their component parts as an assembly only.

To remove the propeller shaft and universal assembly, unbolt the bearing blocks from the companion yokes and take the assembly from under the car. Unhook the tie spring which holds the bearing blocks on the cross and remove the blocks, seals and retainers. Release the lock rings from the cross bearings and take off the bearings and seals. The cross may then be worked out of the yoke.

Assembly may be made in the reverse order, being sure that all parts are clean and properly lubricated.

MECHANICS

CROSS & YOKE TYPE

Fig. 10. A transmission companion flange is not needed with this type joint since the transmission mainshaft forms the male member of the slip joint, while the sleeve yoke forms the female half. The sleeve yoke receives its lubrication from the transmission and, therefore, a grease fitting is not required. To prevent the grease from leaking, however, a metal cup is pressed into the counterbore at the rear of the yoke.

The trunnion pins are drilled to provide an oil reservoir which is filled with oil when assembled and, under ordinary conditions, should require no further attention.

To remove the propeller shaft, disconnect the shaft at the axle end and slide it backward until the sleeve yoke is free of the transmission mainshaft.

Before disassembling, mark the bearings, propeller shaft and sleeve yoke so that all parts, even though some new parts are to be installed, may be reassembled in their respective positions.

To disassemble, remove the lock rings and push one bearing toward the cross —which will force out the opposite bearing. The pushed bearing may then be removed by forcing it out with the cross. Repeat this procedure with the other two bearings. When all bearings are taken out, it may be necessary to remove one dust shield before the cross can be worked out of the yoke.

Wash all parts carefully and probe the oil holes in the trunnion pins to remove any hardened grease that may be present. Examine the bearing surfaces of the trunnion pins and the inside of the outer races for wear, and the rollers for flat surfaces. If the cork seals are brittle or charred, install new seals.

To assemble, pack the rollers with the recommended grease, filling all cavities and reservoirs in the trunnion pins. Then assemble the parts in the reverse order of disassembly.

SERVICE NOTE—When installing the sleeve yoke to the transmission mainshaft, apply a tablespoonful of chassis lubricant to the splines to provide initial lubrication. Also see that the surface of the yoke where the transmission oil seal rubs is smooth. A new seal should always be used at this point whenever the joint is removed.

SPLIT YOKE TYPE

Fig. 11. In this design, the joint consists of a cross with four needle bearing units of the same construction as in the cross and yoke type described above. The bearing cups, however, are of the block type, two of which form one half of each yoke. The rear yoke is splined to the propeller shaft.

To remove the propeller shaft, wrap a piece of wire around the trunnion bearings to prevent the loss of parts while removing the shaft and joint from under the car. Then remove the cap screws attaching the joints to the companion yokes at the transmission and rear axle. Tap the trunnions lightly with a soft-headed hammer to disengage the driving lugs, and remove the assembly.

Follow the same procedure and observe the same precaution in servicing this universal as described for the cross and yoke type.

SAGINAW

CROSS & YOKE TYPE

This design, Figs. 12 and 13, is quite similar to the Mechanics Cross and Yoke type. The only difference is that in the Saginaw, the bearings are held in place by a cap screw and clamp plate. In servicing this type, follow the same pro-

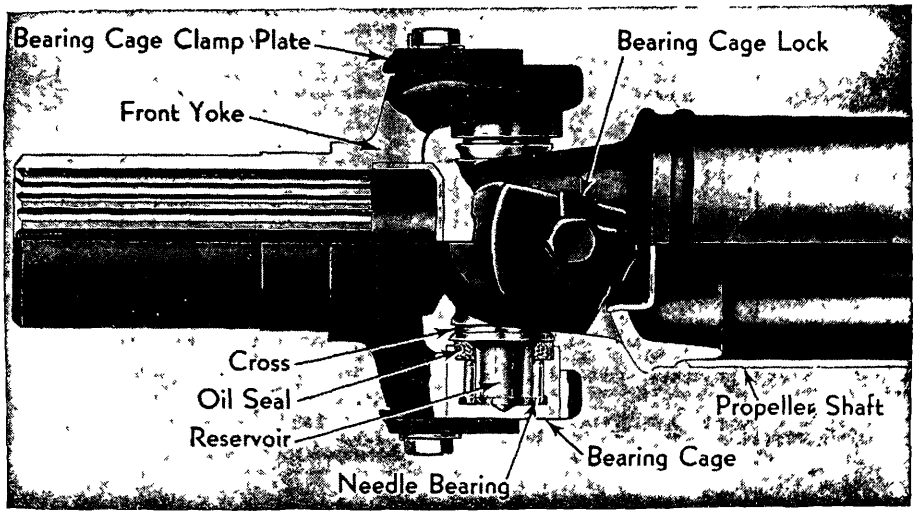


Fig. 12 Saginaw Cross & Yoke Joint

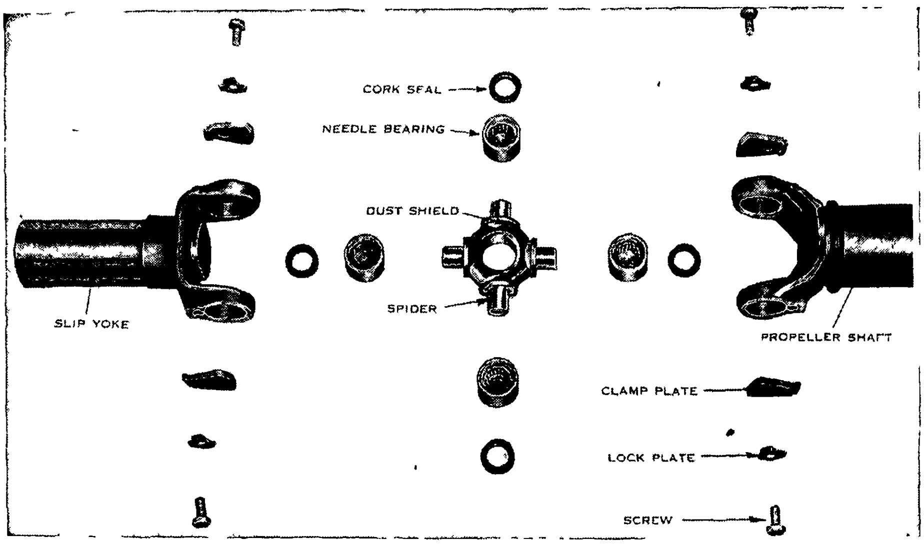


Fig. 13 Exploded view of Saginaw Cross & Yoke Joint

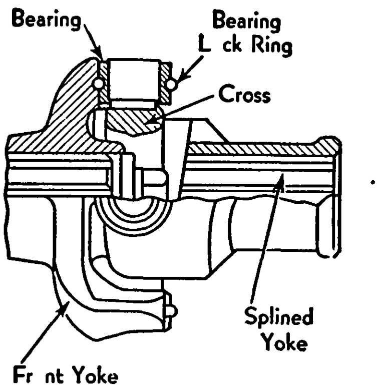


Fig. 14 Spicer Ring & Trunnion Joint with plain bearings

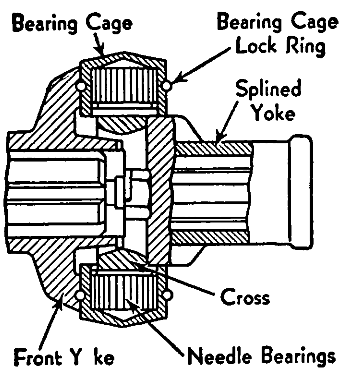


Fig. 15 Spicer Ring & Trunnion J int with needle bearings

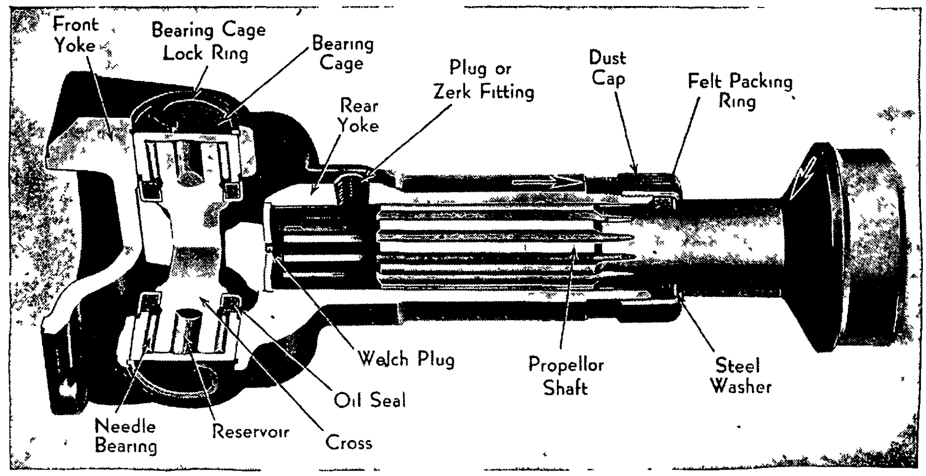


Fig. 16 Spicer Cross & Yoke Joint

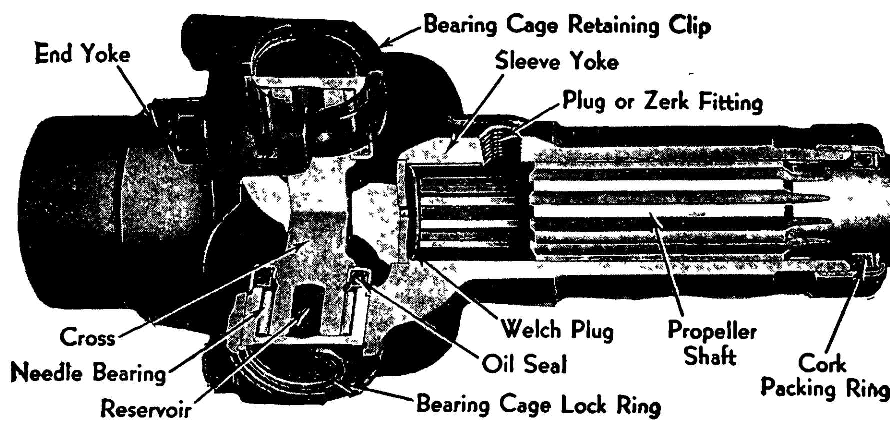


Fig. 17 Spicer Split Yoke Joint

cedure given for the Mechanics type, Fig. 10, being sure that all cap screws are tight. New lock plates should be used and the ears of these plates should be bent so they are flat against the cap screw heads.

SPICER

RING & TRUNNION TYPE

This construction is used on Ford, Mercury and Lincoln cars prior to 1949. 1949 and later models use Mechanics Cross and Yoke type at the front and split Yoke type at the rear. The cross consists of a ring with four integral trunnion pins. In Fig. 14, the trunnion pins are fitted with hardened and ground steel bushings which, in turn, are held in the yokes by wire lock rings. Needle bearings are used in Fig. 15, they being housed in a capped bushing or bearing cage, which also is retained by lock rings.

Both the front and rear yokes have internal splines. The front yoke meshes with the splines on the transmission mainshaft, and end movement is prevented by a washer which seats into the counterbore in the yoke and against the end of the transmission mainshaft.

The joint is entirely enclosed by the torque tube cap and the transmission rear bearing retainer. It is automatically lubricated by grease from the transmission.

To remove the joint, it is necessary to take out the rear axle and propeller shaft. When this is done, remove the cap screw from the end of the transmission mainshaft and slide the universal from the shaft.

With the bushing type joint, Fig. 14, remove the lock rings and drive the bushings out with a flat-nosed punch, tapping with a hammer, first on one side and then on the other. With the needle bearing type, Fig. 15, remove the lock rings and, with a soft-faced hammer, tap the bearing units off the cross.

Wash all parts thoroughly and examine for wear or damage. Make sure there are no grooves or ridges on the bearing surface of the cross, and that the bearing cups or bushings are free from chipped edges or grooves.

Before assembling, oil all bearing surfaces as grease may not reach the parts for the first few revolutions when the car is put into operation. Use care when installing new bushings or roller bearing cups to see that they are driven in straight so that the edges will not mar the bearing surfaces.

When installing the universal to the transmission, see that the bolt which fastens the joint to the transmission mainshaft is drawn down tightly, and that the washer is well seated in the counterbore of the yoke.

When assembling the torque tube to the transmission, use a new gasket between the torque tube cap and the transmission rear bearing retainer.

CROSS & YOKE TYPE

Fig. 16. In this universal, the cross is mounted on needle bearings in the conventional manner. The bearing units are retained in the yokes by lock rings which snap into machined grooves in the yokes. The trunnion pins are drilled to provide an oil reservoir which is filled at assembly. To prevent the entrance of dust and dirt, a welch plug is pressed into the counterbore at the forward end of the splined sleeve of the rear yoke.

To disassemble, pinch the ends of the lock rings together with a pair of pliers. If the rings do not come out readily, tap the end of the bearing lightly—which should relieve the pressure against the ring.

Drive on the end of one bearing until the opposite bearing is pushed out of the yoke arm. Turn the joint over and drive the first bearing back out of the arm by tapping on the exposed end of the cross arm. To avoid damaging bearings, use a soft round drift with a flat face about $\frac{1}{32}$ inch smaller in diameter than the hole in the yoke arm. Repeat the above operation for the other two

bearings, then lift out the cross by sliding it to one side.

Wash all parts and replace any that show wear. Make sure that the grease channel in each trunnion pin is open by forcing grease through the channels with a hand grease gun. Use new seals when assembling, and fill the bearing cups about one-third full of grease and install the rollers. Hold the bearing cups in a vertical position to prevent the rollers from dropping out when installing.

Assemble the joint in the reverse order of disassembly, being sure the lock rings are well seated in the grooves in the yoke arms.

SPLIT YOKE TYPE

Fig. 17. This type joint is quite similar to the cross and yoke universal described above, the chief difference being that U-bolts form part of the front yoke.

To remove the propeller shaft and joint assembly, unscrew the four U-bolt nuts, tap out the U-bolts and slide off the two bearings. This permits the removal of the shaft. Compress the lock rings that retain the other two bearing units and drive them out in the same manner as for the cross and yoke type.

Reverse the procedure to assemble, being sure the grease channels are open. New seals should be used, and the bearings should be lubricated and assembled in the same manner as for the cross and yoke type.

REAR AXLES

GENERAL INSTRUCTIONS

In rear axle service work, there are minor and major operations. Minor operations, such as the removal of axle shafts, bearings and oil seals, can be performed in most cases, without removing the differential carrier from the axle housing. In the case of Ford, Mercury and Lincoln, prior to 1949, however, since the differential side gears are pressed onto the inner ends of the axle shafts, the rear axle must be dismantled in order to perform these operations. (For detailed instructions covering the removal, installation and adjustment of axle shafts, bearings and oil seals, see the car chapters.)

Major operations, such as the replacement of ring gear and pinion, must be performed with the differential carrier removed from the axle housing. The preliminary work required to remove the differential carrier depends upon the construction employed. In most cases, a removable cover is attached to the back of the axle housing, while in others it is welded to the housing. (Procedure for removing differential carriers and axle assemblies is given in the car chapters.)

DISASSEMBLY

Before dismantling the carrier, bear in mind that the factory adjustment of ring gear and pinion sets should not be disturbed unless absolutely necessary. For example, should it become necessary to tear down a differential to replace some part other than a ring gear and pinion, do not disturb the drive pinion adjustment in either disassembling or assembling the unit—assuming of course that it was correct beforehand. Instead, only adjust the ring gear when assembling the unit—which will increase the chances of securing a setting precisely the same as the original setting. In addition, backlash between the ring gear and pinion should be checked and noted before dismantling the unit in order that the gear may be adjusted to the original backlash when making the final adjustments.

It should be remembered that ring gears and pinions are matched at the factory and should remain matched in service. Many times, when one member of a ring gear and pinion set is divorced from the other, the new combination results in a certain amount of noise and an abnormal amount of wear and strain on the teeth. Because of this, service replacements are furnished in matched sets.

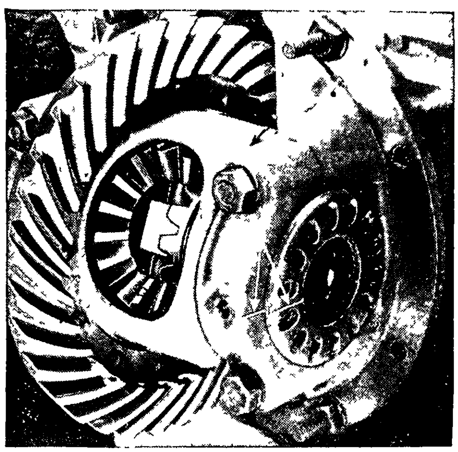


Fig. 1 Marking differential adjusting nuts and bearing caps before dismantling assembly

With the differential carrier mounted in a vise or fixture, the next step consists of removing the ring gear and differential from the carrier. Before proceeding, however, scratch a mark on each differential adjusting nut and bearing cap, Fig. 1. These marks not only locate on which side of the carrier the adjusting nuts and bearing caps are mounted but they show the number of threads exposed on each adjusting nut, and the exact position of the nuts with relation to the bearing caps. If the same ring gear and pinion are to be used again, these marks will serve to bring the original adjustment into being with a minimum of time and effort. (If the differential bearings are adjusted by shims, Fig. 2, simply tie each set of shims together and carefully lay them aside until needed.)

After removing the differential bearing cap screws, take off the caps and adjusting nuts and lift the differential out of the carrier. Where shims are used for adjusting differential bearings, remove the caps from the bearings and pry the differential out of the carrier, Fig. 3.

The first step in the disassembly of the differential is to remove the ring gear. After removing the attaching cap screws, drive the gear off the differential case by tapping lightly with a soft-faced hammer or mallet. Drive out the differential pinion shaft lock pin, Fig. 4, and push out the shaft (sometimes a lock screw is used). The side gears, pinions, thrust washers, thrust block (if used) and spacers will then be loose and may be picked out of the differential case, Fig. 5. (Specific data concerning special installations are given under the car name.) The differential bearings may then be removed from the case with a puller of the type shown in Fig. 6.

The next step is to disassemble the drive pinion. However, it should be removed and disassembled only when it is necessary to replace a part, or to examine closely all parts in connection with a major inspection and overhaul operation. To disassemble, follow the procedure for each type pinion arrangement as given under the car name.

In this connection, however, if the differential carrier was satisfactory from the standpoint of noise before being taken apart, or if it is disassembled for the replacement of a part other than a ring gear and pinion, the location and quantity of shims should be noted. The shims then should be cleaned, tagged and tied together and carefully hung on a hook or set to one side so that, upon reassembly, the original setting may be obtained without delay.

When removing and replacing pinion oil seals, care should be taken to avoid cutting the seal on the sharp edges of the pinion shaft threads, keyway or splines. If the seal is cut and is not replaced, serious leakage of lubricant is almost certain to result.

The best way to guard against cutting the seal is to wrap a piece of shim stock around the pinion shaft so that the oil seal will not come in contact with any sharp edges when the seal is slid off and on. Be sure to blunt or dull the edges of the shim stock so it will not cut the seal.

INSPECTION

BEARINGS—Before inspecting bearings, each one should be cleaned by swishing it around in a pail of clean gasoline or kerosene until it is entirely free from grease and oil. Then blow dry with compressed air (if available) rotating the bearing slowly by hand—not by the air pressure. When cleaned and dried, lubricate the bearing with clean engine oil, rotate it by hand, and check for wear and rough spots. If any defects are discovered, it should be discarded.

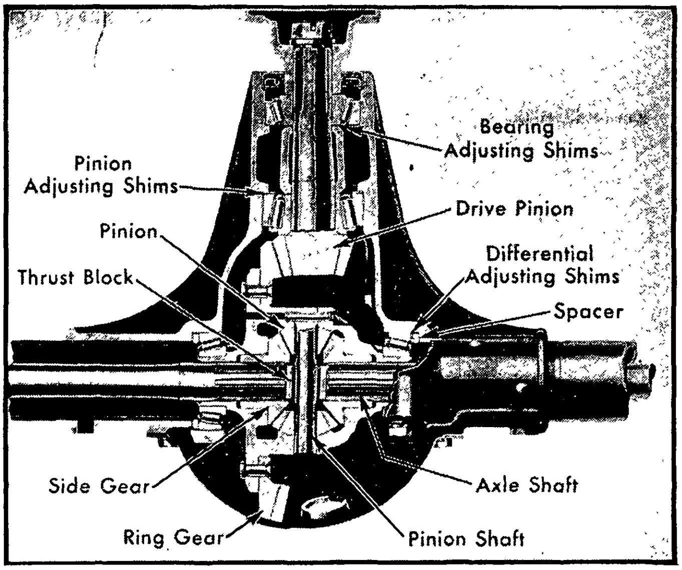


Fig. 2 Showing differential carrier of type having shims for adjusting differential bearings

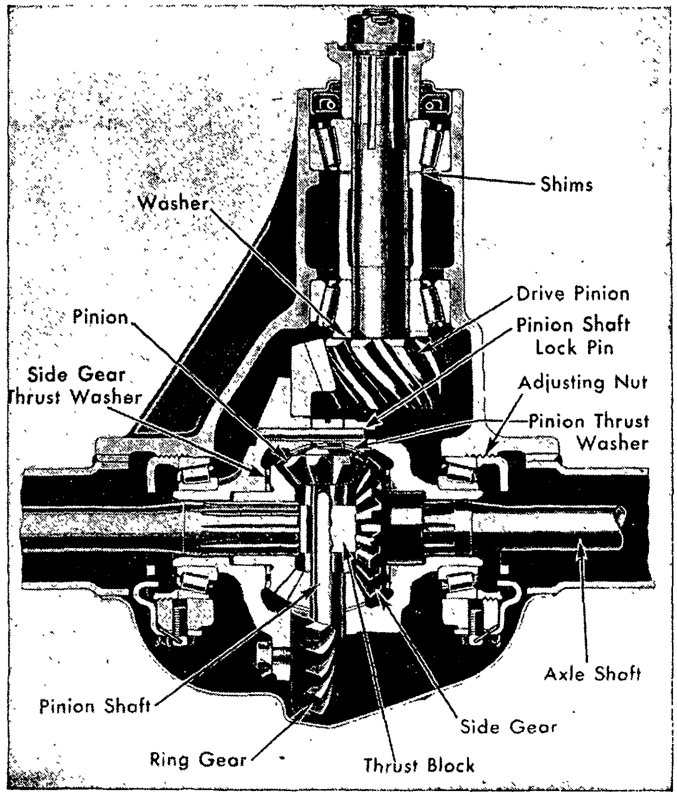


Fig. 5 Details of typical differential unit

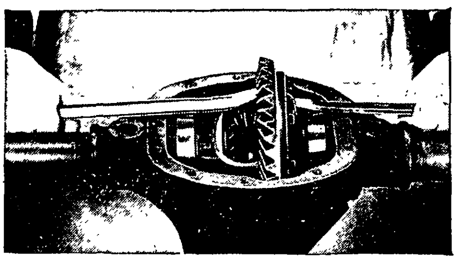


Fig. 3 Method of removing differential fr m carrier n type having shim-adjusted bearings

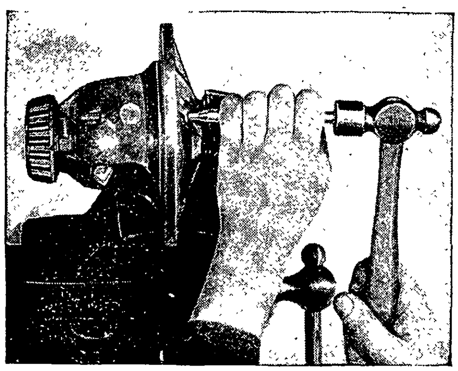


Fig. 4 Removing differential pinion shaft lock pin

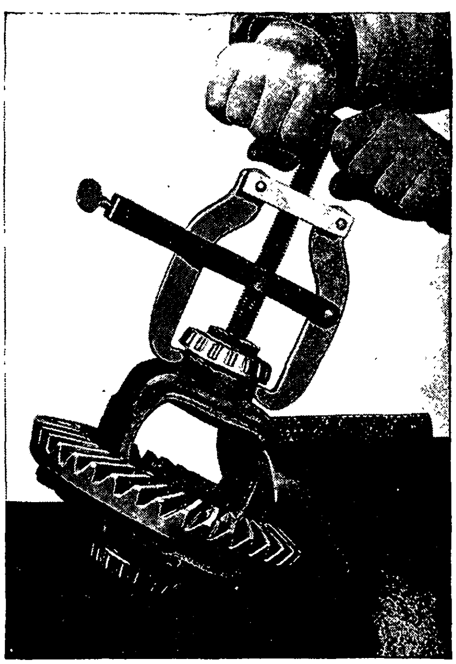


Fig. 6 R m ving differential bearings with puller

DIFFERENTIAL PARTS—All parts of the differential, including gears, differential case, carrier, and the axle housing, should be washed thoroughly in clean gasoline or kerosene. Particular attention should be given to remote corners and recesses in the carrier and axle housing to be sure that all muck, grit, gear chips and old grease are removed.

Examine the ring gear and pinion for cracked, chipped or scored teeth. Inspect the bearing surfaces, also the side gears and differential pinion surfaces of the differential case for evidence of roughness or scoring. Inspect the thrust faces of the differential pinions and check their fit on the pinion shaft. Inspect the thrust surfaces of the side gears and check their fit on the axle shafts. Any gears showing any of the above conditions should be scrapped. If the case is equipped with side gear and pinion gear thrust washers, inspect the washers and replace if worn.

Score marks on the contact face of gear teeth show up as light colored areas which are caused by instantaneous fusing of the mating gear teeth, and usually run from the bottom to the top of the tooth.

A scoring condition may be the result of insufficient lubrication, the improper lubricant for the load required for the gears, dirty lubricant, or improper tooth contact. The gears in the differential which usually cause noisy operation from these conditions are the ring gear and pinion. The side gears and differential pinions rarely give trouble. In fact, they can be badly worn without affecting the operation of the differential, as they are used only when one rear wheel travels faster than the opposite rear wheel. In spite of this, however, worn side gears and differential pinions should always be replaced during an overhaul operation. If not, the condition will become worse and eventually, through failure of these parts, another expensive tear-down will be required.

ASSEMBLY

The sequence of operations in assembling any piece of mechanism is usually performed in the reverse order from which it was disassembled. Differential carrier units are no exception although the sequence given below may be changed to suit shop conditions. For example, instead of starting with the differential case and ring gear, the drive pinion may be set up and adjusted in the carrier first.

CHECKING DIFFERENTIAL CASE RUN-OUT—Mount the differential case on V blocks, Fig. 7, and check the run-out of the ring gear pilot and case flange. To make this check, mount the dial indicator as shown, with the indicator needle set to zero and the contacting pin just touching the surface to be checked.

Rotate the differential case in the V blocks for one complete revolution and note the amount of deflection on the needle If the deflection is in excess of the maximum allowable run-out (usually .002 inch) replace the differential case or true it up on a lathe.

RING GEAR, INSTALL—If the ring gear is the bolt-on type, cut the heads from five or six 1½ inch cap screws having the same thread as the ring gear cap screws (These are to be used as guide pins and can be kept for future jobs) Cut screwdriver slots in the end of these guide pins and screw them in every other hole in the ring gear, Fig 8 Be sure the back face of the ring gear and differential flange face are clean and free from nicks and burrs, and any rust preventive film that may be present

Slip the ring gear with the guide pins on the differential case and tap it in place with a mallet Install the regular cap screws in the open holes and draw them up evenly and tightly Remove the guide pins and install the other cap screws. New lock washers should be used and if the cap screw heads are drilled, use new wire to lock them in place

Mount the assembly in V blocks, Fig 9, and check the run-out of the back face of the ring gear in the same manner as described above for the differential case If the deflection of the needle is in excess of the maximum allowable run-out (usually .006 inch) the ring gear may not be bolted evenly against the flange face.

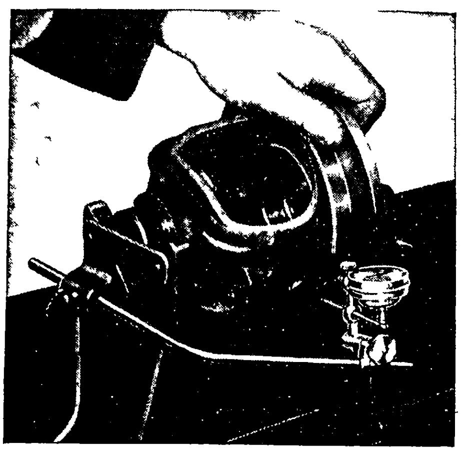


Fig. 7 Checking run-out of ring gear pilot on differential case

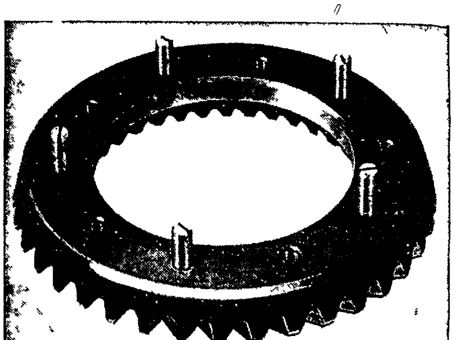


Fig. 8 Use of guide screws for ring gear installation

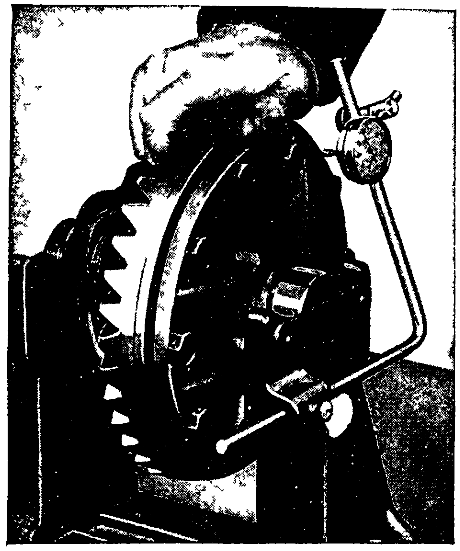


Fig. 9 Checking run-out of back face of ring gear

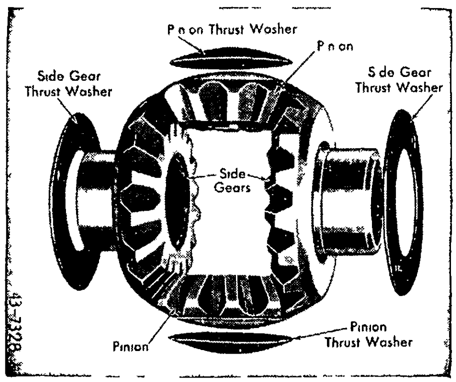


Fig. 10 Layout of differential parts

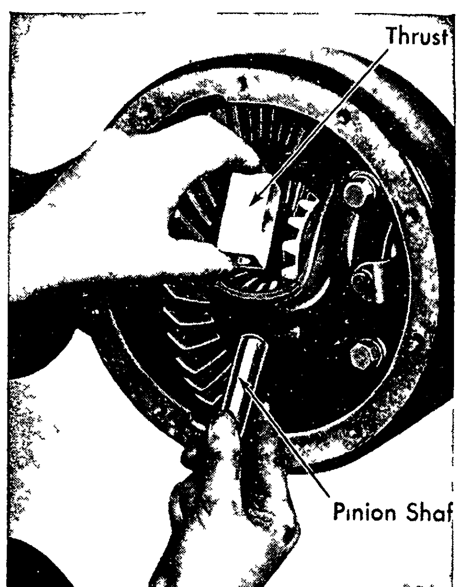


Fig. 11 Installing axle shaft thrust block and differential pinion shaft

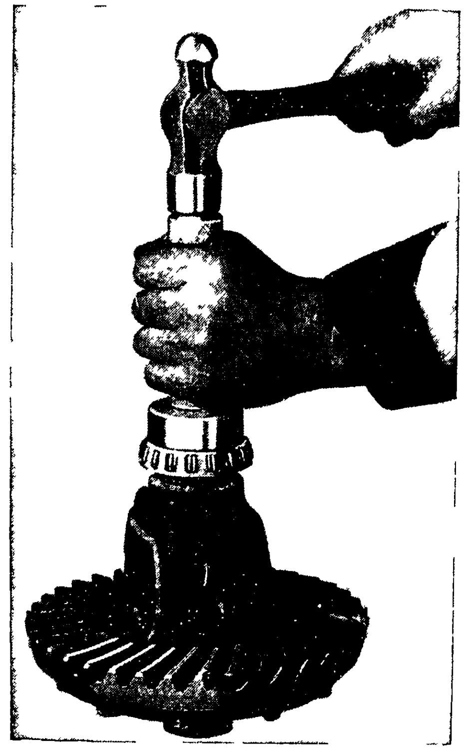


Fig. 12 Installing differential bearings

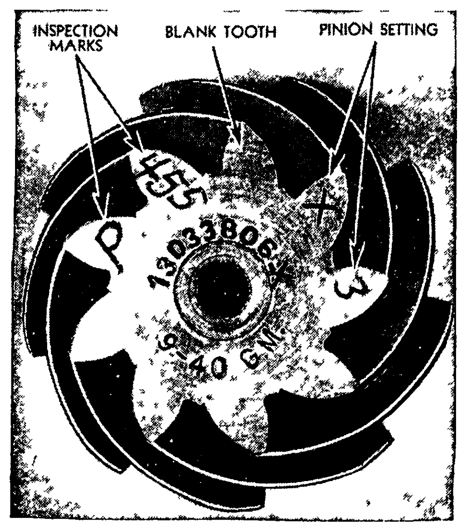


Fig. 13 Example of pinion depth markings

Sometimes this check is made with the side bearings mounted on the differential case hubs If so, and the run-out is excessive, the bearings may be mounted incorrectly or they may be cocked on the hubs

If the ring gear is riveted on the case, it should be removed and replaced in the following manner Drill through the head of each rivet, using a drill slightly larger than the hole in the case When the drill penetrates through the case, the head will come off and the rivet can then be driven out Always drill rivets from the differential case flange side Do not cut them off with a chisel as this distorts the case

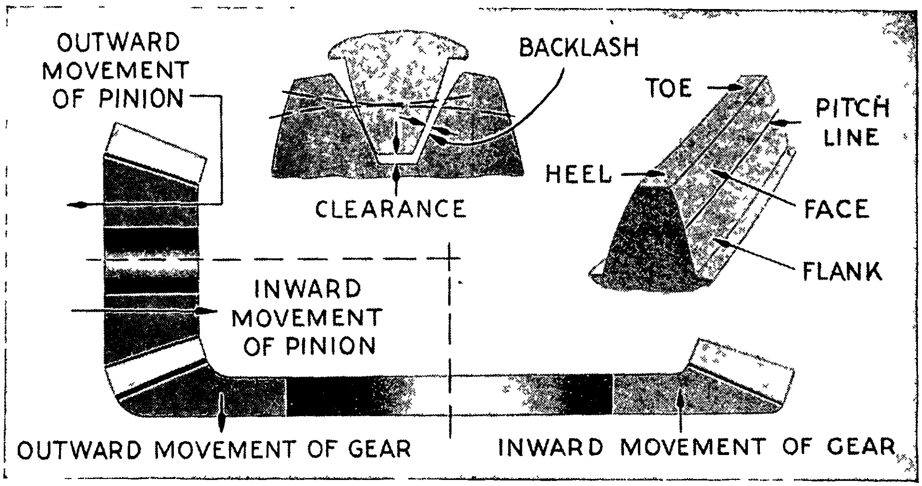


Fig. 14 Sh wing gear movement and t oth terminology

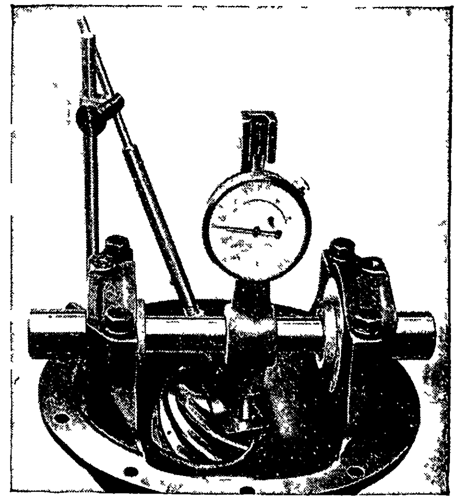


Fig. 17 "Dialocator" as used with hypoid gear installati n

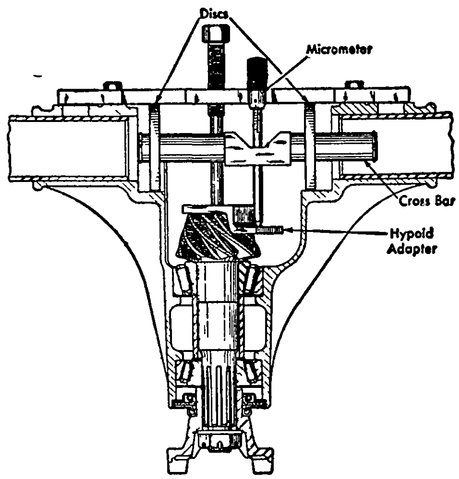


Fig. 15 Micrometer type pinion setting gauge

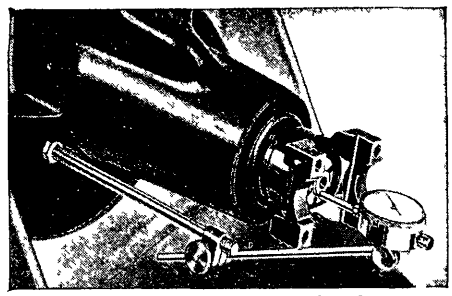


Fig. 18 Checking nd play of drive pini n

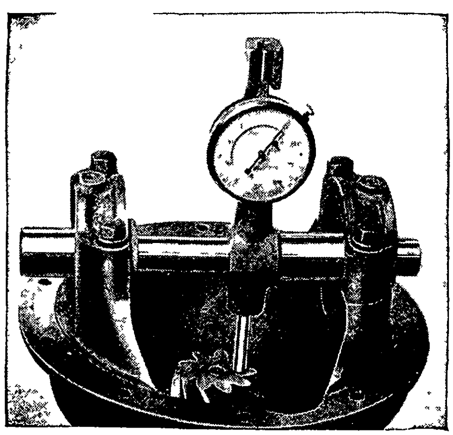


Fig. 16 "Dialocator" as used with spiral bevel gear installation

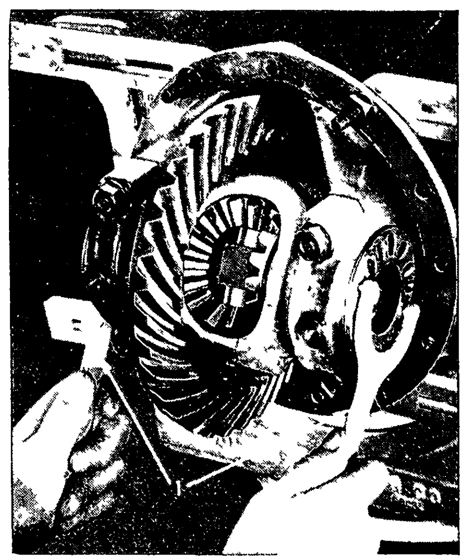


Fig. 19 Adjusting differential bearings on units having adjusting nuts

Remove any burrs from around the rivet holes, and check the run-out of the case as described above.

Before riveting on the new gear, bolt it to the case through every other hole and draw down tight to prevent the rivets being squeezed out between the ring gear and the case. Use cold rivets and a riveting machine, if possible and always head the rivets on the ring gear flange—never on the back of the differential case.

The use of hot rivets, headed over by hand, is only recommended as a last resort when cold riveting equipment is not available. This is because when hot rivets cool off, they contract and very often are loose in the holes, with the result that when the gear is under load, the rivets shear off.

Head over one rivet, turn the differential case halfway around and head a rivet at this point. Then head over a rivet between the two already installed, working successively from one side of the gear to the other until all open holes are filled. Remove the temporary bolts and install the rivets in these holes in the same manner.

When the job is completed, mount the assembly in V blocks and check the run-out on the back face of the gear in the manner described above. If excessive, the ring gear may not be riveted evenly against the flange face. If this is the case, remove the rivets and make the installation correctly.

ASSEMBLY OF DIFFERENTIAL — When installing the differential gears and thrust washers (if used), Fig. 10, coat these parts with differential lubricant to facilitate holding them in place while replacing the differential pinion shaft.

Slip the side gear thrust washers and side gears in the differential case. Roll the differential pinions in place, rotating the side gears until the hole through the center of the pinions is in line with the hole for the pinion shaft in the case. Install the axle shaft thrust block (if used) Fig. 11, and push the pinion shaft in place so that the hole in the shaft for the lock pin or screw registers with the hole in the case. Install the lock pin and peen over the outside edge of the hole to prevent the pin from coming loose in service. If a lock screw is used, install a new lock washer and set the screw up tight.

DIFFERENTIAL BEARINGS, INSTALL —Install the differential side bearings, Fig. 12, with the thick side of the inner races toward the case. Be sure they are not cocked and that the inner races seat squarely against the hubs of the differential case. This completes the assembly of the differential unit.

DRIVE PINION, INSTALL—Due to the fact that all gears are not made on the same machine, a definite setting for pinion depth to bring the ring gear and pinion exactly on the cone centers is determined in manufacture by testing each ring gear and pinion set. These setting marks are etched on the toe end of the pinion and read zero (0), or plus (+) or minus (—) a nominal amount, in thou-

sandths of an inch. Fig. 13 is an example showing a pinion marked plus .003 inch (+3).

A plus mark indicates that the pinion is to be set outward from the center line of the axle. A minus mark indicates that the pinion is to be set inward to the center line of the axle. (Fig. 14 explains gear movements and tooth terminology.)

In order to make these depth settings in accordance with the marks on the pinion, a pinion setting gauge is essential. There are several of these gauges available commercially, each differing in detail but not in principle. Measurements are taken either by a micrometer or a dial indicator.

As shown in Figs. 15, 16 and 17, these gauges are provided with a measuring rod for setting the pinion, and are made adjustable to accommodate all width differential carriers. Different diameter discs are also provided to fit all differential side bearing bores in the carriers. Manufacturers of these gauges usually provide complete instructions for their use, and tables giving the nominal dimension for the various model pinions used on all motor vehicles on which the gauge can be used.

Using the micrometer type gauge, Fig. 15, first install the pinion in the carrier according to the instructions given under the car make, using the shims from the old pinion. Check the pinion shaft end play and make the necessary corrections.

To check the end play, place a dial indicator on the end of the pinion, Fig. 18, work the pinion in and out and note the amount of end play indicated by the movement of the needle. If the job calls for a pre-load of .002 inch, for example, and the indicated end play is .004 inch, .006 inch of shimming should be removed to give the required pre-load of .002 inch.

After the correct pre-load is established, mount the pinion setting gauge in the carrier with the proper size bearing discs, being sure that both discs are seated on the bearing surfaces and do not come in contact with the threads.

To locate the pinion, adjust the micrometer pointer to the nominal setting of the pinion. Then move the pointer to the number of thousandths of an inch etched on the end of the pinion. If a plus mark is shown, adjust the pointer away from the center line of the axle. If a minus mark is shown, adjust the pointer toward the center line of the axle. In other words, a plus mark indicates that the pinion is to be moved toward the front of the car; a minus mark toward the rear of the car. Add or remove shims as required until the pinion is located at the nominal depth, plus or minus the amount etched on the end of the pinion.

Where a pinion setting gauge is not available, assemble the differential in the carrier and adjust the backlash between the ring gear and pinion. Then check the tooth contact in the manner described in a later paragraph.

DIFFERENTIAL BEARINGS, ADJUST—Upon completion of the pinion setting operation, assemble the differential unit in the carrier and proceed as follows:

If the same ring gear and pinion are being used again, and if the adjustment

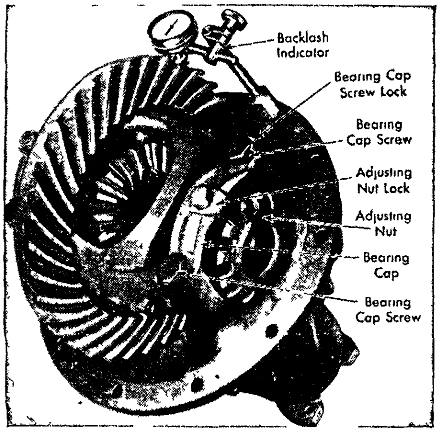


Fig. 20 Checking backlash between ring gear and pinion

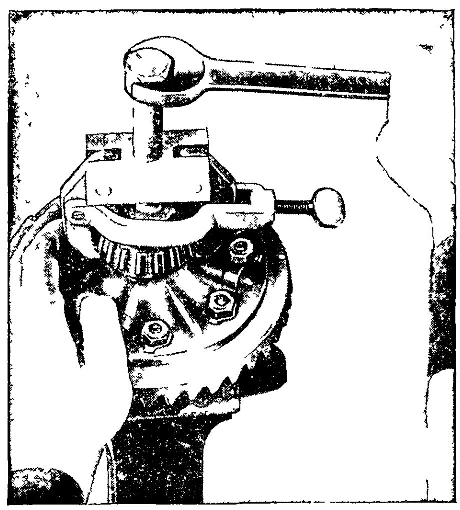


Fig. 21 Using puller to remove differential bearings

was correct before the unit was dismantled, adjust the bearings according to the marks, Fig. 1, that were scratched on the bearing caps and adjusting nuts. If the differential bearings are adjusted by shims, assemble the unit with the same quantity of shims used originally.

If a new ring gear and pinion are being used, or if an adjustment of the old gears was necessary, proceed as follows, being sure to leave off the drive pinion bearing oil seal to eliminate any drag from this source when making adjustments.

To make the adjustment on units having adjusting nuts, place the differential in the carrier and install the adjusting nuts, taking care to slide these nuts alongside the bearings so that the threads on the nuts fit properly into the threads of the carrier. Install the bearing caps, being sure the marks on the caps line up with the marks on the carrier.

Start the cap screws and drop the bearing caps on the adjusting nuts, using the screws as a pilot so as not to cross the threads. Tighten the cap screws and then loosen them from 1 to 1½ turns.

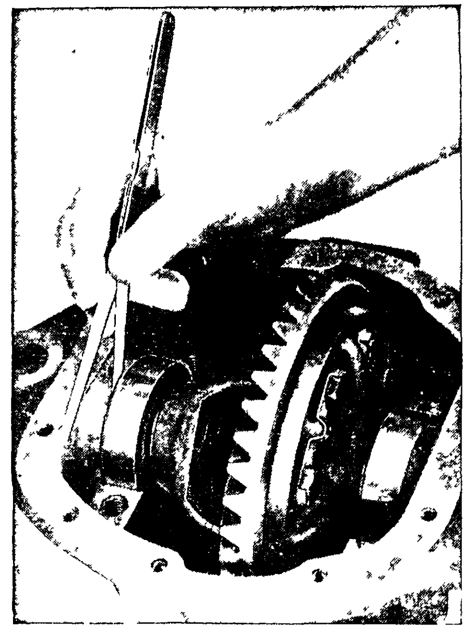


Fig. 22 Checking clearance between bearing cup and differential case n shim-adjusted differential b arings

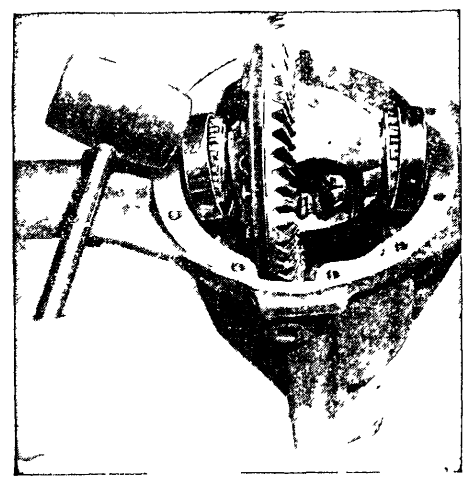


Fig. 23 Installing differential and bearing cups in units with shim-adjusted bearings

Loosen the right adjusting nut, Fig. 19, until the ring gear and differential case are loose in the bearings—usually four to five notches. Tighten the left-hand nut against the bearing race, removing all backlash between the ring gear and pinion, then back off three or four notches.

Tighten the right-hand nut until the bearing race starts to turn—indicating tension on the bearing. Continue to tighten one to two notches more, then back off the nut until the bearing race stops turning. Retighten this same nut until the bearing race again starts to turn, continuing for two notches more and whatever further tightening is necessary to bring the slot in the nut in line with the bearing cap lock, Fig. 20. Tighten the bearing cap screws and

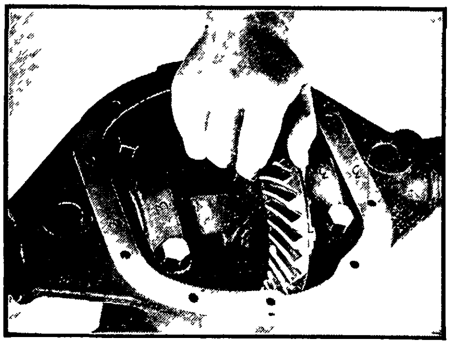


Fig. 24 Sh wing how bearing caps sh uld b installed according to numerals n shim-adjusted differential units

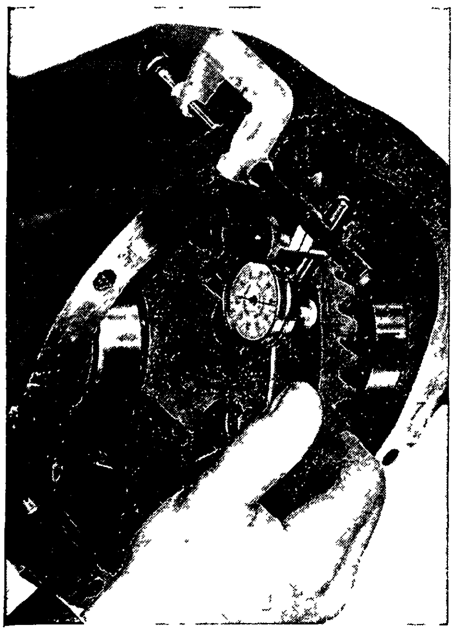


Fig. 25 Checking run-out of ring gear

check the ring gear and pinion backlash.

To check the backlash, mount a dial indicator on the carrier, Fig. 20. To assure an accurate reading, make sure the dial indicator is square with the face of the gear tooth it contacts, and that the pointer is set to zero.

CAUTION—When making this or any other adjustment of the ring gear, tighten the cap screws of the differential bearing caps after each adjustment has been made. This will avoid "creeping" of the ring gear in any direction during the process. However, do not lock the cap screws or adjusting nuts until all adjustments have been completed.

Check the backlash by rocking the ring gear back and forth and noting the amount indicated on the gauge. If the backlash is not within the limits specified by the car manufacturer (usually .005 to .010 inch) an adjustment is required. If the backlash is greater than the allowable maximum, loosen the right-hand nut one notch and tighten the left-hand nut one notch. If the lash is less

Fig. 26 Checking backlash between ring gear and pinion

than the allowable minimum, loosen the left-hand nut one notch and tighten the right-hand nut one notch.

When the adjustment is correct, tighten the bearing caps securely, then recheck the backlash. Install the adjustment nut locks. If the cap screw heads are drilled, lock them with new wire. If nut locks are employed, Fig. 20, be sure to set the ears against the sides of the cap screw heads. Use new lock washers if this locking method is used.

If the differential bearings are adjusted by shims, Fig. 3, the adjustment is obtained by the shims located at each side of the case between the shoulder of the case and the inner race of the bearing. These shims also establish the ring gear position with the pinion. Therefore, backlash must be checked whenever a bearing adjustment is made.

The correct bearing adjustment is one which will provide an .008 inch pinch fit when the differential unit is assembled into the carrier. To make an adjustment, remove the bearing cones and shims, using a puller of the type shown in Fig. 21. Reinstall the bearing cones without the shims and place the assembly in the housing with the bearing cups. Force the unit to one side and check the clearance between the bearing cup and differential case with a feeler gauge, Fig. 22. When the clearance is determined, add .008 inch of shimming—which will give the proper bearing adjustment.

Remove the differential bearings and install equal thicknesses of shims on each side and replace the bearings. Reinstall the differential unit in the housing. This operation is made easier by cocking the differential bearing cups slightly when the differential is placed in the housing and then tapping them lightly with a mallet, Fig. 23. During this operation, be sure the ring gear teeth mesh with the pinion teeth before tapping the bearings in place. After the cups are in position, install the bearing caps. The caps and the gasket surface of the housing are usually marked on one side with a horizontal numeral and on the other side with a vertical numeral, Fig. 24. The position of the numerals should coincide when installing the bearing caps.

Tighten the bearing caps securely and if there is any backlash between the ring gear and pinion, check the back face of the ring gear for run-out, Fig. 25, in a manner already described. If the total indicator reading is in excess of .003 inch, it indicates a sprung differential case or an improperly installed ring gear. In either case, the assembly must be taken apart and rechecked thoroughly.

Mount the backlash gauge indicator on the carrier, Fig. 26, and start checking the backlash between the ring gear and pinion. In the event the lash is not within the proper limits (usually .005 to .007 inch) it will be necessary to change the arrangement of the shims back of the bearings—which are supplied in thicknesses of .003, .005, .010 and .030 inch, any combination of which may be used to obtain the desired result. Make corrections in backlash according to Fig. 27, bearing in mind that shims removed from one side must be installed at the opposite side so that the total shim thickness of the right and left side will remain unchanged, and the bearing adjustment undisturbed.

NOTE—If a pinion setting gauge was not used to locate the pinion, tooth contact between the ring gear and pinion should be checked at this time, and in the following manner:

GEAR TOOTH CONTACT—Paint about 12 teeth of the ring gear, Fig. 28, with red or white lead of suitable consistency and use it sparingly. When the pinion is rotated, the paint is squeezed away by contact of the teeth, leaving bare areas showing the exact size, shape and location of the contacts. Sharper contact can be obtained by applying a small amount of resistance to the ring gear when rotating the pinion. This is done by holding a block of wood against the back of the ring gear, and using a wrench to rotate the pinion. By examining the contact marks, it can be determined whether contact is too high or too low, or too near the heel or toe.

If the contact is high and narrow, Fig. 29, remove shims so as to move the drive pinion in toward the toe of the gear teeth (toward the center of axle) to lower the contact area. This adjustment will decrease the backlash between the ring gear and pinion, which can be corrected by moving the gear away from the pinion. Several adjustments of both ring gear and pinion may be necessary before correct contact and backlash are secured, whether it is this one or those described below.

A low, narrow contact, Fig. 30, requires the addition of shims to move the pinion out from the gear (away from the center of the axle) a sufficient amount to move the contact area to the proper location. To obtain correct backlash, move the ring gear in toward the pinion.

Fig. 31 shows a short toe contact which is corrected by moving the ring

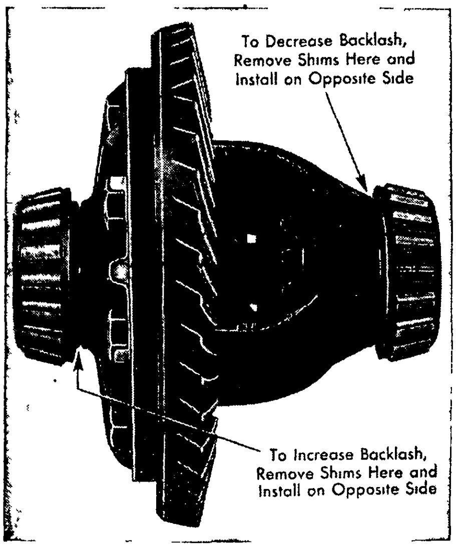


Fig. 27 M th d f correcting backlash betwe n ring gear and pinion on shim-adjusted units

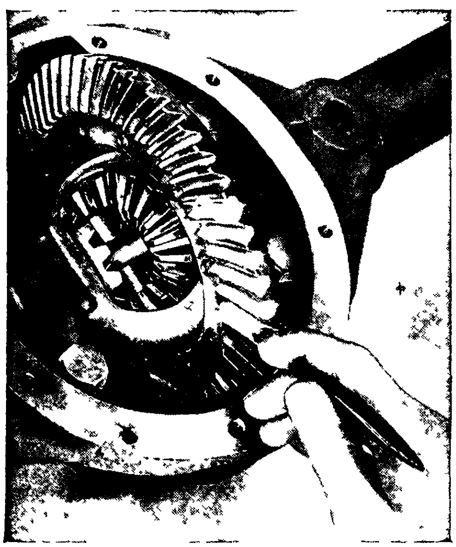


Fig. 28 Painting ring gear teeth t check t oth contact

gear away from the pinion. After establishing the correct contact, the proper backlash is obtained by moving the pinion in toward the toe of the ring gear teeth (toward center of axle).

Fig. 32 shows a short heel contact which is corrected by moving the ring gear in toward the pinion. Correct backlash is then obtained by moving the pinion out toward the heel of the ring gear teeth (away from center of axle).

When adjustments have been properly made, the contact shown in Fig. 33 will be secured. This adjustment provides a quiet operating gear set which, because the load is distributed over the teeth within the proper area, will provide normal service.

Tighten the bearing caps securely, then recheck the backlash. If correct, install the adjusting nut locks, lock the adjustment and install the differential

Fig. 29 Contact too high and narrow. Pinion should be moved toward center of axle

Fig. 30 Contact too low and narrow. Pinion should be moved away from center of axle

Fig. 31 Short toe contact. Move ring gear away from pinion

carrier unit in the axle housing, being sure the gasket is in good condition.

Some manufacturers provide thrust blocks of several thicknesses to maintain correct axle shaft end play. Where this construction is used, install the axle shafts and check the clearance as shown in Fig. 34. If the clearance does not come within the allowable limits, a new thrust block should be installed.

LUBRICATION—The differential carrier should be lubricated with the exact quantity, grade and type lubricant recommended by the manufacturer of the particular unit being serviced. The housing should never be filled above the level of the bottom of the filler plug hole.

Over-filling causes blown grease seals at the wheels, resulting in leakage and an accumulation of dirt and grease around the wheels, tires and brakes. On the other hand, if the lubricant is not kept up to the proper level, gears and bearings may run dry, resulting in excessive wear and noise.

Fig. 32 Short heel c ntact. Move ring gear toward pini n

Fig. 33 Correct tooth c ntact. Gears making contact as shown give best results f r quiet operation and l ng lif

Fig. 34 Checking end play between axle shaft and thrust block

SERVICE NOTE—All the foregoing is general information for servicing differential carrier units used on passenger cars included in this manual. To complete the picture, however, specific data such as specifications, drive pinion setups, special differential designs, propeller shaft installations on torque tube drive cars pertaining to each make of car are given in the car chapters.

HYDRAULIC SYSTEM

FLUID LEVEL—Before checking the fluid level, examine the master cylinder and reservoir, Fig. 1, for evidence of fluid leaks, especially at the brake fluid pipe connection. Examine the rubber boot located at the end of the cylinder. A fluid leak at this point indicates that the master cylinder cup washer is leaking, in which case the cylinder must be removed and disassembled for correction.

Before removing the reservoir filler cap, clean away all dirt so none will fall into the reservoir when the cap is removed. After removing the cap, if the fluid level is more than ⅜" below the bottom of the filler neck, add sufficient fluid to bring the level to this point. Install the filler cap and tighten it firmly so that dirt and water will not enter the cylinder.

Use only approved brake fluid; never use engine oil or other mineral oils as to do so will ruin the rubber parts of the hydraulic system.

BREAK PEDAL FREE PLAY—Check the amount of free pedal travel by applying a light finger pressure to the pedal. A slight resistance will be felt when the pedal travel has reached the point where it operates the master cylinder piston This free travel should be approximately ½", Fig. 2. Adjustment is made by loosening the push rod lock nut and adjusting the travel of the push rod the necessary amount to obtain the desired pedal free play.

MASTER CYLINDER

REMOVAL—Disconnect the pipe from the master cylinder connection. Remove the wires from the stop light switch, if its location is such that this is required, and tape each wire separately to avoid a short circuit. Unfasten the push rod from the brake pedal. Remove the master cylinder mounting bolts and lift the cylinder from the car.

DISASSEMBLE—Fig. 3. Before disassembling, clean all dirt from the outside of the master clyinder, then proceed as follows:

1. Remove filler cap and gasket.
2. Remove end plug and valve seat washer from end of cylinder barrel.
3. Remove rubber boot.
4. Remove pedal stop snap ring with a screwdriver and take out the pedal stop and push rod.
5. Remove piston with secondary cup.
6. Remove primary cup.

CLEANING—Immerse all parts of the master cylinder in alcohol and wash thoroughly to remove old hydraulic fluid. Wipe small parts dry with clean cloth. Inside of cylinder and reservoir may be blown dry with compressed air. Do not use gasoline or kerosene for cleaning master cylinder parts.

INSPECTION—Examine cylinder walls. If found to be scored or rusted, cylinder must be reconditioned by honing, Fig. 4. A hone of the proper size should be placed in the chuck of an electric drill. Work the hone back and forth a few times, then inspect the cylinder to see if walls are cleaned up. Do not hone away any more than is required to remove scores and smooth up the cylinder. Remove burrs caused by honing from around the intake and compensating ports.

Car Make	Brak Mak
AUBURN	
1935-36	Bendix (2)
BUICK	
1935 Model 40	Bendix (5)
1935 Except Model 40	Huck (Mechanical)
1936-38	Bendix (2)
1939-52	Bendix (1)
CADILLAC	
1935 All, 36-90	Huck (Mechanical)
1936-38 Except 36-90	Bendix (2)
1939-40 Except 75, 90	Bendix (1)
1939-40 Models 75, 90	Bendix (2)
1941-52	Bendix (1)
CHEVROLET	
1935	Huck (Mechanical)
1936-50	Huck (Hydraulic)
1951-52	Bendix (1)
CHRYSLER	
1935-42 Except Front Brakes on 1940-42 Eights	Lockheed (1)
1940-42 Eights—Front Brakes	Lockheed (2)
1946-52—Front Brakes	Lockheed (2)
1946 52—Rear Brakes	Lockheed (1)
1949-52 Imperial	Lambert
CROSLEY	
1939-48	Hawley Mechanical
1949-50	Goodyear Hawley Disc Type
1950-52	Bendix (1)
DE SOTO	
1935-52 Except Front Brakes on 1946-52	Lockheed (1)
1946-52—Front Brakes	Lockheed (2)
DODGE	
1935-52 Except Front Brakes on 1946-52	Lockheed (1)
1946-52—Front Brakes	Lockheed (2)
FORD	
1935-36	Ford (1)
1937-38	Ford (2)
1939-48	Lockheed (1)
1949-52	Bendix (1)
FRAZER	
1947-51	Bendix (4)
1949-51	Lockheed (4)
GRAHAM	
1935-41	Lockheed (1)
HENRY J	
1951-52	Bendix (4)
HUDSON	
1936-40 Except 112	Bendix (2)
1938-40, 112	Bendix (3)
1941-52	Bendix (1)
HUPMOBILE	
1936-39	Lockheed (1)
KAISER	
1947-52	Bendix (4)
1949-52	Lockheed (4)

Car Mak	Brake Make
LAFAYETTE	
1935	Bendix (5)
1936	Bendix (2)
1937-39	Lockheed (1)
LA SALLE	
1935-38	Bendix (2)
1939-40	Bendix (1)
LINCOLN	
1935-40 Big Lincoln	Bendix (5)
1936-38 Zephyr	Bendix (5)
1939-52	Bendix (1)
MERCURY	
1939-48	Lockheed (1)
1949-52	Bendix (1)
NASH	
1935-39	Bendix (2)
1940 Model 80	Bendix (2)
1940 Models 10, 20	Bendix (1)
1941-47 Model 40	Lockheed (1)
1941-52 Models 60, 80	Bendix (1)
1948-52 Model 40	Bendix (4)
1950-52 Rambler	Bendix (4)
OLDSMOBILE	
1935-38	Bendix (2)
1939-52	Bendix (1)
PACKARD	
1935-36, 120	Bendix (2)
1935-36 Super 8 & 12	Bendix (5)
1937-39 All	Bendix (2)
1940-52 Except models listed below	Bendix (1)
1804-5-7-8, 1904-5-7-8, 2004-5-7-8	Bendix (2)
Power Brake	See Packard Chapter
PLYMOUTH	
1935-52 Except Front Brakes on 1946-52	lockheed (1)
1946-52—Front Brakes	Lockheed (2)
PONTIAC	
1935-38 and 1942-48	Bendix (2)
1939-41 and 1949-52	Bendix (1)
REO	
1935-36	Lockheed (1)
STUDEBAKER	
1935-46 Except Champion	Lockheed (1)
1939-46 Champion	Lockheed (3)
1947-52	Lockheed (4)
TERRAPLANE	
1935	Bendix (5)
1936-38	Bendix (2)
WILLYS	
1935-38	Bendix (5)
1939	Lockheed (3)
1940-46	Lockheed (1)
1947-52	Bendix (4)

If available, try a No-Go gauge in cylinder, Fig. 5, using a collar of the correct diameter for the cylinder being serviced. No-Go gauge is slightly larger than the maximum allowable diameter at which the piston cups will operate

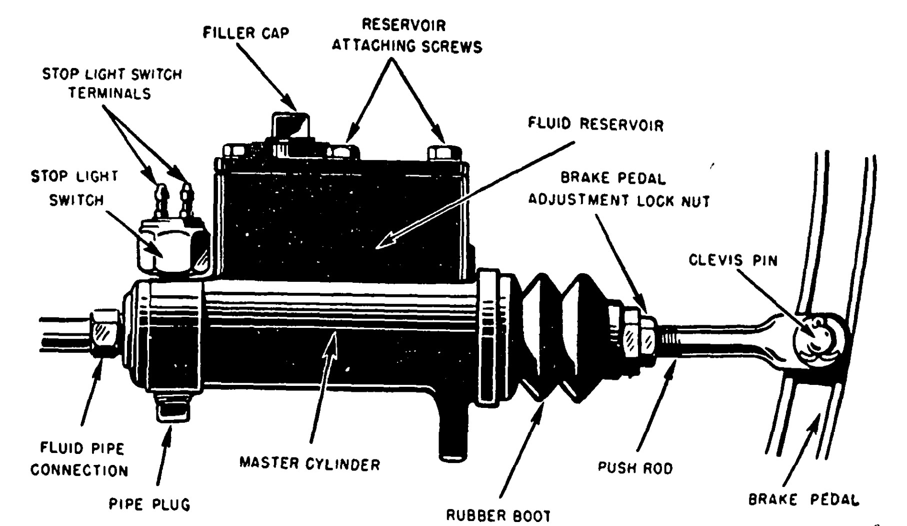


Fig. 1 Exterior view of a typical master cylinder

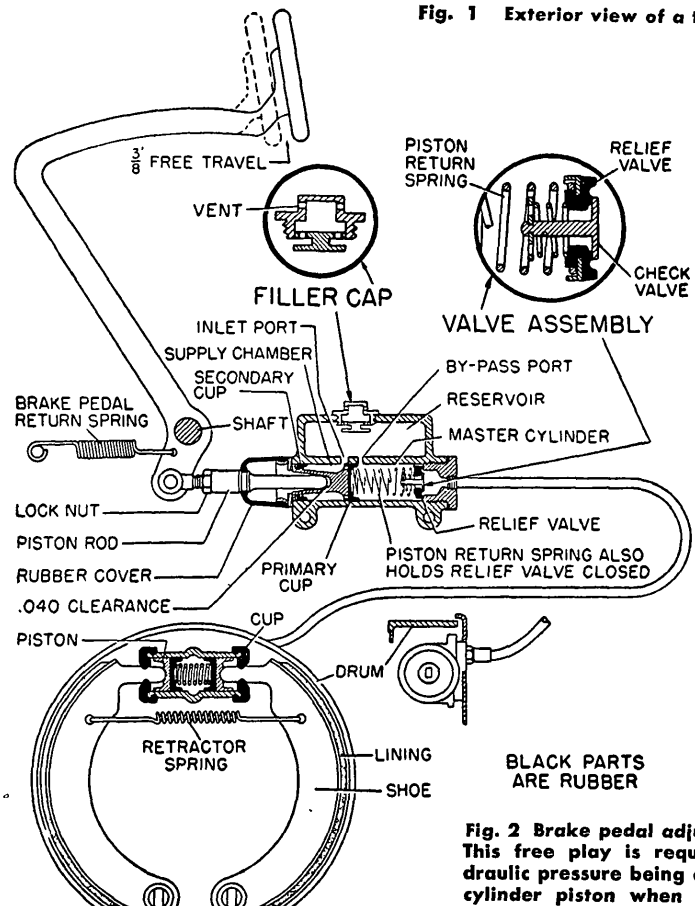


Fig. 2 Brake pedal adjustment for free play. This free play is required to prevent hydraulic pressure being applied to the master cylinder piston when brakes are released

satisfactorily. Therefore, if the gauge will enter the bore, the cylinder must be discarded and a new one installed.

Inspect the check valve seat on the end plug. If found to be pitted or swollen, replace plug and valve seat assembly.

Check the fit of the piston in the cylinder bore. Clearance between the piston and cylinder wall should be from .001 to .005 inch when checked with a feeler gauge, Fig. 6. If the clearance is more than .005 inch and a new piston will not provide the correct clearance, a new housing will have to be installed.

Always use new rubber parts when reconditioning a cylinder. Rubber parts which are swollen or damaged will seriously impair the proper function of parts. Repair kits which contain all the parts usually required for reconditioning master cylinders, are available. While all the parts contained in the kit may not appear to be in need of replacement, experience has proved that the added safety and braking efficiency provided by replacing these parts will offset the slight cost of the parts.

ASSEMBLY — Before assembling the master cylinder, dip all internal parts in hydraulic brake fluid, then proceed as follows:

1. Install the end plug and washer in the end of the cylinder barrel and tighten securely.
2. Install the check valve assembly in the open end of the piston return spring and insert the valve and spring into the cylinder barrel with the check valve at the outlet end.
3. Install the primary piston cup into the cylinder with the lip of the cup toward the outlet end and over the piston return spring. Insert the piston and secondary cup with the open end of the piston away from the outlet end of the cylinder.
4. Install the push rod and stop washer, forcing the piston in far enough to install the stop washer snap ring in the groove in the cylinder bore.
5. Slide the push rod boot over the end of the push rod and place the boot over the flange on the end of the cylinder.
6. Install the filler cap and gasket.
7. Plug all openings in the cylinder against the entrance of dirt during installation.

INSTALLATION—Place the master cylinder in position and install and tighten the bracket bolts so the cylinder is held firmly to the bracket and in line with the pedal push rod. Fasten the push rod to the brake pedal. Connect the brake fluid pipe to the master cylinder and firmly tighten the union to prevent a fluid leak. Remove the tape from the stop light wire terminals and connect them to the stop light switch. Fill the cylinder reservoir with brake fluid, Fig. 7, bleed the brake system and test the brake pedal clearance.

BLEEDING BRAKE SYSTEM

Bleeding, or expelling air from the hydraulic system, is necessary each time the fluid becomes so low in the master cylinder that air enters the system. This condition occurs whenever the master cylinder, or a wheel cylinder, or a brake fluid pipe or hose has been replaced or disconnected. There are two methods of bleeding a hydraulic brake system, (1) manual and (2) pressure.

MANUAL BLEEDING—Fig. 8. Remove the master cylinder filler cap and fill the reservoir. The reservoir must be kept full, or nearly full, of brake fluid while bleeding the brake system. Each wheel has a bleeder valve.

Start at the wheel cylinder to which the brake fluid travels the greatest distance from the master cylinder (right rear wheel). Remove the cap screw from the end of the bleeder valve near the brake fluid pipe or hose connection, Fig. 8. Attach a bleeder tube to the bleeder valve at this point, and place the free end of the bleeder tube in a clean glass jar or bottle. Place a wrench on the bleeder valve at the point where the bleeder hose is connected, and turn the valve ½ to ¾ turn to the left (counterclockwise). This opens the bleeder valve. Slowly depress the brake pedal by hand

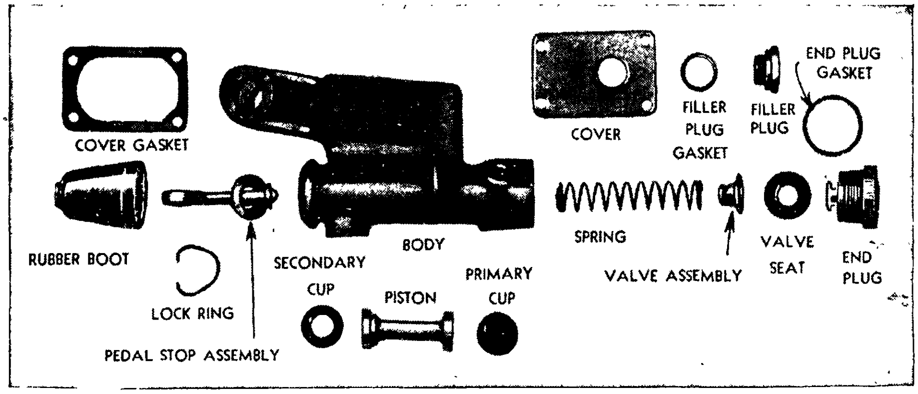


Fig. 3 Exploded view of typical master cylinder

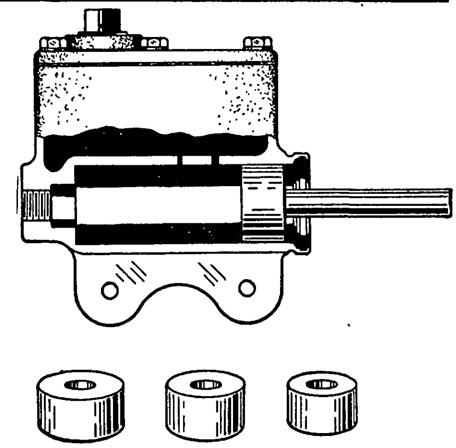


Fig. 5 Using No-Go gauge when insp cting master or wheel cylinder (mast r cylinder shown)

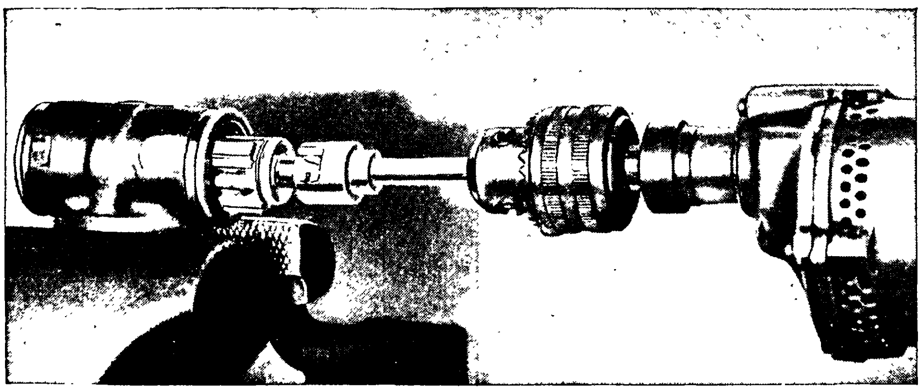


Fig. 4 Using hone to clean up master or wheel cylinder (wheel cylinder shown)

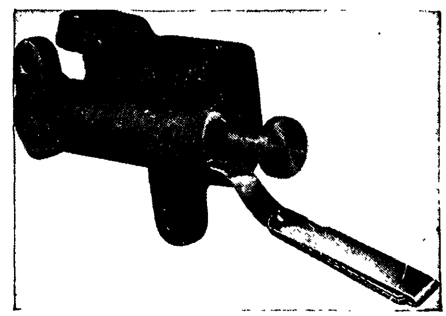


Fig. 6 Checking master cylind r pist n fit with feeler gaug

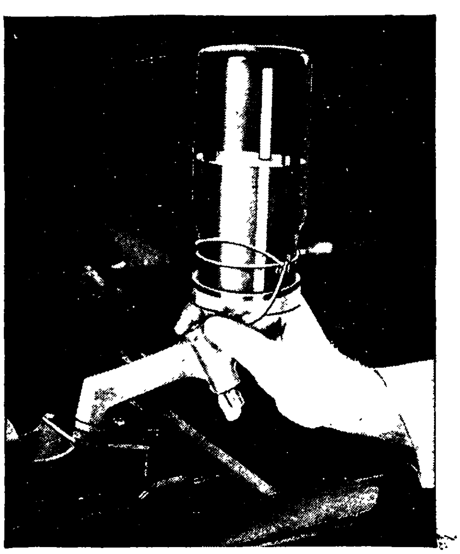


Fig. 7 Adding fluid to master cylinder, using valv controlled filler

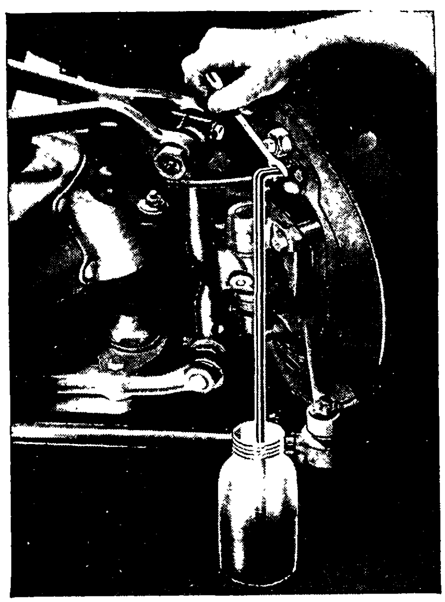


Fig. 8 Manual bleeding of hydraulic system

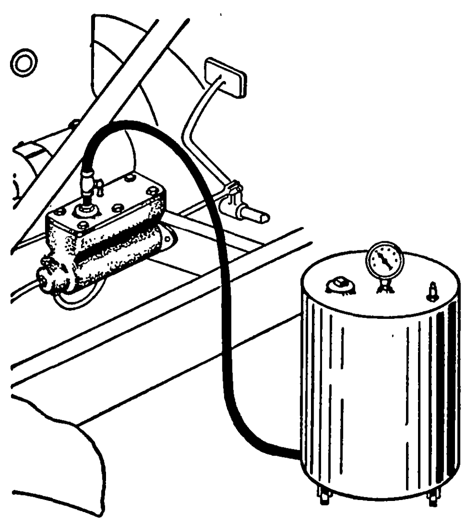


Fig. 9 Pressure bleeding f hydraulic system

to approximately the halfway point; then let the pedal return slowly to the release position. Repeat this procedure several times, keeping the end of the hose submerged in brake fluid until the fluid expelled from the bleeder hose is free of air bubbles. Turn the bleeder valve clockwise to the closed position and remove the bleeder hose. Install and tighten the cap screw in the end of the valve, and again test the valve to be certain that it is seated firmly.

Add new fluid to the master cylinder and repeat the process on the other wheels in turn, always moving to the wheel which is the greatest distance from the master cylinder of those remaining to be bled.

Always add clean fluid to the master cylinder after bleeding each wheel. Never use the fluid drained from the brake system if there is any doubt about its being clean and free from dirt.

PRESSURE BLEEDING—This method of bleeding is accomplished in the same manner as manual bleeding except that

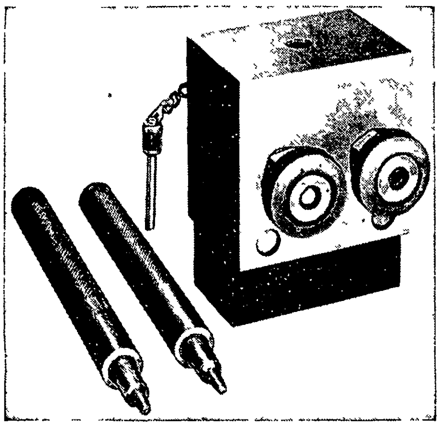


Fig. 10 Flaring tool for hydraulic brake tubing

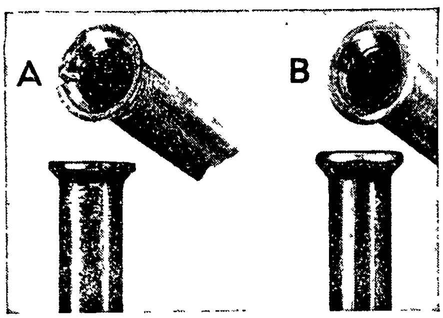


Fig. 11 Showing advantage of double lap flar (B) over single lap flare (A) on hydraulic brake tubing

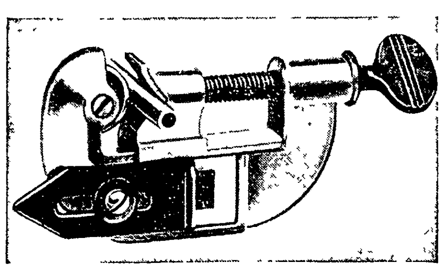


Fig. 12 Special cutting tool for hydraulic brake tubing

the fluid is forced through the lines by air pressure in a tank containing hydraulic fluid.

A typical application of this equipment is shown in Fig. 9. With hydraulic fluid in the tank, charge the tank with 10 to 20 pounds of air pressure. Clean all dirt from around the master cylinder filler cap, remove the cap and attach the hose from the bleeder tank to the master cylinder filler cap opening. Open the bleeder hose valve.

Remove the screw from the bleeder valve at the wheel cylinder. Screw the bleeder hose into the bleeder valve and place the free end of the bleeder hose in a glass jar containing brake fluid, following the same procedure as in manual bleeding. Open the bleeder valve at the wheel cylinder and watch the flow of fluid at the end of the hose. As soon as air bubbles stop, close the valve tightly. Remove the bleeder hose and repeat the process at the other wheels.

HYDRAULIC LINES

A fluid leak at some point is indicated when the master cylinder reservoir requires the addition of fluid at frequent intervals. When this happens, inspect the pipes, connections, and cylinders for leaks while pressure is applied to the brake pedal. If a leak is evident at a tube or hose, replace the part. A leaky wheel cylinder may be indicated by the presence of fluid on the brake support plate, in which case the cylinder must be removed and overhauled.

FLARING BRAKE TUBING — When necessary to replace brake tubing, always use special metal tubing which is especially designed to withstand high pressure and resist corrosion. For this reason, ordinary copper tubing is not satisfactory and should not be used.

The important thing in connection with making up hydraulic brake pipes is the proper flaring of the ends of the tubing for the compression couplings. Unless the tubing is properly flared the couplings will leak and the brakes will become ineffective.

This tubing must be double-lap flared at the ends in order to produce a strong, leak-proof joint. The tool shown in Fig. 10 is used to form the double-lap flare.

Fig. 11 shows two pieces of tubing—one with a single-lap flare "A" and the other with a double-lap flare "B." Note that the single-lap flare split the tubing while the one shown in "B" has a well formed joint.

To flare the tubing, cut it to the desired length, using the tube cutter, Fig. 12, to prevent flattening the tubing. Square off the end with a fine cut mill file, then ream the sharp edges with a reamer blade provided on the tube cutter.

Place new compression coupling nuts on the tubing. Dip the end of the tubing to be flared in hydraulic brake fluid. This lubrication results in a better formation of the flare. Loosen the clamping nuts on the flaring tool and insert the finished end of the tubing in the channel of the die until it bears against the stop pin, Fig. 13.

Tighten the clamping nuts by hand and place the fixture in a bench vise. Then tighten down the clamping nuts firmly with a wrench and remove the stop pin from the die. The tubing is now firmly gripped in the die and ready for the first flare forming operation.

Using the flare forming tool having the concave die, insert the forming tool in the die and strike firm blows with a one pound hammer until the shoulder of the tool contacts the top of the die.

Next, use the flare forming tool having the 45-degree die at its lower end. Insert the tool in the die and strike firm blows until the shoulder of the tool contacts the top of the die. The resulting double-lap flare is shown in Fig. 13.

To install, position the tube and start each connection by hand to be certain that the coupling threads are properly aligned. Then securely tighten each coupling with a wrench. Install and tighten the tube holding clips, then bleed the brake system.

WHEEL CYLINDER

REMOVAL—Block the brake pedal in the released position, Fig. 14, to prevent its being moved accidentally while the cylinder is off, thus avoiding the loss of brake fluid.

Jack up the car and remove the wheel and brake drum. Unfasten the brake hose or pipe from the wheel cylinder connection. Unhook the brake shoe retracting spring to permit the shoes to be moved away from the cylinder.

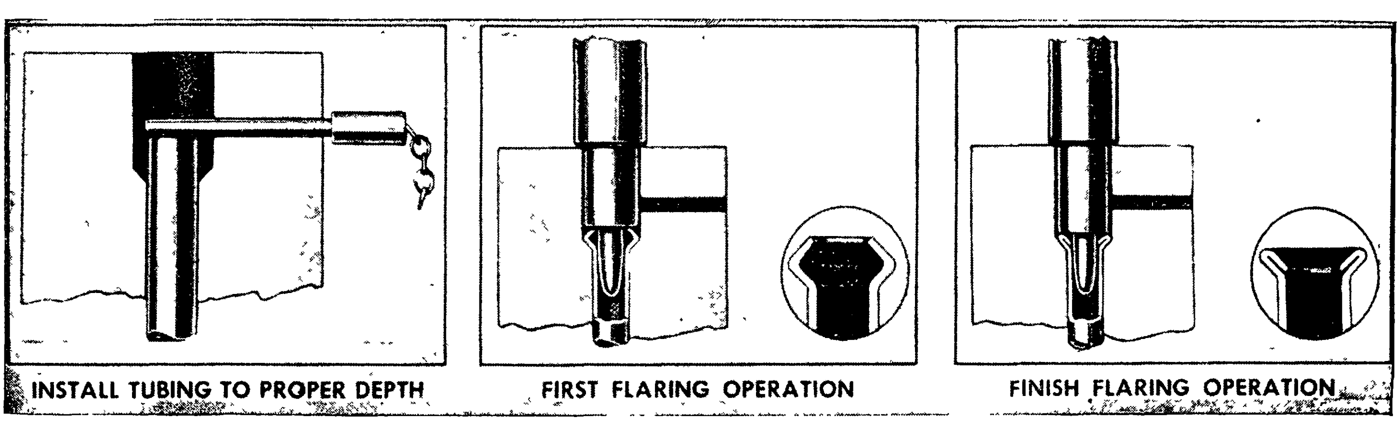


Fig. 13 Meth d of f rming d ubl lap flare in brake tubing

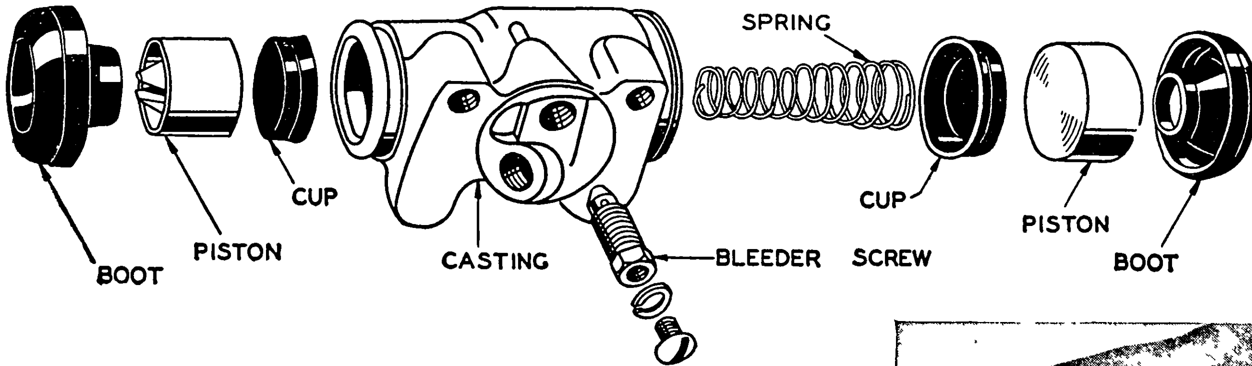


Fig. 15 Exploded view of wheel cylinder with rubber end covers or boots

At this point, if step bore cylinders are used, note carefully in which direction the larger bore is facing. On some cars the larger bore faces the rear while on others it faces the front.

Remove the two screws which fasten the cylinder to the brake support plate and take off the cylinder.

DISASSEMBLY—Fig. 15 is an exploded view of a typical wheel cylinder used with Bendix and Lockheed brakes, while Fig. 16 shows the design used on Chevrolet brakes.

To disassemble either type, remove the end covers and push out the pistons, rubber cups and spring. Wash all parts in clean alcohol, but before doing so, wash your hands with soap and water to avoid the possibility of mineral oil or gasoline coming in contact with the parts during assembly.

INSPECTION—Examine cylinder walls. If found to be scored or rusted, the cylinder must be reconditioned by honing, Fig. 4. A hone of the proper size should be placed in the chuck of an electric drill. Work the hone back and forth a few times, then inspect the cylinder to see if the wall is cleaned up. Do not hone any more than is required to remove scores and smooth up the cylinder.

If available, try a No-Go gauge in the cylinder, Fig. 5, using a collar of the correct diameter for the cylinder being serviced. No-Go gauge is slightly larger than the maximum allowable diameter at which the piston cups will operate satisfactorily. Therefore, if the gauge will enter the bore the cylinder must be discarded and a new one installed.

Check the fit of the pistons in the cylinder. Clearance between the pistons and

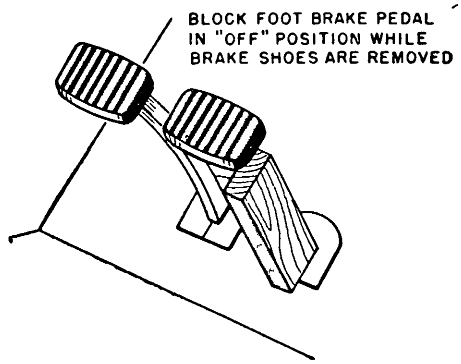


Fig. 14 Method of blocking brake pedal to avoid loss of brake fluid while hydraulic system is open

cylinder wall should be from .002 to .004" when checked with a feeler gauge, Fig. 17. If the clearance is more than .004" and new pistons will not provide the correct clearance, a new housing will have to be installed.

Always use new rubber parts when reconditioning a cylinder. Rubber parts which are swollen or damaged will seriously impair the proper function of the brakes. Repair kits are available which contain all parts usually required for reconditioning wheel cylinders.

REASSEMBLY & REPLACEMENT — Dip pistons and rubber cups in brake fluid. Place the spring in the center of the housing, the rubber cups at each end of the spring, with their cupped sides to the spring and the flat face of the cups flush with the piston. (On step bore cylinders the spring is tapered, therefore,

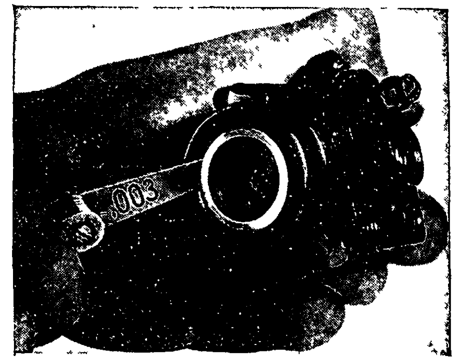


Fig. 17 Checking wheel cylind r pist n fit with feeler gauge

be sure to place the small tapered end against the smaller piston.) Replace the end covers.

Assemble the wheel cylinder to the brake support plate, connect the fluid pipe or hose and hook the brake shoe retracting spring. Install the brake drum and wheel, and bleed the entire brake system.

BRAKE ADJUSTMENTS

To compensate for lining wear, which is indicated when the brake pedal travels within three inches of the floor, a minor adjustment is made to reduce the clearance between the brake lining and brake drum.

A major adjustment becomes necessary when a minor adjustment will not provide a satisfactory brake, when brake shoes have been relined or replaced, or when drums have been turned down.

Minor adjustments can be accomplished without removing the brake drums. Merely jack up the wheels to clear the floor and turn the adjuster as

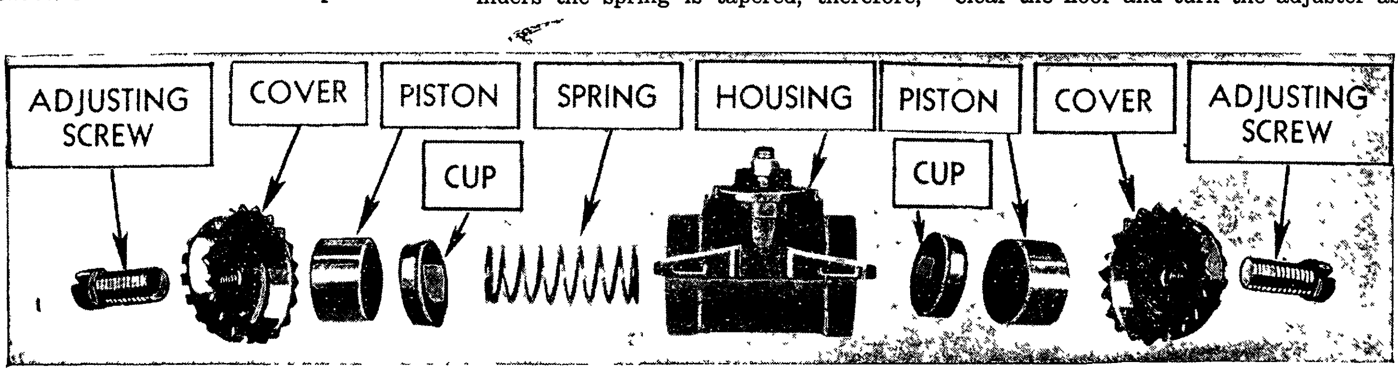


Fig. 16 Expl d d view of whe l cylinder with m tal nd c vers and adjusting scr ws

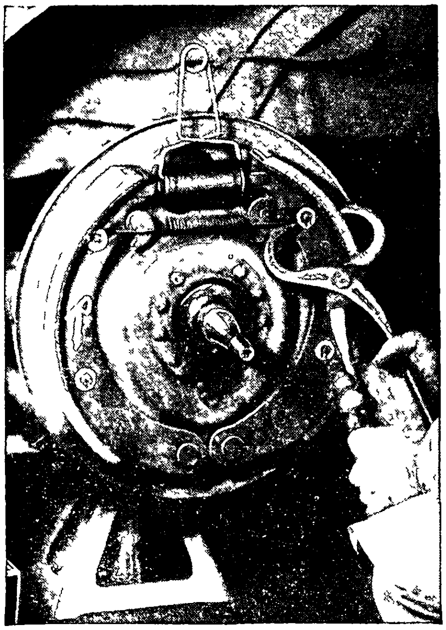


Fig. 18 When removing shoes from Bendix and Lockheed brakes, use piston clamp shown to hold pistons in cylinder. The use of the return spring removing and installing pliers are also illustrated

directed in the following text.

With a major adjustment, the drums must be removed in order to inspect the general condition of the brake system and to perform other operations necessary to complete the adjustment.

When necessary to remove brake shoes from a hydraulic system, install a brake cylinder piston clamp before removing the brake shoes, Figs 18 and 19. This will prevent the cylinder pistons from being forced out of position and will thus prevent brake fluid loss. Remove the brake shoe return springs, using the pliers shown, Fig. 18. The same pliers are used to reconnect the springs.

BENDIX [1]

Hydraulic Single Anchor Brake with No Eccentric Adjustment

Fig. 20—To make a minor adjustment, jack the wheels clear of the floor and release the parking brake fully. Remove the adjusting hole covers from the brake support plates. Then expand the shoes by turning the adjusting screw toward the center of the wheel until the drum can just be turned by hand. Then back off the adjusting screw 14 notches. After completing adjustment, check to see that wheel turns freely without drag. It may be necessary to tap backing plate to permit shoes to centralize before brake will be free.

Repeat adjustment at each wheel, checking after adjustment to see that each wheel turns freely without drag. (Adjusting screw is turned with a screw driver or tool shown in Fig. 21 through adjusting hole in support plate.) Fasten the adjusting hole covers to the support plates, lower the car and test the brakes.

MAJOR ADJUSTMENT — If the shoes have been relined, be sure to assemble them on the support plate properly. On

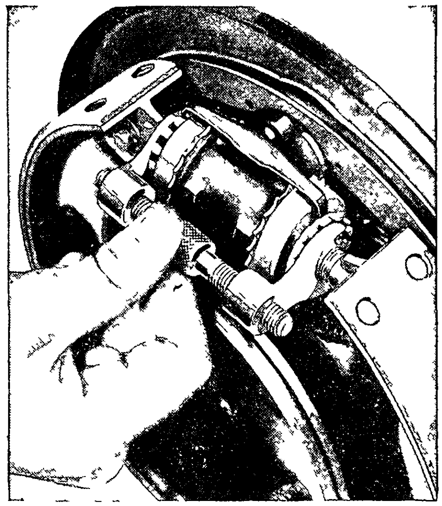


Fig. 19 Type clamp to hold pistons in cylinders of Huck-Chevrolet brakes

some cars, the shoes are stamped P and S, which means primary and secondary, respectively. If the brake uses one short and one long piece of lining on each wheel, the short piece is always for the primary shoe.

1. Disconnect each parking brake cable from the cross shaft at the clevis end.
2. Beginning at any wheel, install the brake drum.
3. Insert a .015 in. feeler gauge between lining and drum about 1½ in from the adjusting screw end of secondary (rear) shoe and expand shoes with adjusting screw until feeler gauge cannot be withdrawn, Fig. 22. Then retract the adjusting screw until a slight drag on the feeler gauge is secured.
4. Withdraw feeler gauge and re-insert it between the lining and drum about 1½ in. from the anchor pin end of the secondary shoe. This should give equal or slightly heavier drag than near adjusting screw. If correct drag is not obtained at this point, anchor pin must be readjusted.
5. Loosen anchor pin nut and turn the pin in the required direction to obtain correct drag on feeler gauge when checking as outlined above. If clearance at anchor pin end of secondary shoe is too great, turn anchor pin in direction wheel turns as car goes forward. If clearance is too small turn pin in opposite direction.
6. Tighten anchor pin nut securely, being sure pin does not turn during the process.
7. Repeat above procedure at other wheels and recheck clearances.

BENDIX [2]

Hydraulic Single Anchor Brake with Eccentric Adjustment on Secondary Shoe

Fig. 23—To make a minor adjustment, proceed as follows:

1. Remove inspection covers from brake drums and disconnect rear cables.
2. Loosen eccentric lock nut and insert a .010″ feeler gauge between lining of secondary shoe and brake drum.
3. Turn eccentric in direction of forward

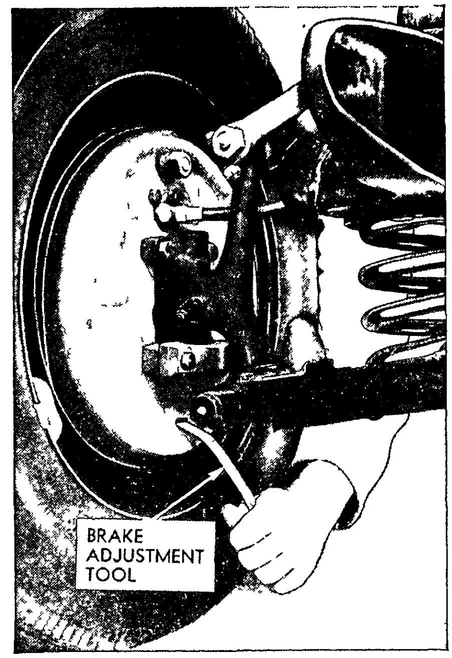


Fig. 21 Method of adjusting Bendix brakes. A screw driver or the tool shown may be used. Tighten brakes by moving tool upward toward center of wheel

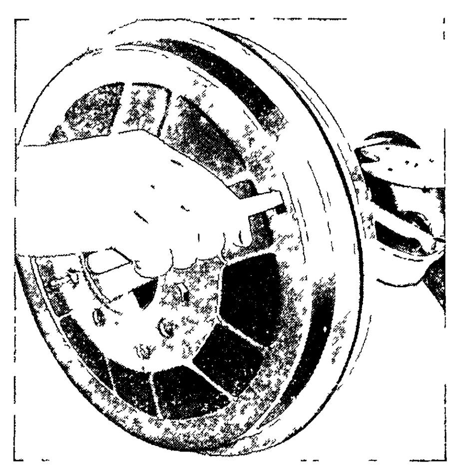


Fig. 22 Using feeler gauge to check clearance between drum and brake lining on Bendix brakes

wheel rotation until a .010″ feeler gauge is snug at the center of the secondary shoe.

4. Tighten eccentric lock nut.
5. Expand brake shoes by turning adjuster, Fig. 21, until light drag is felt on brake drum.
6. Turn adjuster in opposite direction until drum can just be turned freely.
7. Check emergency brake cables and adjust if necessary.
8. Replace adjusting hole covers.

MAJOR ADJUSTMENT—On some cars each brake uses one short and one long piece of lining. If such is the case, the short piece always goes on the primary shoe. Shoes are sometimes stamped with

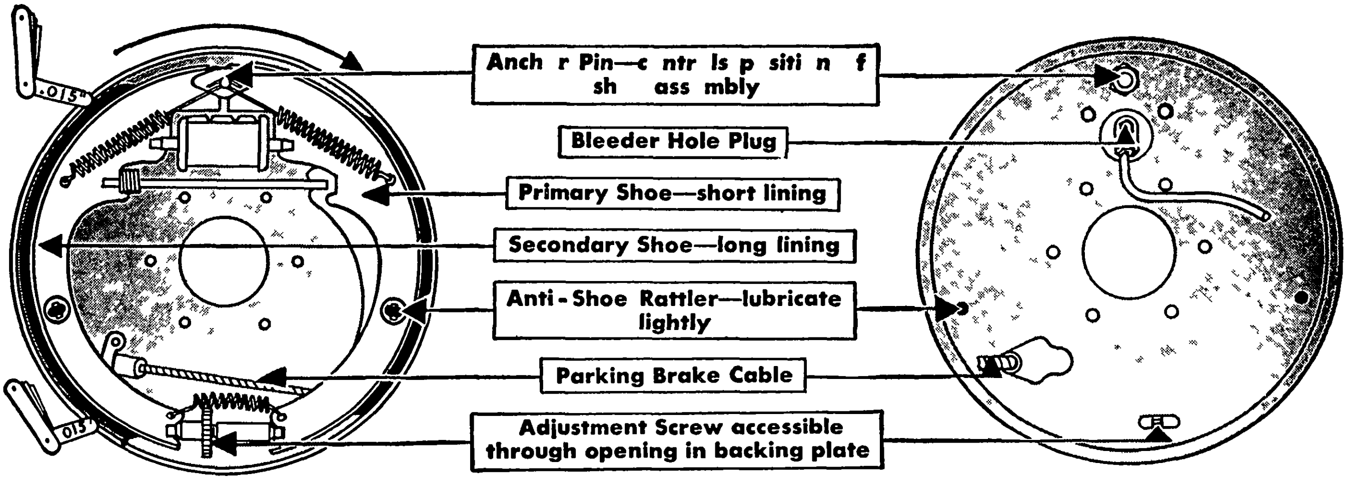


Fig. 20 Bendix hydraulic single anchor brake with no eccentric adjustment. Diagram shows right rear brake; front brake identical except for absence of parking brake

a P or S which means primary and secondary, respectively On some of these cars, brake return springs may have different tension, in which case the heavier spring should be attached to the secondary shoe

1 Disconnect parking brake cable from cross shaft at clevis end

2 Starting at any wheel, install brake drum

3 Turn drum until inspection hole is about 1½' from toe (adjusting screw end) of secondary shoe

4 Insert a 010 feeler gauge, Fig 22, and turn eccentric in direction of forward rotation until feeler is snug

5 Now turn drum until inspection hole is about 1½' from heel (anchor pin end) of secondary shoe and insert 010 feeler gauge at this point

6 Loosen lock nut and turn anchor pin in required direction to give a tight 010" clearance

7 Readjust eccentric to maintain 010" clearance at toe of shoe

8 Tighten anchor pin and eccentric lock nuts securely, being sure pin and eccentric do not turn during the process Recheck clearances

9 Expand shoes by turning adjuster, Fig 21, until shoes are tight against drum

10 After all brakes are set in this manner, set hand brake in second notch

11 Take all slack out of parking brake cables and reassemble at clevis end Then release parking brake

12 Release the adjuster at each brake until each wheel is just free of drag

13 Replace all covers and mount wheels

BENDIX [3]

Hydraulic Double Anchor Brake with An Eccentric Adjustment for Each Shoe

Fig. 24—For a minor adjustment proceed as follows

1 Loosen the lock nut on the primary shoe eccentric and turn eccentric in direction of forward wheel rotation until wheel can just be turned by hand

2 Back off eccentric slowly in opposite direction until drum is just free of lining drag Tighten lock nut

3 Repeat the above on the secondary shoe

4 Remove adjusting hole cover from support plate and expand shoes by turning adjusters, Fig 21, until shoes are tight against brake drum

5 Back off adjuster 12 notches, or enough to remove all drag, and replace cover

6 Repeat the above procedure on other three wheels and check to see that all drums are free of lining drag This drag may be either because of too tight a brake shoe adjustment or because parking brake cables have been shortened too much at some time

MAJOR ADJUSTMENT—

1 Disconnect parking brake cables at the equalizer bar

2 After the drums and brake shoes have been removed, turn both primary and secondary shoe eccentrics so that the high side of the eccentric is away from the anchor link After installing shoes, back off the adjuster at each brake

3 Insert a 010" feeler gauge between the lining and drum about 1½ from the

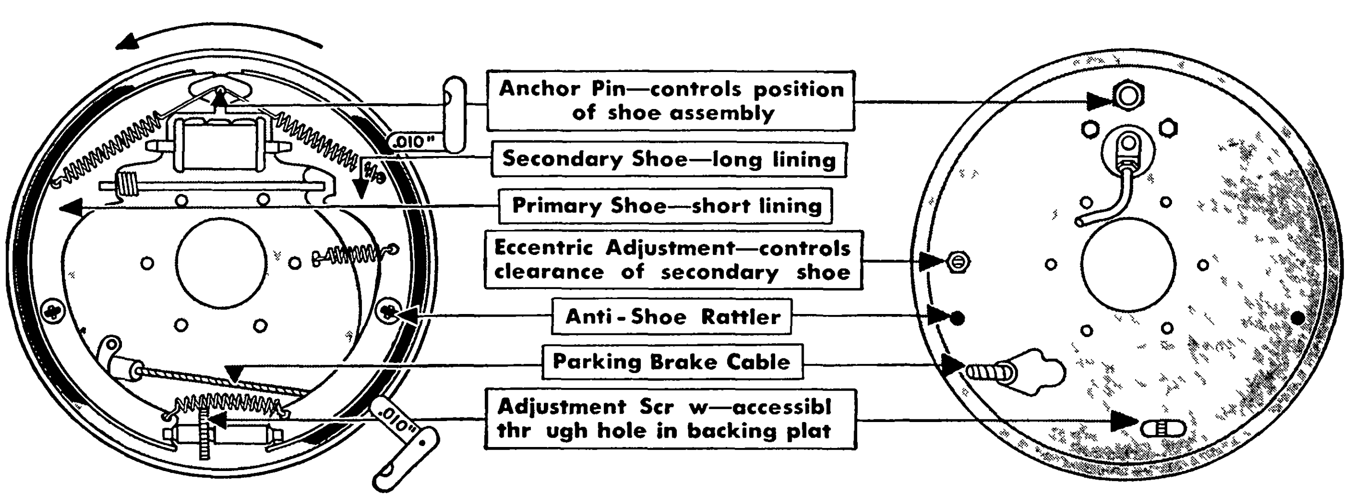


Fig. 23 Bendix hydraulic singl anch r brake with an ccentric adjustment f r sec ndary sh e. Diagram sh ws left rear brak ; fr nt brake identical xcept for absence f parking brak

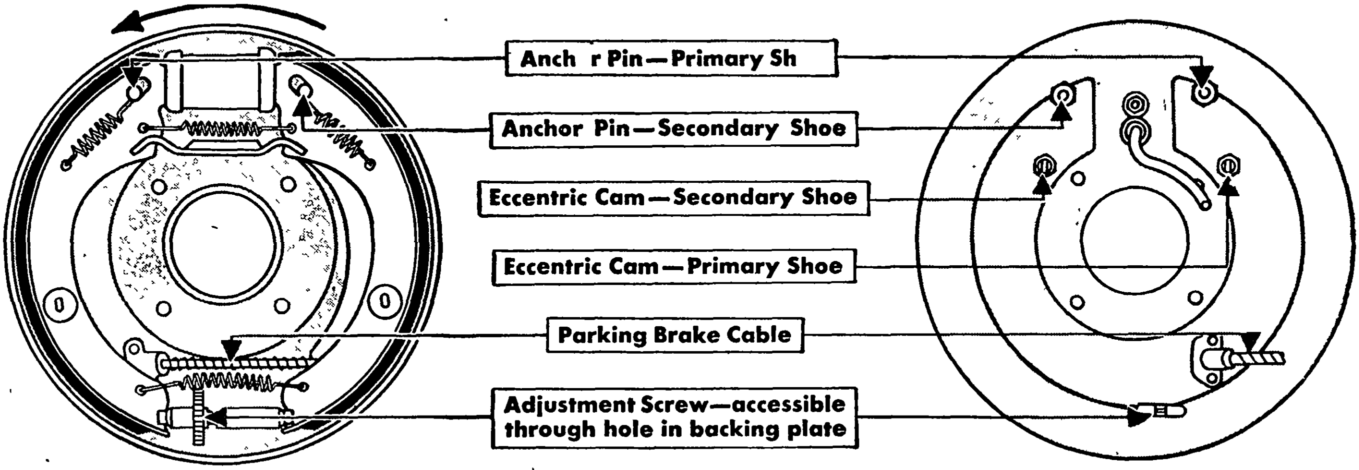


Fig. 24 Bendix hydraulic double anchor brake with an eccentric adustment for each shoe. Diagram shows left rear brake; front brake identical except for absence of parking brake

anchor end of the primary shoe lining.

4. Turn the eccentric adjustment in the direction of forward wheel rotation until feeler is just snug. Hold this adjustment and tighten lock nut.
5. Repeat this adjustment on secondary shoe.
6. Expand shoes tightly against drum by means of adjuster, Fig. 21.
7. Repeat adjustment at each wheel.
8. Set parking brake lever in second notch and check cable length to each rear wheel brake.
9. Pull cable toward equalizer bar to remove all slack so that the clevis pin can just be inserted when cables are pulled tight.
10. Release hand brake lever and back off on adjuster, Fig. 21, until brake drum is just free of lining drag. Be sure to back off same number of notches at each rear wheel brake.

Service Note—When above adjustments do not result in satisfactory brake performance, it may be due to anchor links sticking to the support plates. The anchor nuts are in correct adjustment when the links will move freely with no side play. This adjustment can be made properly while shoes are off for relining. When this is done, remove the anchor links, clean them and before installing, apply lubricant on the side which rests against the support plate.

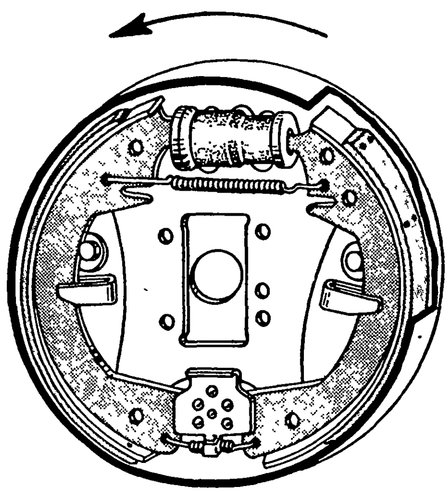


Fig. 25 Bendix hydraulic floating anchor brake with an eccentric adjuster for each shoe. Right brake shown. Note that step bore cylinder is used with larger bore to the front. Rear brake cylinders have same bore

BENDIX [4]

Hydraulic Floating Anchor Brake with An Eccentric Adjuster for Each Brake Shoe

Fig. 25—This design has self-centering brake shoes employing a floating type anchor at the lower end of the shoes. Step-bore cylinders are used on front brakes with the larger bore facing the front of the car.

ADJUSTMENT — Disconnect the parking brake cable. Turn the eccentric adjuster at each shoe outward until the wheel binds. Then back off until the

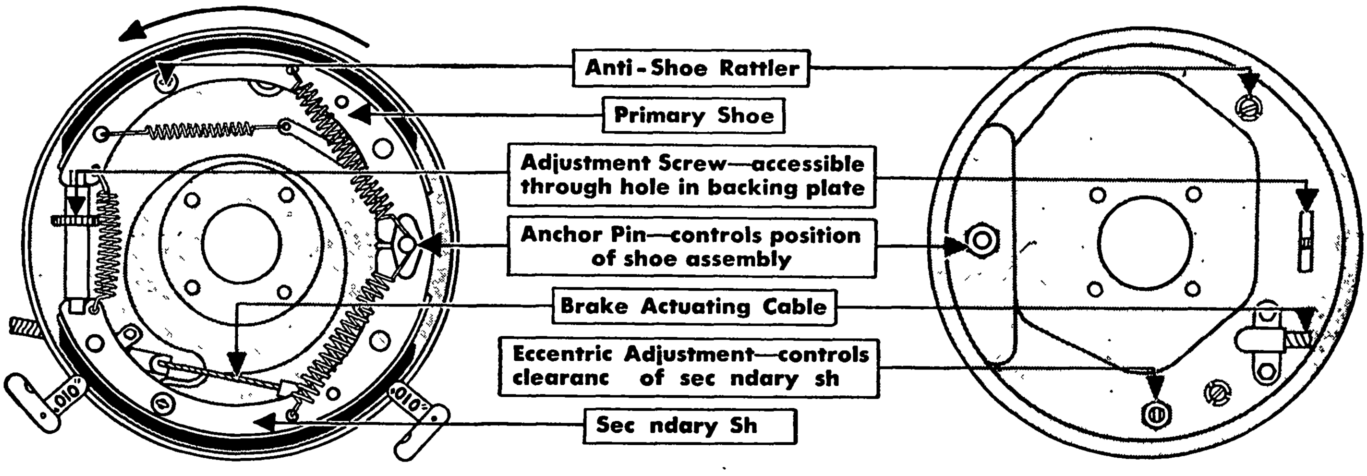


Fig. 26 Bendix mechanical singl anch r brake with eccentric adjustm nt for s c ndary sh e. Diagram sh ws left rear brake; front brak identical exc pt f r absence of parking brak

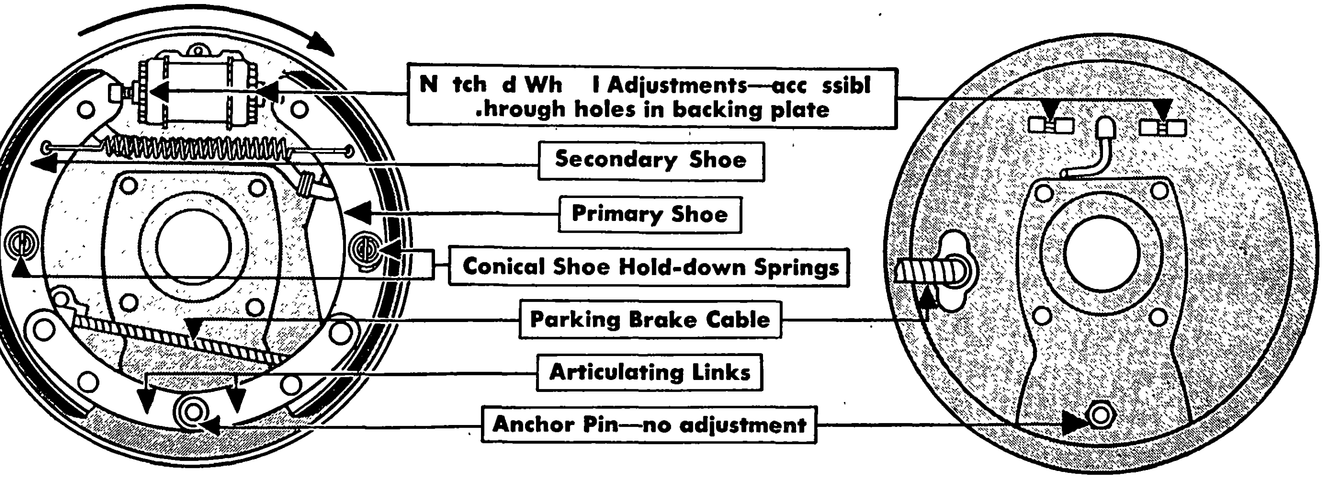


Fig. 29 Huck-Chevrolet hydraulic articulating link brake. Diagram shows right rear brake; front brake identical except for absence of parking brake

wheel is just free. Repeat at other three wheels. Pull hand brake halfway on and adjust linkage so that clevis pins just enter the cable clevises, with all slack removed from cable.

BENDIX [5]

Mechanical Single Anchor Brake with Eccentric Adjustment for Secondary Shoe

Fig. 26—Except that they are mechanically operated, these brakes are quite similar to the hydraulic type shown in Fig. 23, and adjustments are made in the same manner.

GOODYEAR-HAWLEY DISC BRAKE

This brake system, Figs. 27 and 28, consists of a conventional hydraulic master cylinder connected to wheel units by tubing, hose and the necessary fittings. The wheel units consist of a cylinder, piston, outboard housing, pulsator, brake lining and the necessary attaching parts.

A steel disc, approximately 7½ in. in diameter, is used instead of a conventional drum. The disc is covered with a dust shield to keep out water and foreign material.

A circular piece of lining, 1¼ in. in diameter, is riveted to the piston and another to the outboard housing, one being located on each side of the disc.

When the foot pedal is depressed, the pulsator expands and forces the lined piston against the steel disc. The reaction, in the opposite direction, causes the unit to slide through its guides and applies the other lining to the opposite side of the disc, which is then gripped between the two linings.

ADJUSTMENT—Jack up car. Loosen lock nut which has a left-hand thread. Turn compensating screw clockwise (right) until wheel locks. Back off compensating screw ¼ turn. Tighten lock nut, being careful compensating screw does not turn during the process. Repeat operation at each wheel.

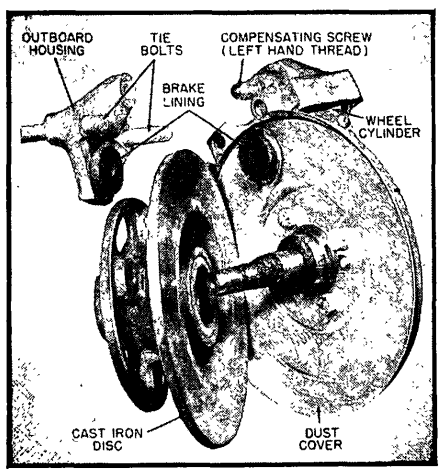


Fig. 28 Goodyear-Hawley disc brake

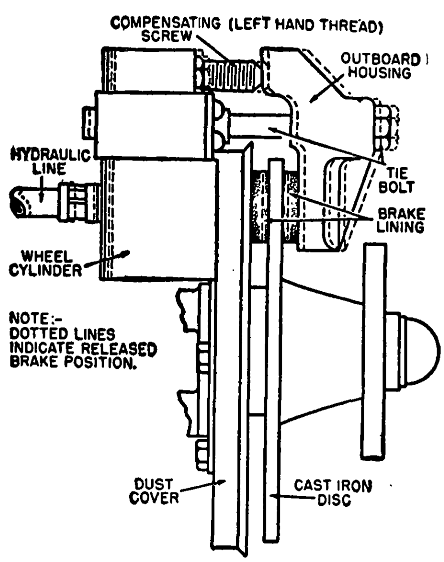


Fig. 27 G dyear-Hawley disc brake

HAWLEY MECHANICAL BRAKE

CROSLEY 1939-48—To adjust these brakes, jack up all wheels and remove all cotter pins, and pins from all cable clevis connections at the cross shaft. Tighten the brake adjusting screws until the brakes just start to drag then back off until the wheels run free. Tighten adjusting screw lock nut.

Hold the foot pedal in about one inch and adjust the cable length at the clevis connections so that, when connected, the brakes barely drag. Then road test the car and equalize the brakes by means of the adjusting screws. Counter-clockwise motion of the adjusting screw tightens the brakes, and vice versa.

Whenever the length of the cables is adjusted, the cable conduit should be filled with grease. Care must be exercised to see that the cables are not buckled or twisted excessively.

HUCK-CHEVROLET

Hydraulic Articulating Link Type Brake

Fig. 29—The foot brake adjustment on all rear wheels is made by inserting a screw driver or similar tool, Fig. 30, through a hole provided in the brake support plate and turning the adjusting wheel. The method of adjusting front brakes is the same except on 1936-38 cars having the enclosed type knee action units. On these cars, it is necessary to remove the front wheels and insert the tool through the inspection hole in the drum.

ADJUSTMENT—

1. Jack up wheels and remove hand brake pull rod clevis pins.
2. Remove adjusting hole covers on outside of support plate.
3. Tighten adjusting wheel of the wheel cylinder on the forward shoe until there is a heavy drag on the drum when turned in the forward direction.
4. Turn adjusting wheel back far enough

to free the wheel of drag.

5. Repeat above on reverse shoe, turning wheel in opposite direction.
6. Adjust other three wheels in same manner.
7. Remove rear drums and check eccentric bolt holding the hand brake cable link to the brake shoe. This bolt is ground flat on the threaded end to indicate the location of its high point. Set the bolt so the flat faces the nearest point of the brake shoe surface.
8. Hold the toggle lever against the shoe, Fig. 31, and adjust the eccentric bolt by turning it with a screwdriver to take up all lost motion between brake lever and connecting link. Hold in this position and tighten lock nut.
9. Reinstall brake drums.
10. With hand brake fully released, adjust hand brake cable or rod to remove all slack without brake drag.

Service Note—The hand brake adjustment described above should be made after a relining job. Cable slack due to adjustment of hydraulic actuated shoes may be taken up at the rod or cable clevis without removing drums, and this procedure may be followed throughout the life of the lining.

The hydraulic system used to operate this brake is different from other hydraulic systems in that the shoe adjustment is made by rotation of metal wheel cylinder caps. The brake has no anchor adjustment. When relining shoes, the coil spring which controls link tension must be removed. Be careful to reassemble it on the outer or drum side of the link, otherwise it will cause interference with the hand brake lever on the rear wheels.

When assembling hand brake lever to brake shoe, make sure that the flat side of the eccentric bolt faces the nearest point of the lining surface. This setting avoids bad lever angularity due to shortening hand brake cables.

HUCK MECHANICAL BRAKE

BUICK ADJUSTMENT — The brakes should be adjusted when the pedal travels to within two inches of the floorboard with the brakes applied. For high speed, brakes should be adjusted when this distance measures 3 inches.

Lubricate all brake connections and the front brake connections with chassis lubricant. The pedal should be set with approximately ⅝" clearance on the floorboard by adjusting the set screw at the lower end of the pedal. Excess pedal movement is removed by adjusting the rod from the cross shaft to the equalizer bar. When adjusting this rod, the vacuum valve must remain in its fully released position. The rod from the equalizer bar should be in the upper hole of the pedal on the 60 and 90 series, and in the lower hole on the 50 series.

Remove all slack from the hand brake lever cable with the lever in its fully released position. When all slack is removed, the cross shaft lever for the power cylinder rod must be against its stop.

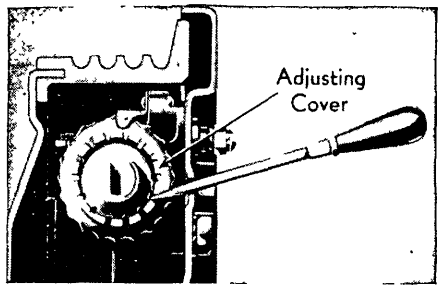


Fig. 30 Adjusting Huck-Chevrolet brakes through slot in brake support plate. On 1936-38 cars with enclosed type knee action, front brake is adjusted through hole in brake drum

Disconnect all the brake rods at the cross shaft lever, and the power cylinder rod at its cross shaft lever. With the wheels in their straight ahead position, operate each brake separately by hand, pulling the brake rod to see that the brake releases to its stop on the backing plate.

When connecting the brake rod, adjust its length at the adjustable yoke so that all slack is removed, but with the cam lever still against its stop.

When connecting the power cylinder rod, pull the piston to its fully released position before adjusting the rod to its correct length.

Jack up all four wheels. Loosen the centralizer lock nuts until the lock washers are free, permitting the centralizers to move. Tighten the adjusting screws until the wheels drag hard. Tighten the centralizer lock nuts. Back off the adjusting screw 14 flats for new linings and 12 flats for old lining.

After backing off the nuts, apply the brakes firmly to seat the nuts. Check the spring locks to make sure that they will hold the nuts from turning.

Before removing the jacks apply the brakes lightly with the pedal jack to determine whether or not all brakes have an equal drag. If not, back off the adjusting nut on the tight wheel.

CADILLAC ADJUSTMENT — The adjustment is made exactly in the same manner as described for Buick. Adjust the front and rear brake rods at the cross shaft end to obtain the correct position at the cam levers. The correct position is when the distance between the center of the brake cable hole and the edge of the brake cable bracket is 3⅝ inches at the front wheels, and 3$\frac{13}{16}$ inches at rear wheels.

CHEVROLET ADJUSTMENT—Disconnect the brake pedal return spring, brake pedal rod, front and rear brake rods and the hand brake rod. Set the hand brake lever in its extreme forward position, and adjust the hand brake rod so that it measures 15¾ inches between centers on the Master models and 9⅜ inches on the Standard models. This can be checked accurately by measuring from the back of the front hole to the back of the slot.

Assemble the hand brake rod. Hook up the pedal return spring and set the brake pedal stop so that the brake pedal clears the floorboard by ¼ inch. With

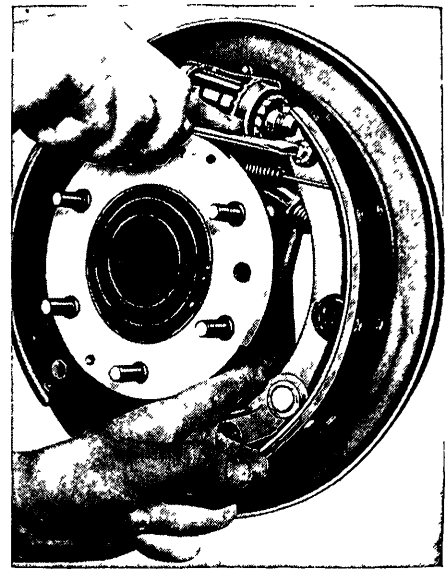


Fig. 31 Adjusting Chevr l t rear brake toggle. This operation is nec ssary whenever brakes have been relined

the brake pedal against its stop, adjust the pedal rod to its correct length and connect the rod.

With the brake cam levers—and rear wheel brake idler levers on the Standard cars — against their stops, adjust the front and rear brake rods. There must be no slack in the cables. Pull on the rod end of the cable until the slack is taken up—but not hard enough to move the cam lever—and then, screw the rod end into the cable end. Connect the brake rods.

Loosen all the centralizer bolts, making sure that the centralizers are free to move by tapping up and down on the adjusting lever hub nut. Now, give the brake pedal a hard, quick push and release it. Then while maintaining a moderate pressure on the brake pedal, tighten the centralizer bolts.

Jack up all four wheels and loosen the lock nuts on the adjusting screw at the cam lever, and turn the adjusting screws to the right until the brake shoes drag lightly on the drum. Tighten the lock nuts. Try the brakes for equalization, and loosen the tight brakes until correct.

LAMBERT

These brakes are provided with an automatic self-adjusting mechanism to compensate for lining wear. The mechanism consists of two identical automatic adjusters mounted at 180 degrees to each other on the inside surface of each inner pressure plate. The adjusters are identical in operation for either front or rear brakes. Two lugs are provided on the inside surface of each outer pressure plate and are placed so as to straddle the automatic adjusters, Fig. 32.

Each self-adjusting unit is composed of a bracket (which is riveted to the inner pressure plate) with two guide flanges, a rod, a lubricating washer, 11 steel adjuster balls, an adjuster washer, a bushing and a sleeve.

When the brakes are applied, the

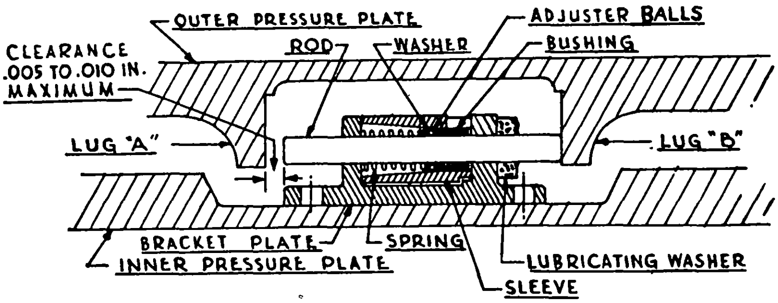


Fig. 32 Cross section of automatic brake adjuster with brake applied. Chrysler disc brake

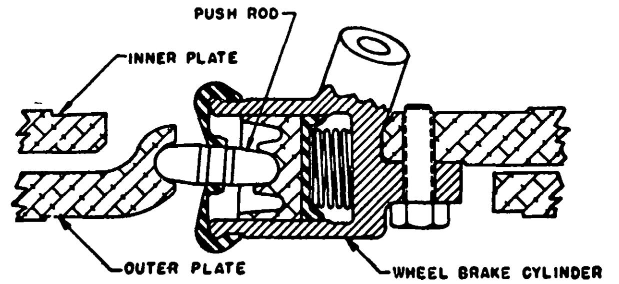


Fig. 33 Cross section of wheel brak cylinder. Chrysler disc brake

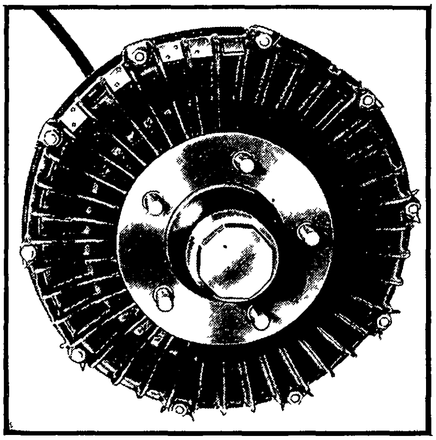


Fig. 35 Chrysler front disc brake

outer plate is rotated with respect to the inner plate and lug "B," Fig. 32, contacts the adjuster rod. If the brake linings are new, the linings contact the brake housing before the adjuster rod is pushed forward. However, if the linings have worn, lug "B" pushes the adjuster rod through the bracket guide flanges until the linings contact the brake housing, and the relative rotation of the outer plate stops.

When the brakes are released, the brake return springs cause the outer plate to tend to return to its former position with respect to the inner plate. However, when lug "A" comes into contact with the adjuster rod, the locking action provided by the automatic adjuster prevents the adjuster rod from being pushed back, and the outer plate cannot return completely to its former position.

Because the distance between the length of the rod and the distance between the finished surfaces of the lugs has been calculated to provide the desired clearance between the linings and housing when the brakes are released, proper clearance is maintained regardless of the wear on the linings. Consequently, no service adjustment of the brake to compensate for lining wear is required during the useful life of the linings.

Two brake wheel cylinders are mounted in each brake assembly on the inner pressure plate. As in the shoe-type hydraulic brake system, hydraulic pressure forces the brake cylinder push rods out. Each push rod contacts a boss on the outer plate and, therefore, the

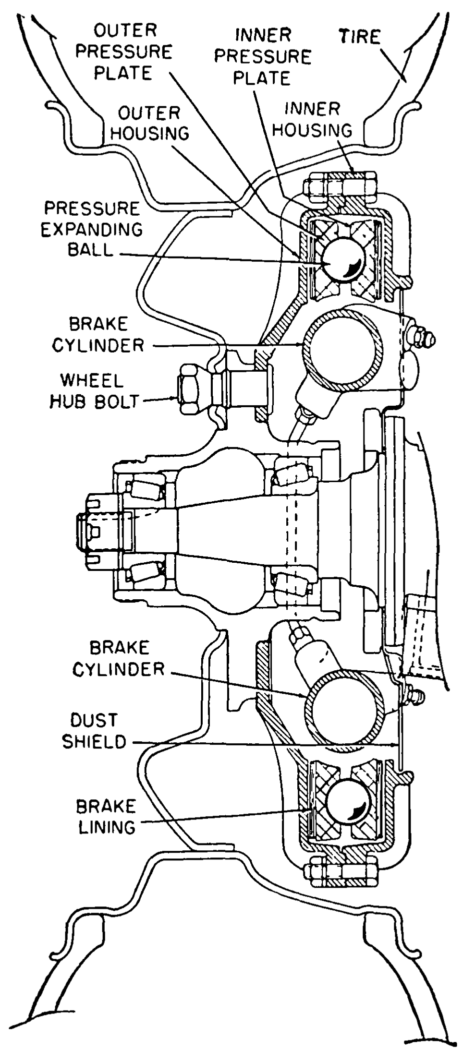


Fig. 34 Cross section of Chrysler disc brake

push rod action provides the desired rotation of the outer plate with respect to the inner plate, Fig. 33. Fig. 34 is a sectional view of the Chrysler Disc brake.

BRAKE SERVICE—None of the parts of the four wheel disc brake assemblies are interchangeable. When more than one assembly is being serviced at one time, care should be taken to keep the parts of each assembly separated from the others.

With the tire and wheel removed, Fig.

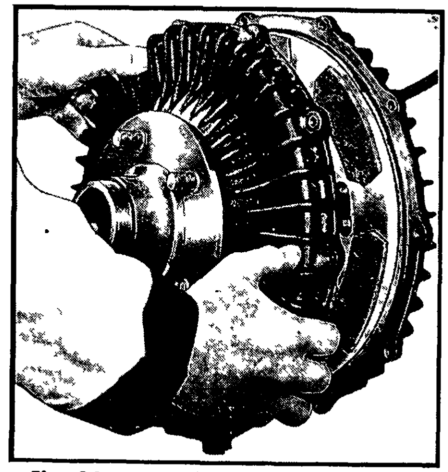


Fig. 36 Removing hub and uter brake housing. Chrysler fr nt disc brake

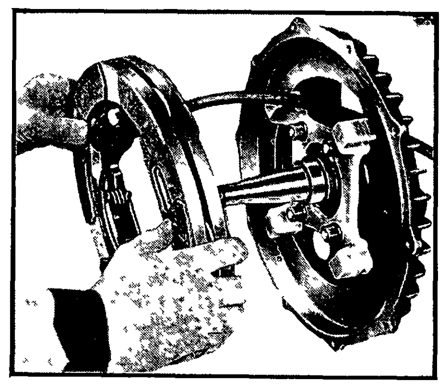


Fig. 37 Removing brake pr ssur plates. Chrysler front disc brake

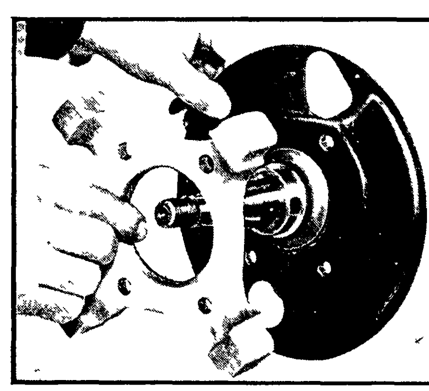


Fig. 38 Rem ving spider and dust shield. Chrysl r fr nt disc brake

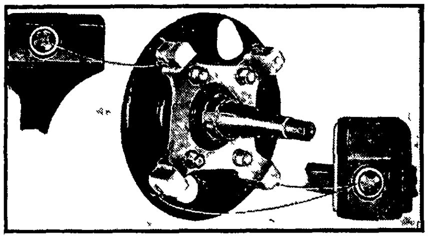


Fig. 39 Installing dust shield and spider. Chrysler left front disc brake

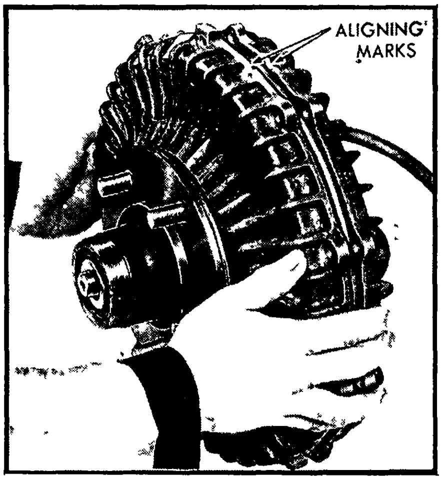


Fig. 40 Installing hub and outer brake h using. Chrysler front disc brake

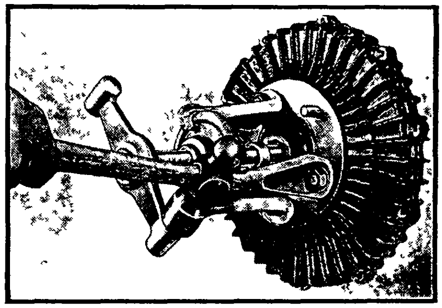


Fig. 41 Removing hub and outer brake housing with special puller C-844.

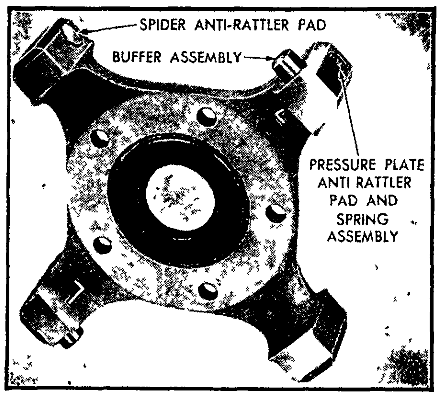


Fig. 42 Spider assembly. Chrysler rear disc brake

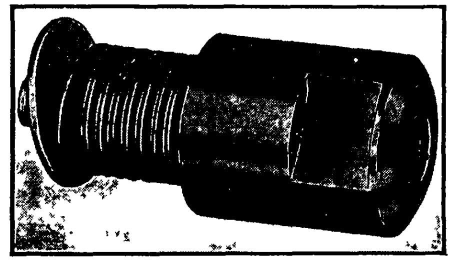


Fig. 43 Buffer assembly f r Chrysler rear disc brak

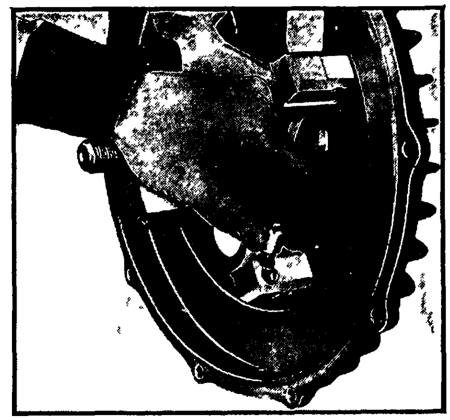


Fig. 44 Installing buffer in spider anch r. Chrysler rear disc brake

35, it will be noted that the brake assembly is composed of two cast iron halves. The outer wheel brake housing is bolted to the inner housing by ten bolts, located around the circumference. The wheel, in turn, is bolted to the outer housing. Both housings incorporate radial fins to provide more area for better cooling. It should also be noted that the brake assembly incorporates a dampener spring around the assembly which is attached by ten clips. Balance weights are attached by means of "easy" rivets and also are held rigidly by the housing attaching bolts.

FRONT BRAKE DISASSEMBLY—

1. Remove dampener spring and clips.
2. Remove ten housing attaching bolts around outside diameter of brake housing. The inner and outer housings are matched sets and should remain as such. A cut-out is cast in each housing and they should be mated. Check housings before separating so that if they are not marked they should be before disassembly.
3. Remove hub dust cap, cotter pin, nut and washer.
4. Separate inner and outer housings by tapping lightly at one of the attaching bolt hole flanges with a fibre hammer. When housings separate, remove outer wheel bearing.
5. Remove assembly of hub and outer brake housing, Fig. 36.
6. Disconnect front brake hose from tube at frame connection. The hose should be held down to drain fluid from it. Remove the brake tube dust grommet (2 screws) from the dust shield and slide the grommet off the brake shoe. (On late C-47 and on all C-49 Town and Country and C-50 models, the dust grommet will not have to be removed from the shield.) Cover the open end of the brake tube with absorbent cloth to prevent brake fluid leaking on brake parts.
7. Remove brake pressure plate assembly, Fig. 37.
8. Place brake pressure plate assembly on a clean surface or cloth on the bench. This is necessary because the linings are located on the outer surfaces of both pressure plates and as such can be damaged by dirt, grease and brake fluid, if present.
9. Lift off inner half of brake housing.
10. Remove spider and lift off dust shield, Fig. 38. The spider is rigidly bolted to the steering knuckle on front wheels and function as both a locator and an anchor for the pressure plates. The spider prevents these plates from moving radially and from spinning freely when they contact the brake housing. Four anchors on the perimeter of the spider perform these locating and anchoring functions.

FRONT BRAKE ASSEMBLY—

1. Install dust shield and spider. The front spiders must be installed so that the pressure plate anti-rattler pad and spring assembly is at a two-o'clock position on the right front wheel and at a ten-o'clock position on the left front wheel to prevent a clocking or turning movement of the inner pressure plate, Fig. 39. It should also be noted that the two lower arms of the spider each contain an anti-rattler pad and spring which reduces the vertical movement of the inner pressure plate.
2. Install inner half of brake housing.
3. Prior to installing pressure plate assembly, release both self-adjusters.
4. Install pressure plate assembly.
5. On early C-47 models, install brake tube dust grommet.
6. Connect brake tube to frame connection.
7. Install assembly of hub and outer brake housing. Inner and outer brake housings are matched and balanced as an assembly so that it is necessary to line up the mating cut-out in each housing, Fig. 40.
8. Install outer wheel bearing, washer and nut. Adjust bearing, install cotter pin and replace hub dust cap.
9. Install the ten housing bolts, lock washers and nuts.
10. Install dampener spring and clips.
11. Replace wheel and tire assembly.

REAR BRAKE DISASSEMBLY—

1. Remove dampener springs and clips from around perimeter of housings.
2. Remove ten housing bolts, nuts and lock washers. Check housings before separating so that if they are not marked, they can be before disassembly.
3. Remove cotter pin, axle nut and washer.
4. Separate inner and outer housings by tapping lightly at one of the attaching bolt hole flanges with a fibre hammer.
5. Install wheel puller C-844, Fig. 41, and remove assembly of hub and outer brake housing.

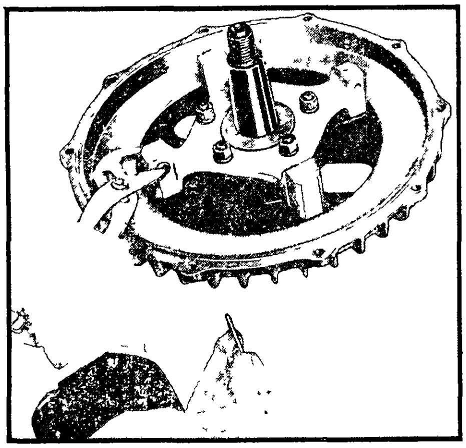


Fig. 45 Installing buffer lock pin. Chrysler rear disc brake

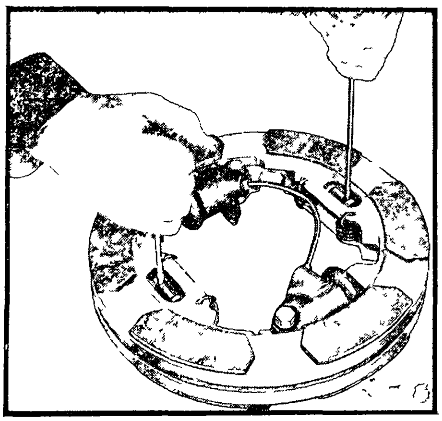


Fig. 46 Releasing automatic adjusters. Chrysler disc brake

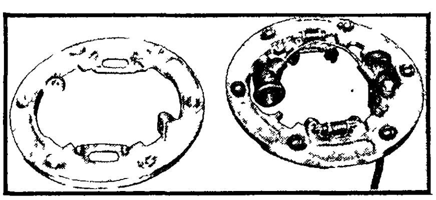


Fig. 47 Sh wing pressure expanding balls in ramps on Chrysler front disc brak . Rear brake is similar

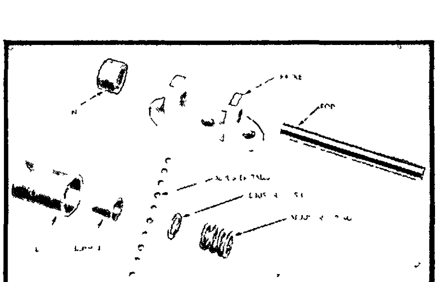


Fig. 48 Expl d d vi w f aut matic adjust r. Chrysler disc brake

6. Remove axle shaft key.
7. Disconnect brake hose from tube at axle housing connection. Allow fluid to drain from hose.
8. Remove brake hose dust grommet from early C-47 models only. Cover open end of brake tube with absorbent cloth to prevent brake fluid leaking on brake parts.
9. Remove brake pressure plate assembly. When this is done a buffer will drop out of the spider, Fig. 42. Two of these buffers are used and their function is to control pressure plate clocking.
10. Place pressure plate assembly on a clean surface or cloth on the bench.
11. Lift off inner half of brake housing.
12. Remove spider and oil seal. Lift off dust shield. The spider is rigidly bolted to the rear axle housing on the rear wheels and functions both as a locator and an anchor for the disc pressure plates. The spider prevents these plates from moving radially and from spinning freely when they contact the brake housing.

REAR BRAKE ASSEMBLY—

1. Install dust shield. Before installing the spider and oil seal, note that two of the spider arms are drilled to accommodate the two buffers, Fig. 42, two spider anti-rattler pads, and two pressure plate anti-rattler pad and spring assemblies which must face down. The buffers control the clocking motion of the other pressure plate and consist of a housing with integral shaft on which Belville washers are stacked. These washers are held in place by a regular washer and lock washer. The buffers are pre-calibrated and must be replaced as an assembly, Fig. 43.
2. Assemble the spider and oil seal with the inside face of the seal flush with the inside face of the spider.
3. Wrap a piece of wax paper over the axle shaft to cover the key slot. This will prevent cutting the seal lip. Then install spider and seal in correct position, aligning buffer loading pin holes in spider with corresponding holes in dust shield.
4. Install inner half of brake housing.
5. Prior to installing pressure plate assembly, release both self-adjusters.
6. Insert two buffer assemblies in the spider anchors, Fig. 44, being sure lock groove in buffer is facing dust shield.
7. Using a pair of water pump pliers, hold buffer in compressed position in spider leg, Fig. 45, and insert lock pin through hole in dust shield so the buffer will remain in the compressed position when pliers are released. (Pins can be made of $\frac{3}{16}$" round stock, 1½" long with blunt ends.)
8. Install brake pressure plate assembly.
9. After pressure plates are in position, remove buffer lock pins.
10. Install brake tube dust grommet on early C-47 models only.
11. Connect brake hose to tube at axle housing connection.
12. Place assembly of hub and outer brake housing in position on axle shaft and line up key ways. Be sure inner and outer housings are matched according to the mating cut-outs.
13. Insert axle key and drive it home with fibre hammer.

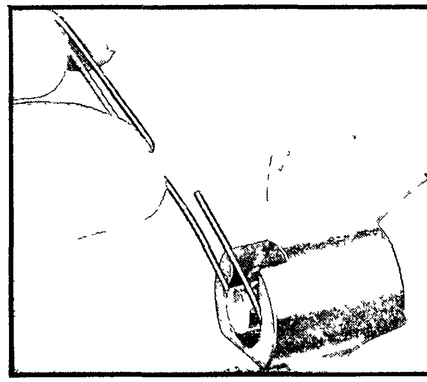


Fig. 49 Securing dummy shaft and bushing in position with c mmon pap r clip. Chrysler disc brake

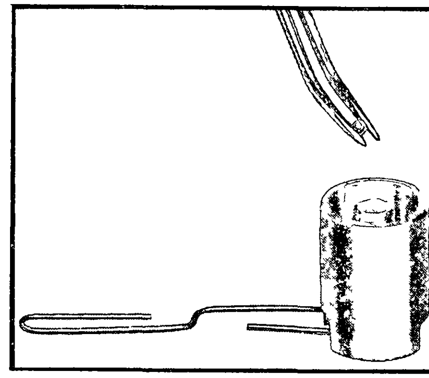


Fig. 50 Installing adjuster balls in sl eve. Chrysler disc brak

14. Install washer, axle nut and cotter pin.
15. Install ten housing bolts, nuts and lock washers.
16. Install dampener spring and clips.
17. Replace tire and wheel assembly.

BLEEDING BRAKE SYSTEM—Bleeding this brake system is the same as for conventional shoe-type brakes. However, best results are obtained by bleeding all four lower cylinders and then bleeding all four upper cylinders.

After bleeding the brakes, the brake pedal will still be low. This condition will continue until the car is driven and the brakes automatically adjust themselves by applying the brakes a few times at 15 or 20 miles per hour. If new linings have been installed, erratic operation may prevail for a few miles of operation. The car should be driven and brakes operated until normal brake applications result in smooth straight stops. This may take up to 25 or 30 miles.

DISASSEMBLING PRESSURE PLATES—

1. Release automatic adjusters, Fig. 46. By inserting a thin shank screwdriver between the release sleeve in the automatic adjuster and the adjuster guide of each adjuster, and then twisting both screwdrivers, the pressure plates will snap back into fully released position.
2. Remove four pressure plate retaining

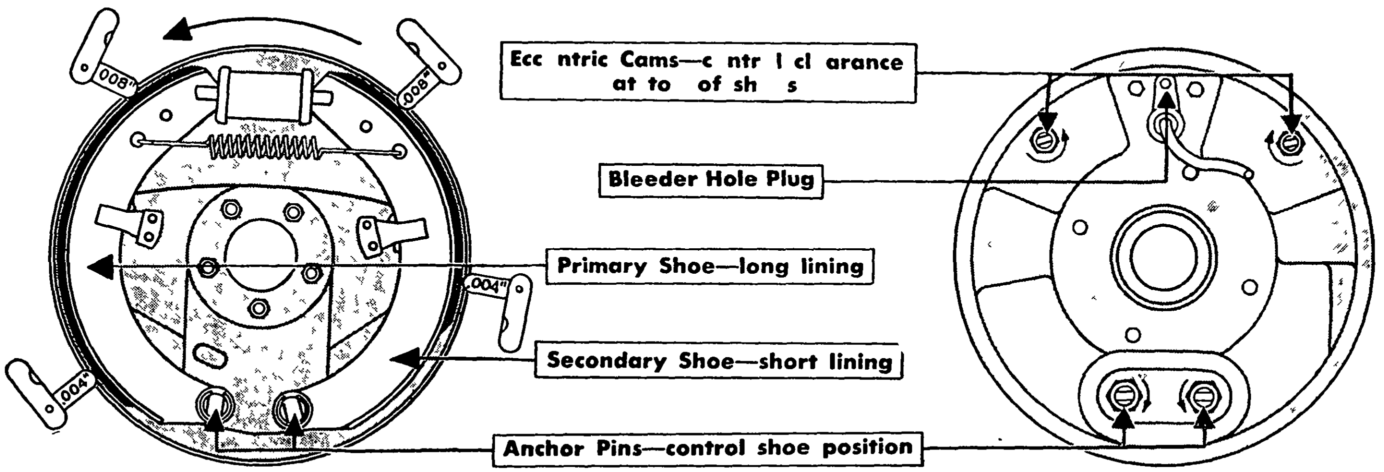


Fig. 51 Lockheed hydraulic brake with two eccentric anchor pins and double piston cylinder. Diagram shows right brake

springs. These coil springs perform the same function as the return spring in the shoe-type brake in that they pull the pressure plates together when hydraulic pressure is released and prevent the plates from maintaining friction contact with the brake housing. A "V" slot cut in one side of screwdriver will greatly assist in spring removal.

3. Separate the discs. By referring to Fig. 47, it can be noted that on each pressure plate, six ball ramps are machined into the inside surface. These ramps have 32½ degree pressure angle, which angle determines the amount of self-energization of the brake. Four slots in the inside edge of each pressure plate serve as locating recesses for the spider anchors. As the radial clearance between the end of each anchor and the base of the pressure plate slots is held to a minimum, the anchors prevent the pressure plates from moving radially, or off center.

4. Six lining segments are cyclebonded onto the outside surface of each pressure plate. A full lining is not used because it has been determined that an interrupted lining has better cooling characteristics. Despite this use of lining segments instead of full linings, the 12 inch disc brake has about 30 per cent more lining area than the 12 inch shoe-type brake.

ASSEMBLING PRESSURE PLATES—

1. With the wheel cylinders and automatic adjusters properly installed on the inner pressure plate, place the six steel pressure expander balls in the ramps as shown in Fig. 47. It should be noted that the locating recesses for the spider anchors are wider on the rear brake inner pressure plate than they are on the front brake inner pressure plate. This is to provide movement of the inner pressure plate so that self-energization can be accomplished in reverse speed. The front brakes are not self-energizing in reverse speed.

2. Place the other plate in position on the inner plate. It will be necessary to cock the wheel cylinder push rods slightly when positioning the outer plate. Automatic adjuster rods must also

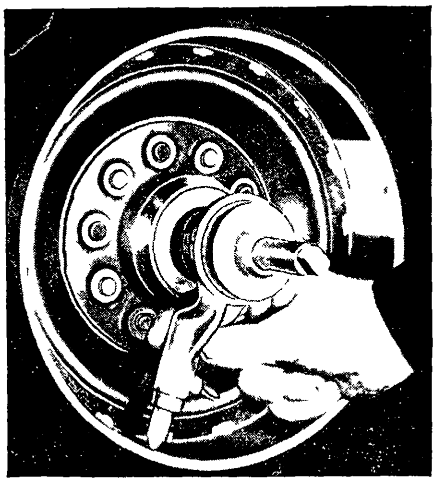


Fig. 53 Measuring brake drum diameter with drum gauge

be centered so that the operating lugs on the outer plate will straddle the rods.

3. Install the four pressure plate retaining springs.

SERVICING AUTOMATIC ADJUSTER—Fig. 48. The rod in the automatic adjuster will only move in one direction and can be pushed or pulled out by hand. The adjuster sleeve can then be removed by sliding the sleeve out from between the bracket guides. It is not necessary to remove the bracket from the inner pressure plate. Hold a finger over each end of the sleeve during removal so that the contents will not be lost.

To assemble the automatic adjuster, it will be necessary to make a dummy shaft of ¼ inch round stock, ¾ inch long and chamfered on one end.

Place the adjuster sleeve (slotted end down) upright on a finger and insert the dummy shaft (chamfered end up) in sleeve. Position bushing over dummy shaft. Hold dummy shaft and bushing in proper position by large end of a common paper clip, Fig. 49. Install 11 adjuster balls in sleeve, Fig. 50, and then

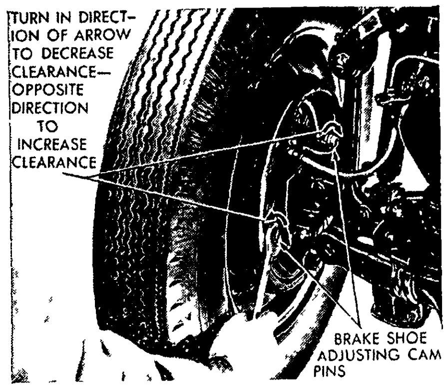


Fig. 52 Adjusting Lockheed brakes

insert adjuster washer. Position adjuster spring in sleeve and, while holding thumb over spring, carefully remove paper clip. Continue to hold pressure on spring, compressing it enough to slide sleeve into position on bracket. It should be noted that the sleeve is grooved and the bracket is stepped so that installation can be made the right way only.

Align the sleeve so that the dummy shaft is in line with the holes in the bracket guides. Insert the adjuster rod into the stepped end of the bracket and force the dummy shaft out Center the adjuster rod as nearly as possible. Finally, install the lubricating washer on the adjuster rod at the stepped end of the adjuster bracket.

LOCKHEED [1]

Hydraulic Double Anchor Brake with Double Piston Cylinder

Fig. 51—Eccentric anchor pins are used on all cars using this type brake except 1939-48 Ford and Mercury. On these cars, eccentric washers are used with non-eccentric anchor pins. To make a minor adjustment, see Fig. 52 and proceed as follows:

1. Beginning at any wheel, turn one of the brake adjusting cams until the

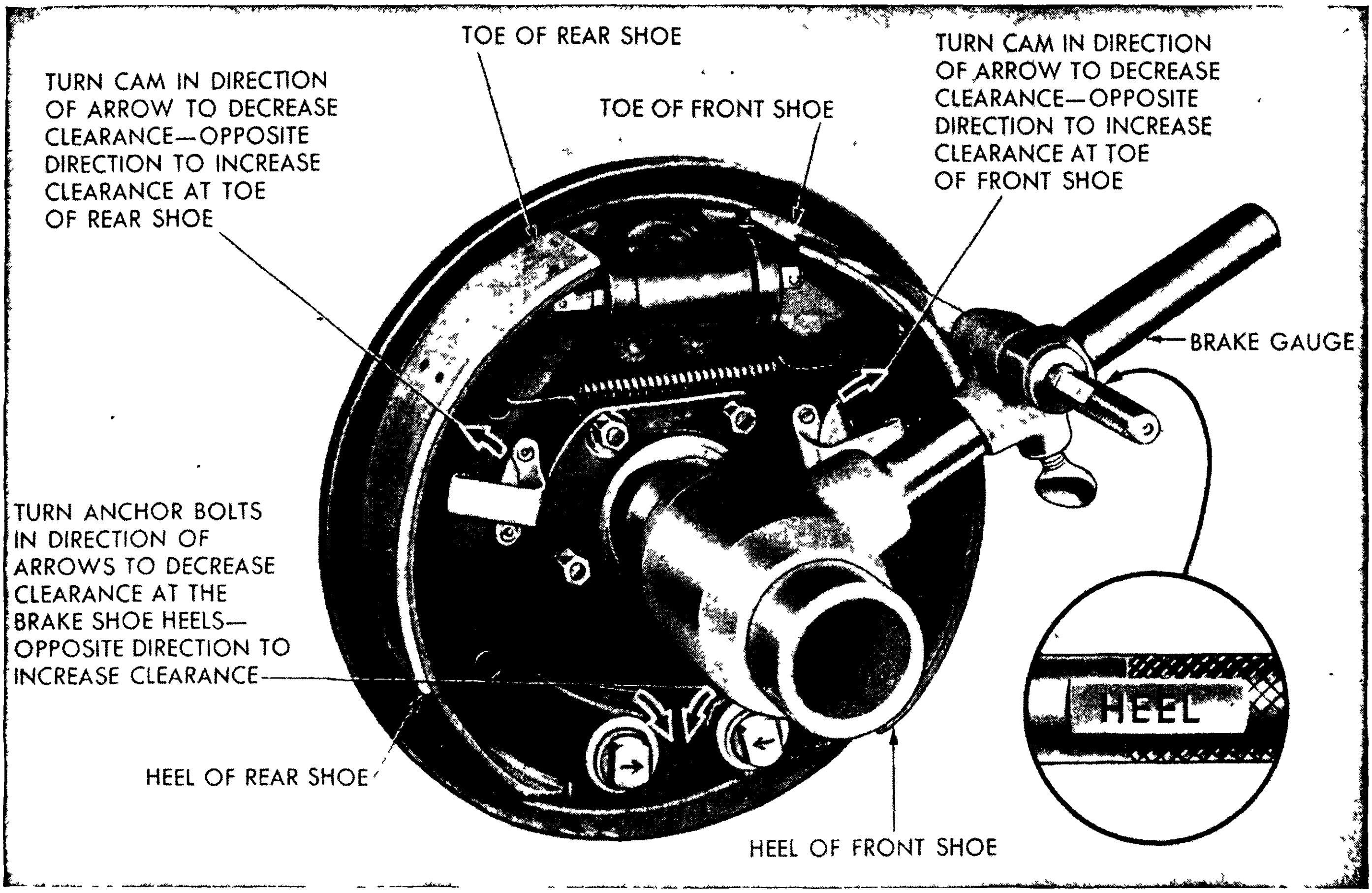


Fig. 55 Showing brake gauge mounted on axle in position for brake adjustment

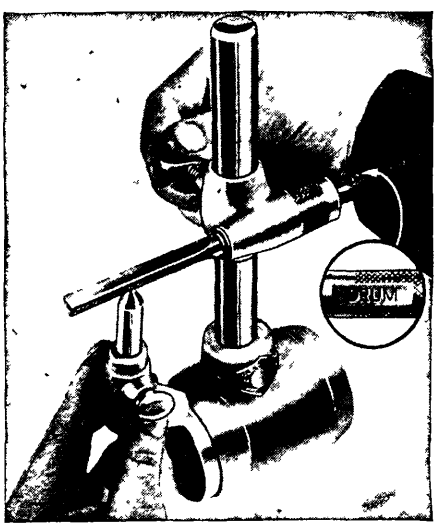


Fig. 54 Adjusting brake gauge arbor to diameter f brake drum as measured with drum gauge

brake shoe is held against the brake drum, locking the wheel.
2. Back off the cam until the wheel is just free.
3. Follow the same procedure with the other adjusting cam on the same brake.
4. Repeat the above at the other three wheels.
5. Apply and release the brakes.
6. Check each of the wheels to make sure all spin freely.

MAJOR ADJUSTMENT—If this adjustment is being made in conjunction with a reline job and the brake shoes have lining of different lengths, see that the shoe with the longer lining is the forward shoe in each wheel.

This adjustment should be made with a special *Drum and Shoe Gauge,* which should be set to the drum diameter and installed on the axle or spindle. There are several makes of these gauges and the instructions furnished by the manufacturer should be followed. In the procedure given below, one such gauge is illustrated.

1. Disconnect parking brake cables if connected to rear brakes (Chrysler-built cars employ a transmission brake; merely release the lever).
2. Loosen the anchor pin lock nuts.
3. Set adjusting cams in released position—opposite to that shown in Fig. 52.
4. Set gauge to drum diameter, Fig. 53.
5. Set brake shoe gauge arbor, Fig. 54, so that the finger marked "drum" just contacts the point of the brake drum gauge pin.
6. Assemble the gauge over the spindle or axle, using the proper adapter bushing so the entire tool is centered properly, Fig. 55.
7. Turn the adjusting cam on the forward shoe until the lining just touches the gauge, avoiding any pressure on gauge which would cause distortion.
8. Set the eccentric anchor pin (or washer) on same shoe until gauge is free.
9. Check with a feeler gauge—.005" at heel, .010" at toe—and lock anchor pin nut.
10. Set the reverse shoe in the same manner, using same clearances, and lock anchor nut.
11. Follow same procedure for setting shoes on other three wheels.

USING DUMMY DRUM—If a gauge of the type mentioned above is not available, Lockheed brakes may be adjusted satisfactorily by using a dummy drum, Fig. 56. In using this appliance, check the clearances with feeler gauges between the dummy drum and brake lining in the same manner as with the special gauge.

ADJUSTMENT WITHOUT GAUGE OR DUMMY DRUM—If either of these appliances is not available, a major adjustment of Lockheed brakes may be accomplished as follows:

1. If the eccentric anchor pins are not provided with means for turning with screwdriver or wrench, remove them from the support plates, grind off the case-hardened surface and slot the end with two hacksaw blades placed side by side in the same frame. Slot all anchor pins in a like location. Then mark with

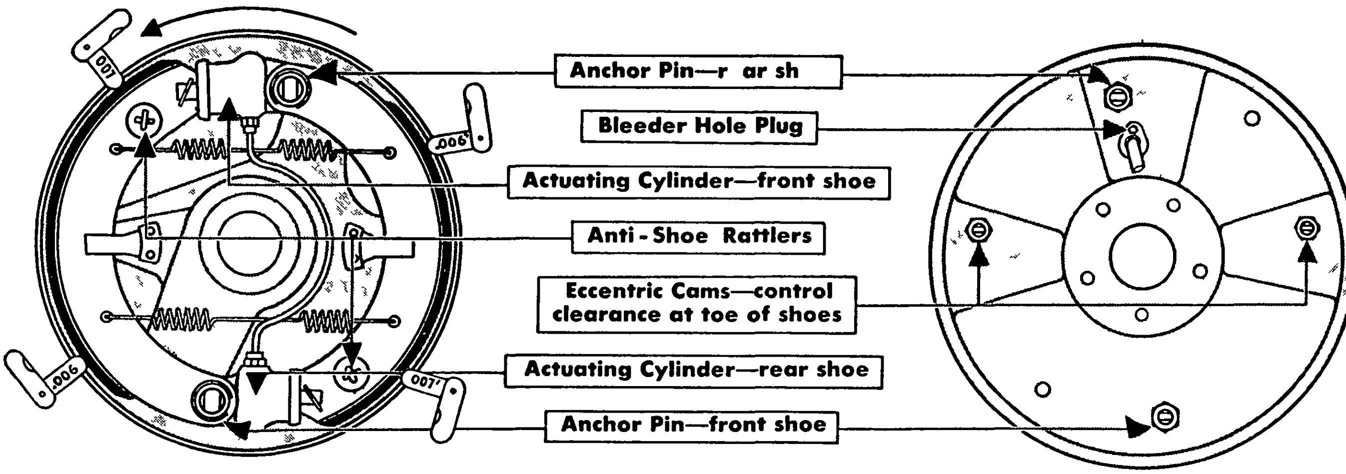


Fig. 57 Lockheed hydraulic brake with two single piston cylinders and two eccentric anchor pins. Diagram shows left front brake. Rear brakes are type shown in Fig. 51

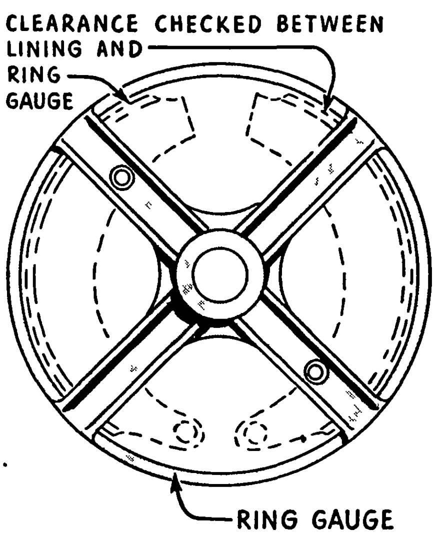


Fig. 56 Sh wing use of dummy drum or ring gauge t check brake shoe clearance on L ckheed brakes

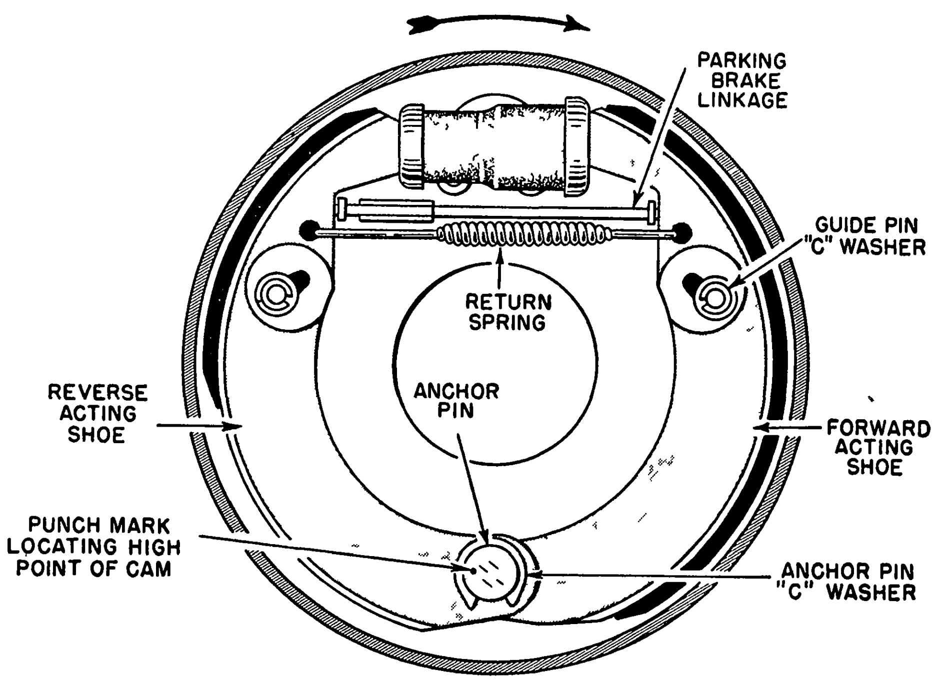


Fig. 58 Lockheed hydraulic double piston cylinder brake with a single eccentric anch r. Diagram shows right brake

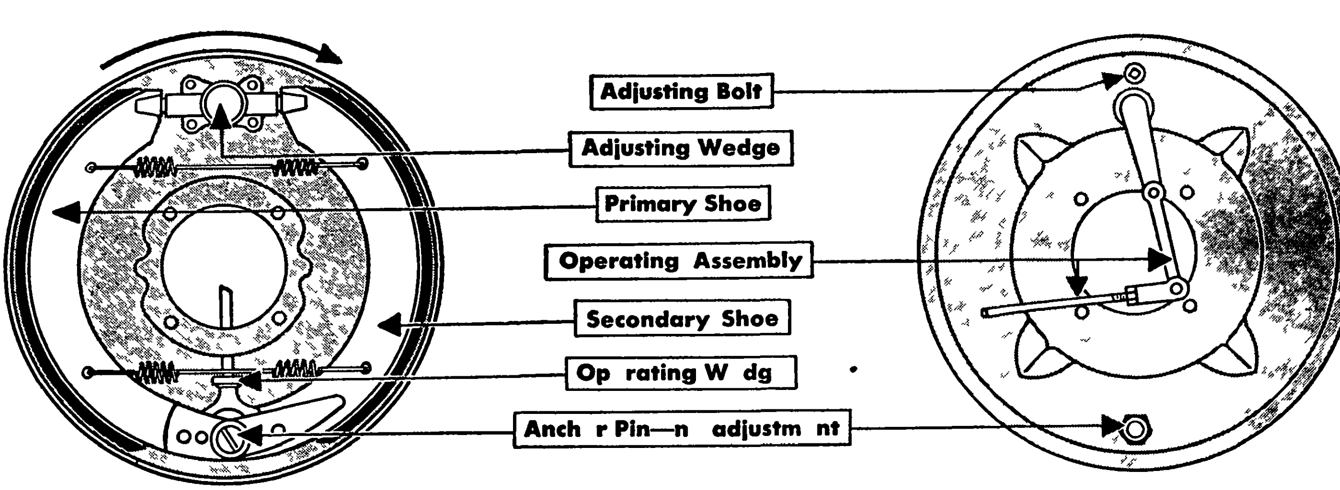


Fig. 60 F rd mechanical brak , 1935-36

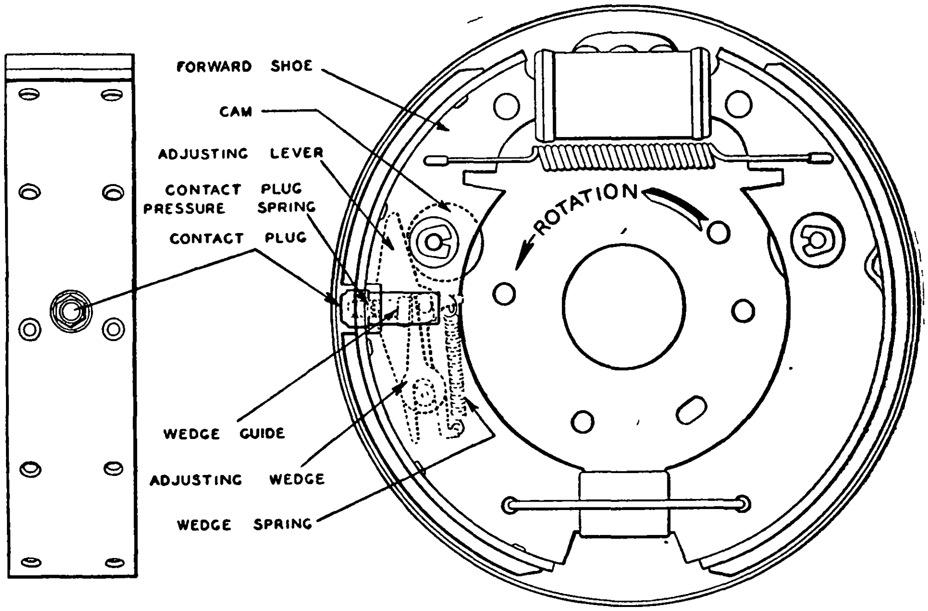


Fig. 59 Lockheed self-adjusting, self-centering hydraulic brake

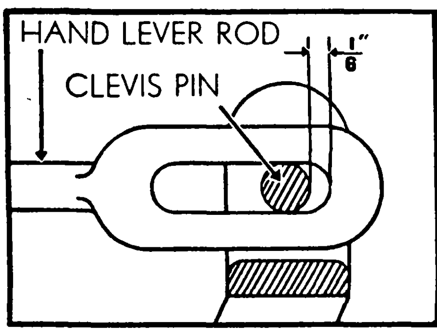


Fig. 61 Pedal pull rod adjustment on Ford m chanical brakes

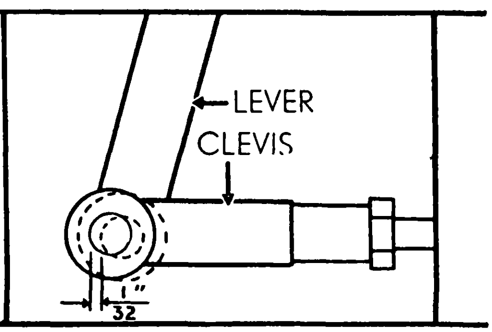


Fig. 62 On Ford mechanical brakes, adjust length of brake pull rods so each is 1/32" less than free length when connected. This preloads system slightly and prevents lost pedal motion

a prick punch the highest point of the eccentric. This is indicated by arrows on some brakes.

2. Replace the anchors and shoes and turn the anchors so that the punch marks are together inward, or that the points of the arrows are facing each other.
3. Turn adjusting cams to bring the shoes as far as possible away from drum.
4. Adjust one shoe at a time, turning cam out until shoe just drags.
5. Turn anchor until drum turns freely. Note that the movement of the anchor lowers the shoe so that the toe of the shoe no longer drags.
6. Again turn eccentric cam until toe of shoe just drags on drum.
7. Then turn anchor in same direction until drum turns freely.
8. Repeat the above until further turning of anchor will not free the drum from the drag obtained by setting the cam.
9. Then back off both anchor and cam very slightly until drum turns freely.
10. Repeat above procedure on all shoes, and a brake adjustment very close to the tolerance of .005" clearance at the heel and .010" at the toe will be obtained.

LOCKHEED [2]

Hydraulic Single Piston Two Cylinder Brake with Two Eccentric Anchors

Fig. 57—This design is used on the front wheels only on Chrysler 1940-51 (except 1949-51 Imperial), and on the front wheels only on 1946-51 DeSoto, Dodge and Plymouth. On all these cars, the type brake shown in Fig. 51 is employed on the rear wheels.

To adjust these brakes, follow the same procedure given for Fig. 51. However, see Fig. 57 for the points at which the recommended clearances of .006 and .007" are measured.

LOCKHEED [3]

Hydraulic Double Piston Cylinder Brake with Single Eccentric Anchor

Fig. 58—This brake is typical of other Lockheed brakes. It uses step-bore wheel cylinders with the larger piston acting on the forward shoe. The single eccentric anchor, however, permits adjustment of heel clearance on the forward acting shoe only. The lining on the reverse shoe is restricted to the cylinder end of this shoe. This tends to equalize lining wear and to increase the effectiveness of this shoe when applied in backing up. Later type sof this brake have cylinders of equal bore.

Adjustments are identical to that described for the double anchor type, Fig. 51, except that the anchor adjustment is made on the forward shoe only. The clearance requirements are .006" at heel, .010" at toe.

LOCKHEED [4]

Hydraulic Self Adjusting, Self Centering Brake

Fig. 59 — This brake differs from the conventional Lockheed brake in two respects: (1) It is self-centering in that the brake shoes center themselves in relation to the drum when the brakes are applied, and (2) it is self-adjusting—the brake shoes are automatically adjusted to compensate for normal lining wear.

Increased pedal travel indicates the need of a reline, provided the hydraulic system is functioning properly.

MAJOR ADJUSTMENT — This adjustment is made when overhauling the brake system or as an initial adjustment when brakes are relined.

1. Always use a new contact plug when brakes are relined.
2. Clean and examine all parts of the take up device for wear.
3. Replace worn parts.
4. Press down on the contact plug and completely retract the wedge.
5. Hold the wedge back and release the contact plug.
6. Mount the shoe in a vise so that the adjusting lever rests on top of the vise jaw, and file the plug to within .005" of the top of the lining.
7. Mount shoes on brake support plate.
8. Back off on adjusting cams and install drum.
9. Make initial adjustment by turning adjusting cams until a drag is felt and back off until wheel is just free.
10. Repeat steps 7, 8 and 9 at other wheels.
11. Set hand brake lever in first notch and adjust both cables at their clevises so that a slight drag is felt at both rear wheels.
12. Release hand brake and check rear wheels for freedom of movement.

FORD [1]

Mechanical Brake, 1935-36

MINOR ADJUSTMENT—Fig. 60.

1. Jack up wheels and release hand brake.
2. Check cross shaft levers to see that they do not pull beyond centers. Pull rod and cross shaft lever should form less than right angle with maximum pedal pressure.
3. Take up on adjusting wedge until slight drag is felt and back off until wheel is just free.

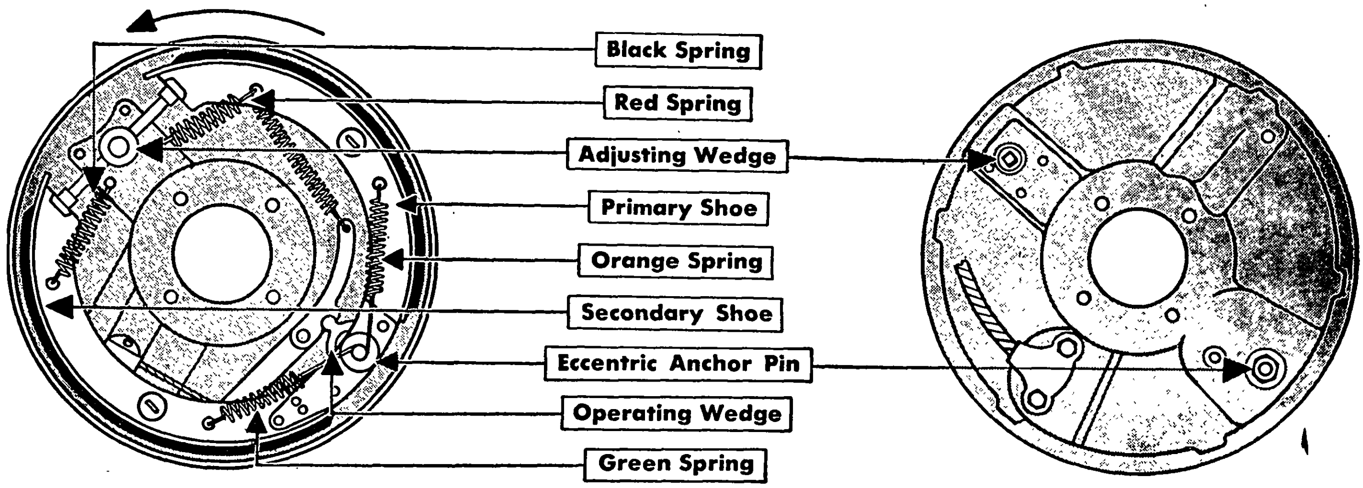


Fig. 63 F rd mechanical brake, 1937-38. Diagram shows left rear brake. Note position of colored brake shoe return springs

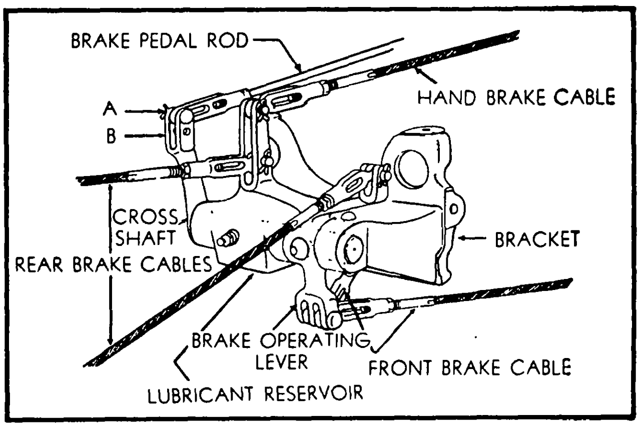


Fig. 64 Ford mechanical brak linkage, 1937-38. N te the two locations for brak p dal rod at A and B. P siti n A is used f r n rmal pera- ti n. P siti n B can be used when a harder pedal acti n and more pedal r serv is d sired

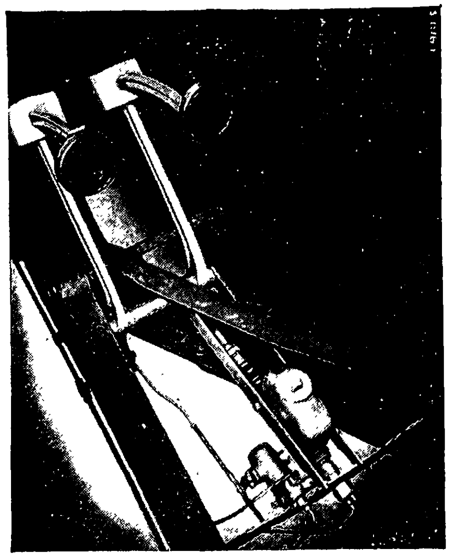


Fig. 65 Hill holder m unting

4. Repeat step three on other three wheels.

5. Equalize wheels by backing off the adjusting wedge on tight brake.

MAJOR ADJUSTMENT—

1. Disconnect pull rods from cam levers on all brakes.

2. Loosen clevis lock nuts at opposite end of rods.

3. Beginning at any wheel, take up on adjusting wedge until a slight drag is obtained and back off until wheel is just free.

4. Repeat step three at other three wheels.

5. Adjust pedal rod if necessary to obtain 1/8" clearance between clevis pin in cross shaft lever and back of slot in hand brake rod, Fig. 61.

6. Reconnect brake pull rods to take out all backlash and lost motion. It is recommended that the length of the brake pull rod be 1/32" less than the actual distance between cross shaft levers and brake cam lever, Fig. 62. This preloads the system slightly and prevents lost pedal motion.

7. Check each wheel separately. If any wheel drags excessively, it indicates that the rod has been shortened too much.

8. Set hand lever in first notch. Turn each wheel at least one complete revolution. Drag should be equal. If not, equalize wheels by backing off adjuster on tightest wheel until all turn with same effort. Release hand brake and see that all wheels are free of drag.

FORD [2]

Mechanical Brake, 1937-38

Fig. 63—In assembling these brakes, be sure to connect the return springs properly. Four springs are used on each brake, each having a different tension. The red and orange springs are connected to the primary shoe and the black and green springs are connected to the secondary shoe.

On the front brakes, the primary shoe is the lower shoe and on the rear brakes the primary shoe is the one toward the rear of the car.

MINOR ADJUSTMENT—Place hand brake lever in fully released position. Take up on the adjusting wedge until the wheel drags and back off until wheel is free. Repeat on other three wheels.

MAJOR ADJUSTMENT—Using brake gauge or dummy drum.

1. Release hand brake.

2. Remove clevis pins from front and rear brake cables at cross shaft, Fig. 64.

3. Remove wheels and brake drums.

4. Install brake gauge or dummy drum and turn adjusting wedge to obtain .005" clearance at the adjuster ends of the two shoes.

5. Check adjustment of the brake shoes at the anchor end and adjust to get as near .005" clearance as possible.

6. To adjust the anchor end of the shoes, loosen anchor pin lock nut on brake support plate. The anchor may then be forced toward or away from the drum, as necessary, by tapping with a soft hammer. The anchor is also eccentric and the ends of the two shoes can be centered by turning the anchor pin. Some earlier cars require an Allen set screw wrench to make this adjustment. Lock the anchor nut with a 16" wrench.

7. Repeat the above on other three wheels and reinstall the hub and drum assemblies.

8. Check the position of the brake cross shaft levers. The front brake cable operating lever should rest against the cross shaft bracket, Fig 64. If levers

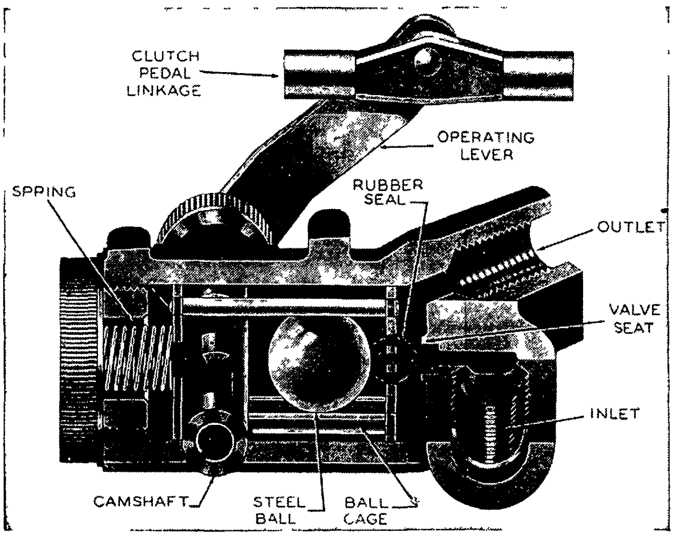


Fig. 66 Sectional view of hill holder when clutch pedal is released

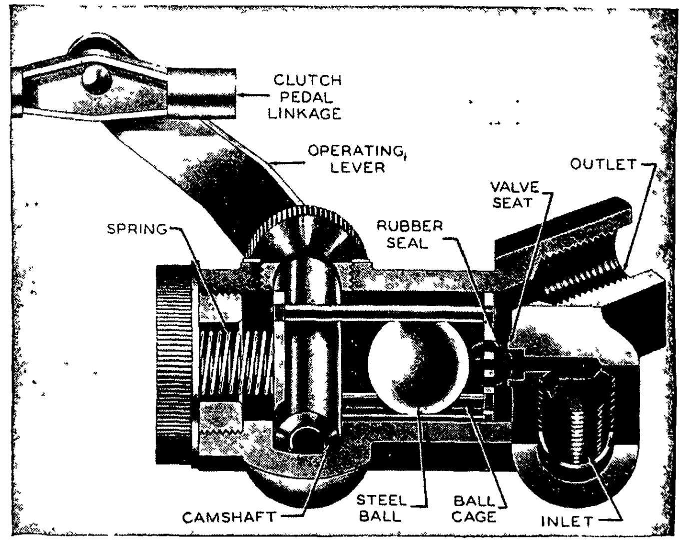


Fig. 67 Sectional view of hill holder when clutch pedal is depressed

are not so positioned, adjust pedal-to-cross shaft rod.

9. Take up the adjuster on each brake until the shoes are tight in the drums.

10. Adjust each cable by turning the clevis until the clevis pin can just be installed when there is a pull on the cable of about 25 pounds (measured with spring scale). Make sure cable conduits are properly seated at the frame and support plate brackets.

11. Back off the adjusters until the wheels are just free.

12. Equalize the brakes by using a pedal jack or by setting the hand brake in the first or second notch, backing off on the tightest wheels to get the same drag on each brake.

13. Check equalization on brake testing machine or on the road.

MAJOR ADJUSTMENT — Without use of brake gauge or dummy drum.

1. Release hand brake.

2. Remove clevis pins from all brake cables at cross shaft.

3. Take up adjuster until brake drags, then loosen anchor pin lock nut and tap anchor outward toward drum with light hammer.

4. Turn anchor to right or left to so centralize the shoe assembly as to increase the drag as much as possible. If the wheel is freed appreciably, the adjuster should be taken up again and the anchor operation repeated to decrease drag.

5. Tighten anchor lock nut with a 16" wrench, holding the anchor so it cannot turn during the process.

6. Repeat the adjustments at the other three wheels, leaving the adjusters taken up so that the shoes are tight in the drums.

7. Adjust each cable by turning the clevis until the clevis pin can just be installed when there is a pull on the cable of about 25 pounds (measured with a spring scale).

8. Insert cotter pin and set lock nut on clevis. Make sure that cable conduits are properly seated at the frame and brake support brackets.

9. Back off adjuster at each brake until wheels are just free.

10. Equalize brakes by using a pedal jack or by setting the hand brake in the first or second notch and back off the tightest wheels to get the same drag on each brake.

HILL HOLDER

This device, called "NoRoL" by its manufacturer, provides greater ease of vehicular control on hills and in traffic. It is connected to the clutch pedal, Fig. 65, and keeps the brakes applied as long as the clutch pedal is depressed when the car is on an upgrade, even after the brake pedal is released. The driver is then able to use his right foot for the accelerator pedal.

The hill holder is connected hydraulically between the brake master cylinder and the wheel cylinders. Brake fluid from the master cylinder enters the inlet of the hill holder and passes through the outlet to the wheel cylinders when the brake pedal is depressed. Within the hill holder is a valve operated by a ball cage and a steel ball within the cage. The position of the ball cage is controlled by a camshaft operated by linkage from the clutch pedal.

Fig. 66 illustrates the position of the ball cage when the clutch pedal is released. When the clutch pedal is depressed, Fig. 67, the operating lever is pulled to the left and turns the camshaft so that the ball cage fits into the flat surface on the camshaft. The spring then forces the ball cage to the right so that the rubber seal is pressed against the valve seat.

When the car is stopped on an upgrade with the brakes applied and the clutch pedal depressed, the ball rolls against the rubber seal which, in turn, rests against the valve seat, preventing the brake fluid in the wheel cylinders from returning to the master cylinder. Pressure is therefore maintained in the wheel cylinders to keep the brakes applied.

When the clutch pedal is released, the camshaft is rotated and lifts the ball cage away from the valve seat, allowing brake fluid to pass through the valve to the master cylinder, thus releasing the brakes.

When the car is on a downgrade, the ball rolls away from the rubber seal, rendering the valve inoperative regardless of clutch pedal position.

The hill holder does not affect the ordinary use of the brakes for when the brakes are applied, pressure of the fluid from the master cylinder forces the ball cage back against the spring even if the clutch pedal is depressed, allowing fluid to flow through the outlet through the wheel cylinders.

HILL HOLDER ADJUSTMENT—In adjusting the hill holder, first be sure it is level. This can be determined with a spirit level mounted on the two bosses on top of the housing.

The control rod, which is connected to the lever, must be so set that the brakes release just ahead of clutch engagement or when the car begins to accelerate. If brake release is delayed, the effective rod length should be shortened. Should the brakes release too quickly—permitting the car to move backward before clutch engages—the rod should be lengthened.

STEERING GEARS

Car Mak	G ar Make
AMERICAN BANTAM	
1938	Ross (2)
1939-40	Ross (3)
AUBURN	
1935-36 Six	Ross (1)
1935-36 Eight	Ross (4)
AUSTIN	
1935	Saylor
BUICK	
1935-36	Saginaw (4)
1937-40	Saginaw (6)
1941-52	Saginaw (10)
CADILLAC	
1935 V8 Except 146" W. B.	Saginaw (4)
1935 V8 146" W. B.	Saginaw (5)
1935 V12	Saginaw (5)
1936-37 V16	Saginaw (5)
1936 Except V16	Saginaw (4)
1937 Models 75, 85	Saginaw (4)
1937 Except 75, 85, 90	Saginaw (6)
1938-39 All	Saginaw (6)
1940 Except 72	Saginaw (6)
1940 Model 72	Saginaw (10)
1941-52	Saginaw (10)
CHEVROLET	
1935-36 Standard	Saginaw (1)
1935-36 Master	Saginaw (3)
1937-38 Knee Action	Saginaw (7)
1937-40 I-Beam Axle	Saginaw (2)
1939-48 Knee Action	Saginaw (8)
1949-52	Saginaw (9)
CHRYSLER	
1935-37	Gemmer (2)
1938-52 Standard	Gemmer (3)
CORD	
1936-37	Gemmer (2)
CROSLEY	
1939-52	Ross (2)

Car Make	Gear Mak
DE SOTO	
1934-37	Gemmer (2)
1938-52 Standard	Gemmer (3)
DODGE	
1935-37	Gemmer (2)
1938-52	Gemmer (3)
FORD	
1935-1936	Gemmer (1)
1937-48	Gemmer (3)
1949-52	Gemmer (4)
FRAZER	
1947-52	Gemmer (3)
GRAHAM	
1935 Models 72, 73	Ross (4)
1935-37 Models 74, 75, 80, 85, 90, 95	Ross (2)
1936 Model 90A	Ross (1)
1937-41 Except 85, 95	Ross (3)
HENRY J	Gemmer (3)
HUDSON	
1935-36	Gemmer (1)
1935 De Luxe	Gemmer (2)
1937-52	Gemmer (3)
HUPMOBILE	
1935-38	Gemmer (2)
KAISER	
1947-52	Gemmer (3)
LAFAYETTE	
1935-36	Gemmer (2)
1937-40	Gemmer (3)
LA SALLE	
1935-36	Saginaw (4)
1937-40	Saginaw (6)
LINCOLN	
1935-40 Series K	Lincoln
1936-48 Series H	Gemmer (2)
1949-52	Gemmer (3)

Car Mak	Gear Mak
MERCURY	
1939-52	Gemmer (3)
NASH	
1935-36	Gemmer (2)
1937-52	Gemmer (3)
OLDSMOBILE	
1935-36	Saginaw (4)
1937-52 Except 1949-52 "98"	Saginaw (6)
1949-52 "98"	Saginaw (10)
PACKARD	
1935-36 Except 120	Gemmer (3)
1935-38, 110, 120	Gemmer (2)
1937-38 Super 8	Packard
1937-39 Twelves	Packard
1940-52	Gemmer (3)
PIERCE ARROW	
1935-38	Ross (4)
PLYMOUTH	
1935-39	Gemmer (2)
1940-52	Gemmer (3)
PONTIAC	
1935-36	Saginaw (4)
1937-52	Saginaw (6)
REO	
1935-36	Ross (4)
STUDEBAKER	
1935-36 Dictator	Ross (1)
1935-36 Commander & President	Ross (4)
1937-52 Commander & President	Ross (3)
1939-52 Champion	Ross (3)
1951-52 (Partial)	Saginaw (9)
TERRAPLANE	
1935-36	Gemmer (1)
1937-38	Gemmer (3)
WILLYS	
1935-36	Lavine
1937-39	Gemmer (1)
1940	Gemmer (2)
1941-52	Ross (3)

BEFORE making an adjustment for play or binding in the steering gear, jack up the front wheels and make sure that the complaint is not due to some other cause. Do not make adjustments in the steering gear to correct any erratic action of the front wheels, as evidenced by wheel shimmy or steering wheel fight. If these conditions exist, check the tires for proper inflation and see that the camber, caster and toe-in are according to specifications. Shock absorber tension or adjustment should be according to the recommended standard. Tie rod and drag link sockets or connections should also be adjusted to the correct tension and freedom. Make sure that the pitman arm is tight on the cross shaft and that its lockwasher and nut are tight also.

End play in the worm (or cam) shows up as play in the steering tube, indicated by up and down movement of the steering wheel. When this adjustment is correct, the steering wheel should turn freely with the thumb and forefinger lightly gripping the steering wheel rim, and without any up and down movement of the column tube. If end play is less than .010", no adjustment is required.

To correct misalignment of the steering column, loosen the frame bracket bolts enough to allow the gear to shift, and to line up at the angle determined by the setting of the steering column bracket at the instrument board. Then tighten the frame bracket bolts. Now, loosen the instrument board bracket and allow it to match the position of the steering column, and then tighten the bracket. If the bracket is of the single-position type, change the bracket to the position of the steering column. Do not spring the column to the bracket.

To locate the steering gear in its central position, turn the steering wheel from one extreme to the other and count the number of turns required. Now, turn the steering wheel just one-half the distance of the total movement. Some steering wheels have a trade mark, or depression, on the under side of the spoke that should point directly up or down, whichever location is nearest when

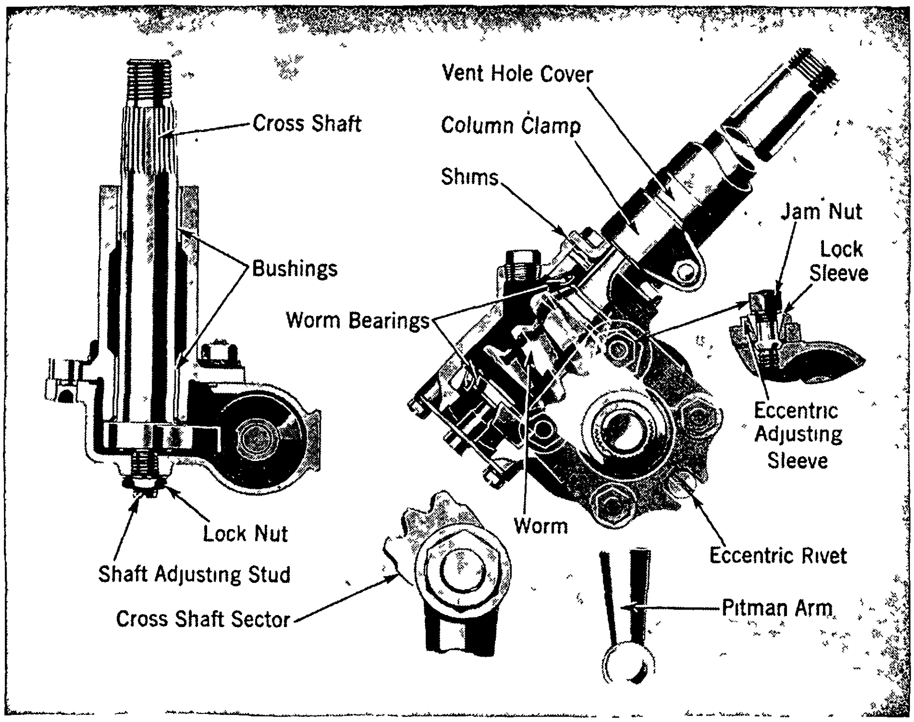


Fig. 1 Gemmer worm and sector gear

the steering gear is in its central position.

While making any adjustment, free the steering gear of any load by disconnecting the drag link from the pitman arm.

When the adjustment is completed, the gear should be free from backlash in its straight-ahead position, and must be free to move throughout its complete travel without binding at any point. Now, turn the steering wheel to its central position and place the front wheels in their straight-ahead position. It should be possible to connect the drag link to the ball end of the pitman arm, without moving the steering gear any appreciable amount. If this cannot be accomplished, remove the pitman arm from the steering gear cross shaft and place it on the serrations in the correct position. If this is not done, the front wheels will not be able to swing equally to the right and left.

GEMMER [1]

WORM & SECTOR WORM END PLAY, ADJUST

Fig. 1. Loosen the jacket clamp bolt and move the clamp up about ⅜" above the lower end of the jacket. Loosen the instrument board bracket clamp from the column jacket. Work the jacket down until its lower end is against the steering gear housing cap. Remove the housing cap screws and work the jacket up until it is stopped by the bottom of the steering wheel recess. There should now be ⅜" clearance between the top of the housing and the housing cap, which will permit the removal of the adjusting shims.

Use a knife to separate the top shim, passing the blade all the way around between the shims, using care to avoid damage to the remaining shims. Now, cut the shim near one of the holes—on an angle—and remove.

Reverse the operations to assemble, being careful to locate the column jacket so the top end will clear the bottom of the steering wheel recess, thus preventing friction at this point. Locate the jacket clamp as near to the bottom end of the jacket as possible.

CROSS SHAFT END PLAY, ADJUST

See that the housing cover nuts and the eccentiric sleeve jam nut are tightened securely. Turn the steering wheel to either extreme position and then back an eighth of a turn. Gripping the pitman arm at the hub, the cross shaft should rotate freely without any end play. Adjust as required by means of the adjusting screw at the side of the housing, next to the engine. Be sure to lock securely with the lock nut, after which re-inspect for end play and freedom of the steering gear throughout its range.

WORM & SECTOR MESH, ADJUST

Turn the steering gear to the central position of its complete travel (drag link disconnected). Place the marked spoke of the steering wheel in the correct position and shake the pitman arm to determine the amount of lost motion.

Loosen the housing cover nuts ¼ turn, and the eccentric sleeve jam nut ½ turn. Turn the eccentric adjusting sleeve very gradually, checking at each movement the amount of lost motion still existing at the pitman arm. Adjust to the point where the lash can just be felt at the end of the pitman arm, being sure to finish the movement of the eccentric sleeve in the clockwise direction. Turn the steering wheel throughout its full travel to check for free operation. If it is too tight, turn the eccentric sleeve in a counter-clockwise direction until the gear is free, and make the adjustment again more carefully. Tighten the eccentric sleeve jam nut securely first, and then tighten the housing cover nuts.

TOOTH CONTACT, CENTRALIZE

The worm is machined in such a manner that close mesh with the sector teeth is provided at the central position. This corresponds to the straight-ahead driving range, with gradual relief toward the extremes of the worm. Since any normal wear is more pronounced at the central position, this provision allows for subsequent adjustment without fear of binding toward the extremes.

When the sector teeth are properly centralized in relation to the worm thread, there should be an equal amount of lash in the mesh of these parts at ⅓-turn of the steering wheel at each side of the central position. If this is not the case, the sector shaft can be shifted to either side of the central position of the worm by means of an eccentric rivet adjustment, which is located at the lower portion of the cross shaft cover.

In making this adjustment, the check must start with the sector shaft teeth meshed at the central position of the worm. The central position is found by turning the steering wheel to the central position of its complete travel and locating the marked spoke of the wheel as previously described.

Turn the steering column ⅓-revolution to the right and shake the pitman arm, and note the amount of play at this point. Now, turn the steering column ⅔-revolution to the left—which is really ⅓-revolution to the left of the central position—and shake the pitman arm. The lash at this position should be the same as when turned to the right of center. If there is more lash at the left position, turn the eccentric rivet slightly in a counter-clockwise direction. If the lash is more at the right, turn the rivet in a clockwise direction.

After these positions have been equalized, adjust for proper mesh of the shaft teeth in the worm as described under WORM & SECTOR, MESH. After making the final adjustment, tighten the eccentric sleeve jam nut securely, and then, the housing cover nuts. Be sure to tighten the sleeve jam nut first.

STEERING GEAR, OVERHAUL

DISASSEMBLE — Remove the housing cover and sector shaft by removing the three cover nuts, the eccentric sleeve jam nut and the eccentric sleeve. Remove the nuts from the studs which hold the worm shaft upper bearing to the housing, and remove the housing cap and shims—which will permit the withdrawal of the worm and tube assembly. Remove the lower bearing cage. Inspect all parts.

INSPECTION—The bearing rollers and races must be free from pits and wear.

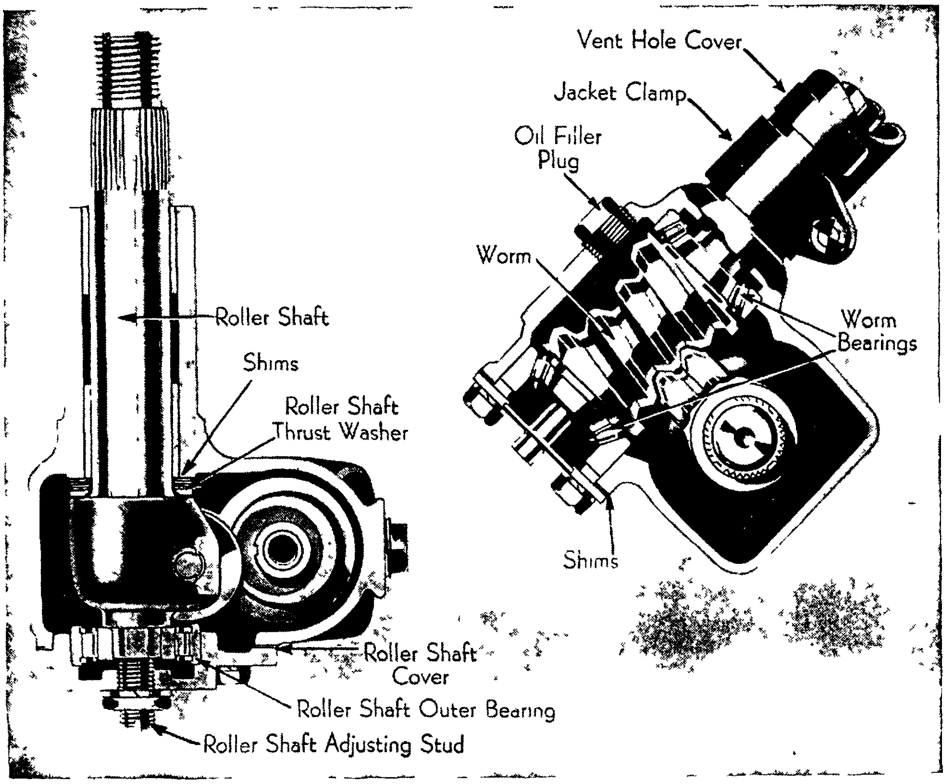


Fig. 2 Gemmer worm and roller with internal mesh adjustment and straddle-mounted shaft

The pressure faces of the worm, as well as the sector teeth, should be polished, but should show no irregular wear. The sector shaft and its bearings should not be scored, and the bearings should fit on the sector shaft without appreciable radial looseness. Make sure that the main tube is not bent.

ASSEMBLE — Press the lower worm bearing cup into the housing. Lubricate the worm lower bearing cage with gear oil and install it into position. Replace the worm and tube, and assemble the upper bearing cage, bearing cup and spacer. The balance of the assembly is contained in the adjustments already described.

LUBRICATION — Remove the steering gear housing plug and the vent hole cover. Fill the housing with approved lubricant until it comes out of the vent. Replace the plug and the vent cover to prevent dirt from entering the housing. Avoid the use of graphite, white lead or heavy solidified oil.

GEMMER [2]

WORM & DOUBLE ROLLER INTERNAL MESH ADJUSTMENT

WORM END PLAY, ADJUST

Figs. 2 and 3. Be sure the end play is in the worm and not play in the column jacket bushing. To make the adjustment, loosen the four cover screws ⅛ inch. Use a knife to separate the top shim, passing the blade all the way around between the shims, being careful not to damage the remaining shims. Remove only one shim at a time between inspections to remove the end play. The adjustment is correct when there is no end play, and no stiffness in the steering gear throughout the complete range of its travel.

ROLLER SHAFT END PLAY, ADJUST

Turn the steering wheel to either extreme, and then, back ⅛ of a turn. Gripping the pitman arm at the hub, the roller shaft should rotate freely without a particle of end play. If end play exists, adjust as required by means of the roller shaft adjusting screw located at the back of the housing. Be sure to tighten the lock nut securely and then, re-inspect for end play and free rotation throughout the entire range of the steering gear.

WORM & ROLLER MESH, ADJUST

This adjustment should never be made without first correcting the roller shaft and column adjustments. Proceed as follows: Turn the steering wheel to the central position of its complete travel (drag link disconnected) and shake the pitman arm to determine the amount of lost motion. If this motion exceeds $\frac{1}{32}$", roller shaft adjustment should be made, in which case, the steering gear should be removed from the car.

Place the gear assembly in a vise with the column in a position to the right of the vise. Remove the roller shaft, using care to see that all the shims remain on the shaft. This will prevent them from dropping into the housing behind the worm, which may cause interference with proper gear operation.

Remove the column jacket and replace the steering wheel on the tube. If proper worm bearing adjustment has not been made, re-adjust as already described. Note that the roller shaft thrust washer is assembled with the chamfered side next to the roller shaft thrust face.

To make the adjustment, remove shims

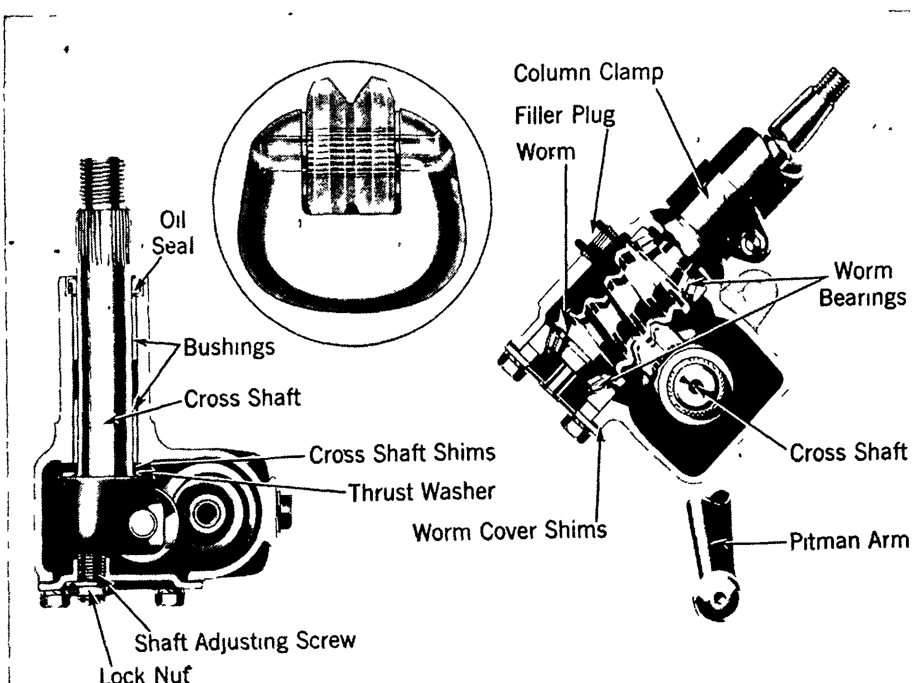


Fig. 3 Gemmer worm and r ller with internal mesh adjustment

which are in place behind the roller shaft thrust washer. The position of the roller contact with the worm is offset from the center line of the worm, therefore, when a shim is removed, the roller is moved into closer mesh with the worm.

Select, through trial, the proper amount of shims to produce not more than .006" play, measured at the end of the pitman arm, and without heavy drag at the steering wheel. Remove only one shim from the roller shaft, and insert the shaft in the housing. Then, turn the steering wheel nearly all the way to the left stop. Hold the roller shaft in place with thumb pressure on the head end of the roller shaft, and revolve the steering wheel to the right, until the shaft roller is in the center of the worm. (Do not reverse the turn to the left). While still holding the roller shaft in place, grip the splined end of the shaft with the other hand and try to rotate it. If any play exists, remove another shim, and repeat the operation until play by hand in the center of the gear is removed.

When the proper amount of shims have been selected, turn the steering wheel CLOSE to either extreme, and re-assemble the shaft roller cover and tighten the screws securely. (Drive the pitman arm on the roller shaft.) Now, loosen the roller shaft adjustment screw lock nut and tighten the screw until all end play in the roller shaft has been removed, when the shaft is rotated in this lash position, close to the end of the worm. Tighten the lock nut securely and re-inspect the gear for freedom of operation throughout, and at the same time, being sure that no end play exists in the roller shaft.

When reassembling the jacket on the gear, use nothing but castor oil to lubricate the column jacket bushing. Be sure to align the gear in the car as already described.

STEERING GEAR, OVERHAUL

DISASSEMBLE — Remove the roller shaft cover screws and remove the cover plate and gasket. Remove the roller shaft and its thrust washer and shims. Remove the worm cover plate screws, cover plate and shims. Push the column tube out of the bottom of the housing, which will remove the lower thrust bearing cup, spacer cup, rollers and the worm upper thrust bearing rollers. Pull the upper bearing cup.

INSPECTION — If the roller bushings are worn, replace the housing assembly. If the roller shaft is worn or scored, it should be replaced. If the roller is worn, or if the bearing is worn or loose, replace the shaft and roller assembly. If the worm is worn, the worm and tube should be replaced. If the column tube is worn or bent, it should be replaced. Before reassembling, dip all wearing surfaces into steering gear lubricant.

ASSEMBLE — Install the upper worm thrust bearing cup in the housing. Place the upper worm thrust bearing rollers on the worm and install the worm and tube assembly. Install the lower thrust bearing rollers and cup. Install the bearing cup spacer, shims and cover. Tighten the cover screws securely and adjust the steering gear as already described.

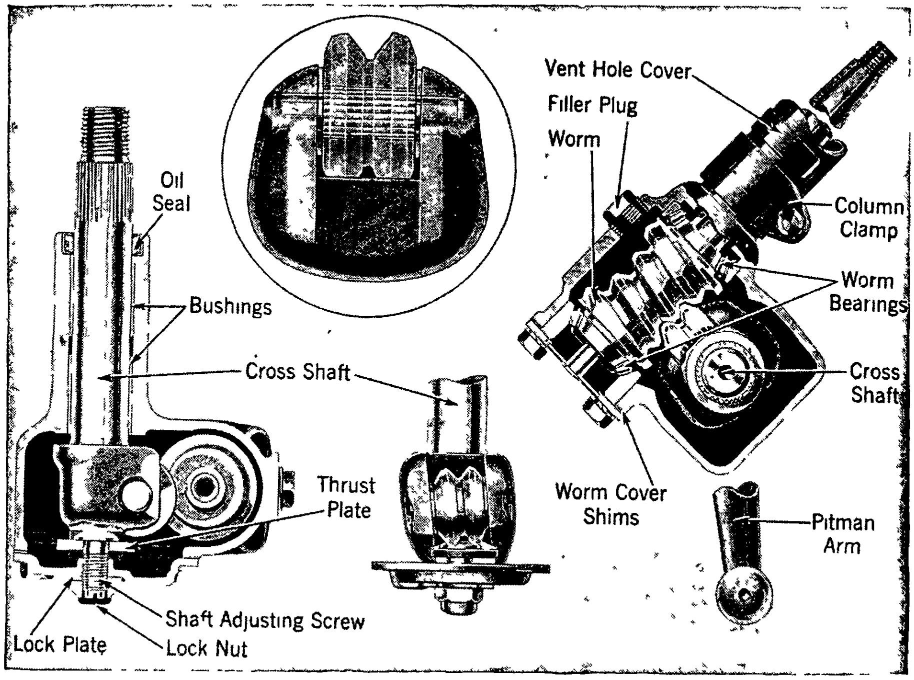


Fig. 4 Gemmer worm and roller with external mesh adjustment. Some gears of this type have three-tooth r llers

LUBRICATION—Lubricate the steering gear as described for the WORM & SECTOR type and adhere to the same precautions.

GEMMER [3]

EXTERNAL MESH ADJUSTMENT TYPE

Fig. 4. This gear is the same as Gemmer (2) except for the roller shaft and worm mesh adjustment, which is accomplished externally which makes it unnecessary to remove the gear from the car.

To make the adjustment, remove the roller shaft adjustment screw lock nut and slide the lock plate off far enough to clear the lock boss on the roller shaft cover. Now, with the steering wheel in its central position (drag link disconnected), tighten the roller shaft adjustment screw just enough to remove play between the roller shaft roller tooth and the worm. Check this by the amount of play felt at the pitman arm. It is better to leave a slight amount of play at this point than to tighten too much. If tightened beyond the point where the lash is removed, serious results will occur which will cause poor steering operation. Now, slide the lock plate into position against the lock plate cover, and in the locked position. Replace the adjustment screw lock nut and tighten securely.

Whenever the pitman arm is removed, use a suitable puller, as any other means of removal will cause damage to the adjustment parts.

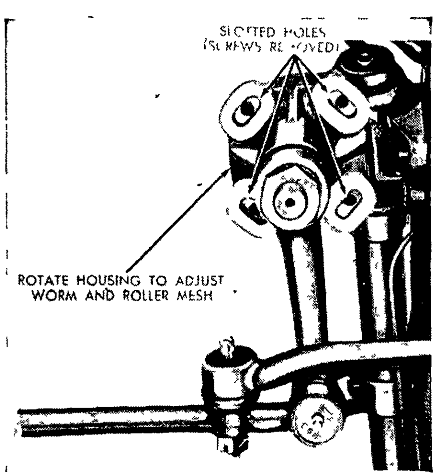


Fig. 4A W rm and r ller mesh adjustment n Gemm r (4)

GEMMER [4]

Fig. 4A—Worm end play and roller shaft end play is adjusted in the same manner as for *Gemmer (2)*.

However, to adjust the mesh of the worm and roller, see Fig. 4A and note that the housing attaching screw holes are slotted to provide for adjustment of the gear lash. Loosen the housing attaching screws and rotate the housing in the right-hand direction until all backlash is removed. Then tighten the screws.

LINCOLN

WORM & SINGLE TOOTH WORM END PLAY, ADJUST

Fig. 5. Remove the worm adjusting nut lock screw and the plug located at the top of the steering gear housing. Then, with a screwdriver or punch applied to the notches in the adjusting nut

(which can be seen through the holes from which the lock screw and plug are removed), turn the adjusting nut down (clockwise) until the endwise movement of the worm is corrected.

After making the adjustment, select one of the holes for locking the nut and insert the locking screw. NOTE: Sometimes after an ideal adjustment has been made, the notch in the adjusting nut will not register in the center of either locking screw hole. In which case, NEVER tighten the adjustment, but select a position which most nearly matches, and unscrew (turn counter-clockwise) the adjusting nut until the lock screw can be inserted.

ROLLER SHAFT END PLAY, ADJUST

To check for excess play between the roller and worm, set the steering wheel in its central position with the drag link disconnected. If play is felt by movement in the pitman arm, adjust as follows:

Remove the locking screw which is located at the inner end of the housing toward the engine. Without removing the lock plate, turn the adjusting screw clockwise until all end play is removed, and replace washer and screw, and tighten securely.

NOTE: If an ideal adjustment has been made and the hole in the locking plate does not register with the holes by which it is to be secured, NEVER turn the adjustment up tighter, but loosen it until the locking screw can be applied. The lock plate can be reversed on the adjusting screw to obtain a more ideal condition.

WORM & ROLLER MESH, ADJUST

This adjustment should be the last one attempted when making a complete adjustment of the steering gear. The roller shaft has its bearing in an eccentric steel bushing, and wear between the worm and roller may be taken up by turning this eccentric bushing so that it throws the roller into closer mesh with the worm.

Turn the front wheels to the straight-ahead position, and disconnect the drag link. Remove the eccentric bushing lock bolt which releases the lock. To take up for wear at this point, turn the lock plate clockwise. To determine proper adjustment, move the pitman arm to test for lash between the roller and worm. There should be no play felt in the pitman arm when properly adjusted, making sure the steering wheel has not shifted from the central position.

STEERING GEAR, OVERHAUL

The overhaul procedure for this gear is similar to that which is described for the Gemmer double roller type, and the same precautions should be taken when inspecting parts for scores, pit marks and excessive wear.

ROSS [1]

WITH INTEGRAL STUD

Fig. 6. When making adjustments, free the steering gear of all load, preferably by disconnecting the drag link from the steering arm. If the jacket tube is held in the adjusting plug by means of a clamp bolt, loosen the bolt. If there is no clamp bolt, the tube has a tight press fit in the plug and the instrument board bracket clamp must be loosened so that the tube will turn when the adjusting plug is turned.

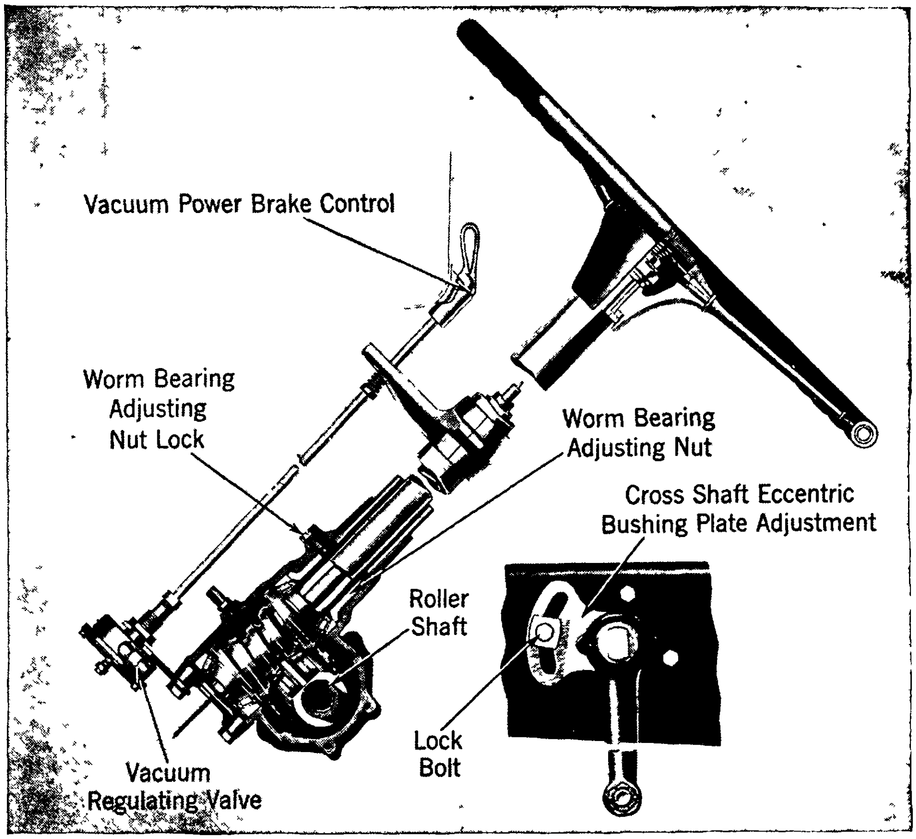


Fig. 5 Lincoln (Series K) steering gear

CAM END PLAY, ADJUST

This adjustment should always be made first before attempting any other. Loosen the housing side plate adjusting screw to free the stud in the cam groove. Back off the lock screw located at the top of the housing and turn down the adjusting plug until there is a barely perceptible drag so that the steering wheel can be turned freely with the thumb and forefinger lightly gripping the rim. Tighten the lock screw and nut.

LEVER SHAFT STUD BACKLASH, ADJUST

Backlash at this point shows up as end play of the lever shaft and also as backlash at the steering wheel and at the ball of the steering arm.

Note that the groove is purposely cut deeper in the ends of the cam than in the mid-position. This produces a high range through the mid-position and makes the groove narrower through this range. This permits take-up of backlash in the mid-position, where maximum wear occurs, without causing a bind in the ends.

The adjustment should always be made to the mid-position of the cam. Tighten the side cover adjusting screw until a very slight drag is felt through the mid-position high range, when turning the steering wheel slowly from one extreme to the other. It is important that the gear does not bind at any point. A closer adjustment than just a very slight drag will not correct any steering condition, but will damage and wear the parts and impair the operation of the gear.

When the proper adjustment has been made, tighten the lock nut and give the gear a final test. Make sure that the steering ball arm is tight on the splined shaft and that the lock-washer and nut are tight also.

ROSS [2]

Fig. 7. The adjustments for this gear are the same as in the Ross (1) except for the CAM END PLAY. To make this adjustment, proceed as follows:

Loosen the housing cover side plate adjusting screw to free the stud in the cam groove to relieve bearings of side thrust.

Unscrew the four clamp screws and move up the housing upper cover as far as possible (about ¼" to permit removal of shims. Separate the top shim with a knife blade. (.003" shims are on top. .003", .010" and .030" shims are used in between the paper gaskets.) Clip and remove a .003" shim, and re-assemble clamp screws and tighten securely.

There should be a barely perceptible drag so that the steering wheel can be turned freely, with the thumb and forefinger lightly gripping the rim, without

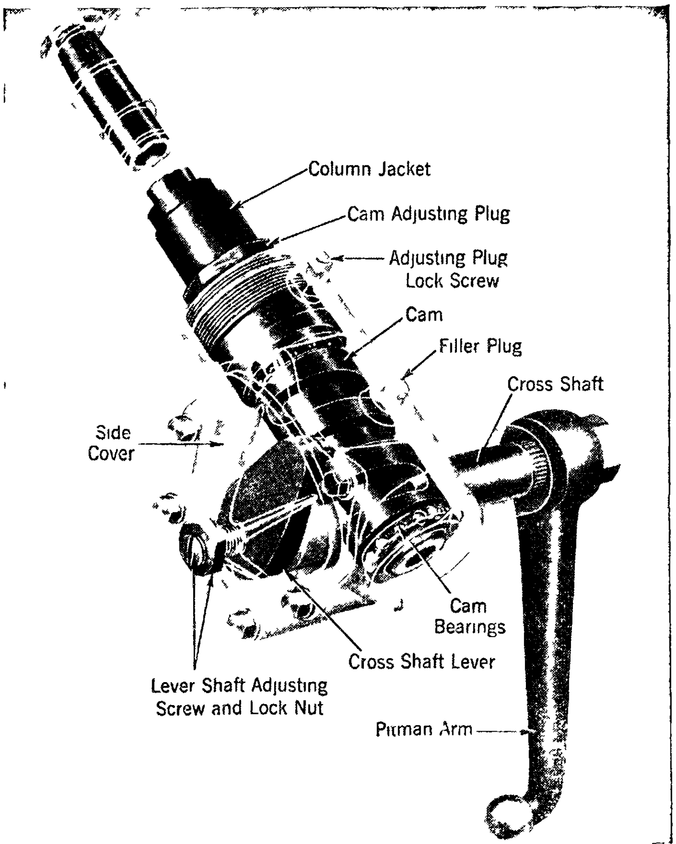


Fig. 6 R ss gear with integral stud and cam adjusting plug

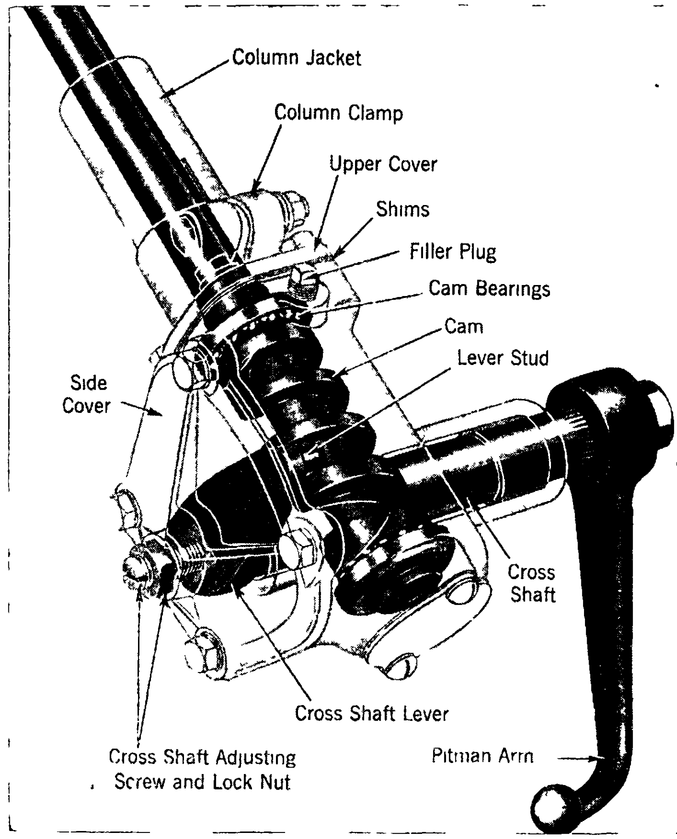


Fig. 7 Ross gear with integral stud and shim-adjusted cam

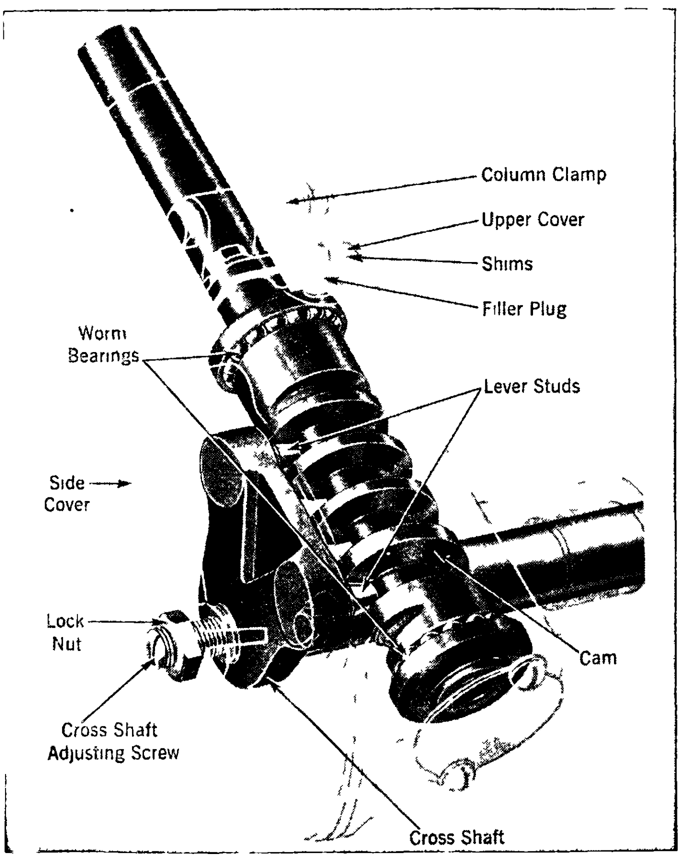


Fig. 8 R ss twin lever gear

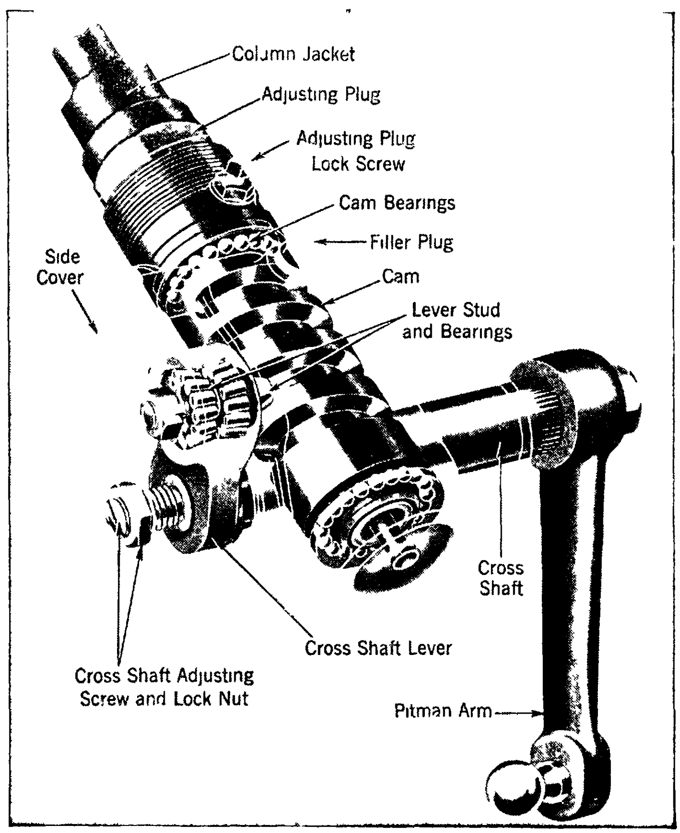


Fig. 9 Ross b aring m unted stud gear

any up and down movement of the column tube If this has not been accomplished, remove additional shims in the same manner until adjustment is correct.

ROSS [3]

TWIN LEVER TYPE CAM END PLAY

Fig 8 Loosen the housing side cover adjusting screw to free the pins in the cam groove Unscrew the four clamp screws and move up the housing upper cover as far as possible (about ¼') to permit removal of shims Combination of 003 , 010 and 030 shims are used in between paper gaskets Clip and remove a 003 shim or more as required Re-assemble clamp screws and tighten securely

There should be a barely perceptible drag so that the steering wheel can be turned freely, with the thumb and forefinger lightly gripping the rim without any up and down movement of the column tube If this result is not obtained, remove or replace shims until adjustment is correct

CAM & LEVER SHAFT PINS MESH, ADJUST

Note that the groove is purposely cut shallower in the straight-ahead driving position of each pin This produces a high range in the groove, which is equal at each pin, that causes closer mesh of the pins in the groove through the central position of travel of each pin This feature permits a close adjustment for normal straight-ahead driving and also permits take-up of backlash at this point after normal wear of the groove, without causing a bind elsewhere

Do not make the adjustment in the off 'straight-ahead positions Backlash at these points is not objectionable Tighten the side cover adjustment screw until a very slight drag is felt through the central position when turning the steering wheel slowly from one extreme to the other A closer adjustment other than a very slight drag at this central position will not correct any steering condition, but will damage and wear the parts and impair operation

When the proper adjustment has been made, tighten the lock nut and give the gear a final test Make sure the pitman arm is tight on the splined shaft and that the lockwasher and nut are tight also

ROSS [4]

ROLLER BEARING MOUNTED STUD TYPE

Fig 9 The adjustments for this gear are the same as described for the integral stud type In addition to the adjustments covered in that gear, the roller bearing stud unit should be adjusted as follows

Straighten out the prong of the locking washer and tighten the nut as required, while holding the stud to keep it from turning Use care to avoid damage to the bearing surface Tap each end of the stud to test the adjustment and if

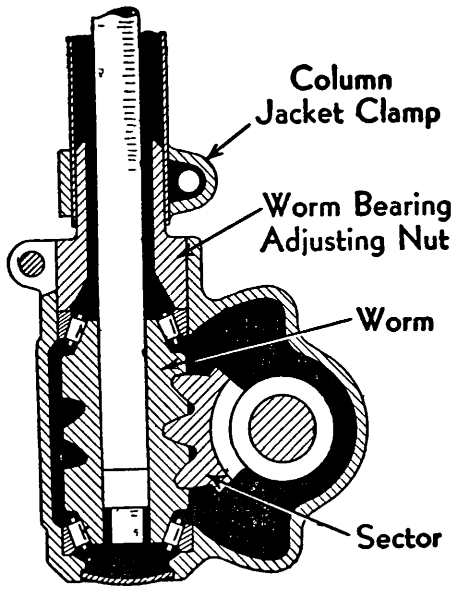


Fig. 10 Saginaw worm and sector gear

correct lock the adjustment by bending the prong of the locking washer against the side of the nut Make sure to use a prong of the washer that has not been bent at some previous adjustment Wash the bearings in gasoline and give a final test

ROSS GEAR, OVERHAUL ALL MODELS

Remove the adjusting plug lock screw at the top of the housing and the cross shaft adjusting screw Remove the housing side plate cover and withdraw the cross shaft Loosen the column clamp and remove the housing top cover For units equipped with a column adjusting plug, unscrew the plug On all units, remove the cam and tube assembly

Wash all parts and check the bearings for pits or score marks See that the cam and stud or pins, are not worn excessively Make sure that the column tube is not bent

When assembling, dip all wearing surfaces in gear lubricant and assemble in the reverse order and follow instructions for adjustments as described in the preceding paragraphs

SAGINAW [1]

WORM & SECTOR

Fig 10 There are three adjustments to this gear Worm shaft end play, sector shaft end play and backlash between the worm and sector These adjustments should be made in that order

WORM SHAFT END PLAY, ADJUST

Disconnect the drag link from the pitman arm and the horn wire from the mast jacket Loosen the nuts holding the mast jacket to the instrument panel and the steering gear housing clamp bolt Tighten the mast jacket clamp bolt as much as possible Rotate the mast jacket to the right as far as possible without stiffening the action of the steering wheel when turning through its entire range Do not attempt to turn the mast jacket to the left as it is impossible to turn the nut back If turned too far, it will be necessary to disassemble the entire steering gear

Tighten the housing clamp bolt and loosen the mast jacket clamp bolt Rotate the mast jacket until the horn wire is at the bottom and tighten the mast jacket clamp bolt Tighten the bolts at the instrument panel and connect the horn wire

Turn the steering wheel all the way in one direction Hook a spring scale on the steering wheel to see how many pounds it takes to move the wheel If the bearings are properly adjusted it will take from 1¾ to 2¼ pounds If the scale reads less than this, readjust the steering

SECTOR SHAFT END PLAY, ADJUST

Loosen the nut at the engine side of the steering gear and turn the adjusting screw clockwise until all end play is removed from the sector shaft Tighten the lock nut securely

WORM & SECTOR BACKLASH, ADJUST

Locate the steering wheel in the straight ahead driving position Move the pitman arm back and forth to determine the amount of backlash

Loosen the three cover stud nuts ¼ turn only Loosen the remaining nut ½ turn With one wrench on the eccentric bolt and another wrench on the eccentric sleeve, turn the two in opposite directions until all backlash is removed Tighten the nuts and recheck for back lash at the pitman arm Connect the drag link and check the backlash at the steering wheel In the straight ahead driving position, the wheel should have no backlash but should not be tight

When properly adjusted, the steering gear will be without backlash in the straight ahead position only and will have a few thousandths clearance when the wheel is turned

STEERING GEAR, OVERHAUL

After removing the assembly from the car, loosen the mast jacket clamp bolt and remove the mast jacket Remove the bolts holding the pitman arm shaft housing and remove this housing from the gear case Remove the sector shaft Remove the adjusting nut clamp screw and pry the slot apart with a screw driver and remove the worm adjusting nuts Remove the worm and tube Remove the roller bearings from the tube and the gear housing

If the mast jacket bushing is worn replace by driving the bushing from the mast jacket from the bottom end When installing a new bushing it is recommended that a special bushing driver be used as it seats the bushing in the proper place in the mast jacket

If the cross shaft housing bushings are worn, replace the new ones with the open end of the oil grooves toward the inside of the housing This housing is serviced with the bushings as an assembly, but if new bushings have been

installed in an old housing, they should be line reamed to insure proper alignment of the cross shaft.

Assemble in the reverse order and adjust the steering gear as already described.

SAGINAW [2]

Before making any adjustments on this gear, Fig. 12, disconnect the drag link from the pitman arm and tighten the pitman arm nut with an 18" wrench. Check the alignment of the mast jacket at the instrument panel in the following manner:

Make sure that the mast jacket clamp at the instrument panel is tight, then back off the frame mounting bolts until quite free. With a feeler gauge, check the clearance between the bracket and the frame side rail, Fig. 11. If this clearance exceeds .031", at either the front or rear of the housing bracket, install a shim (Part No. 476612) so that the gear assembly will be in correct alignment with the instrument panel. Be sure the frame mounting bolts are tight.

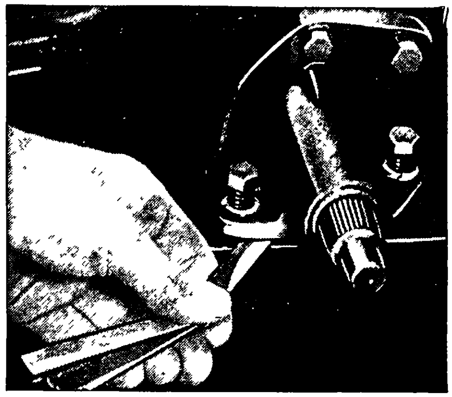


Fig. 11 Checking clearance between bracket and frame

WORM SHAFT END PLAY, ADJUST

Tighten the three machine screws holding the end cover to the housing. Loosen the adjusting screw lock nut at the bottom of the housing. With the steering gear close to one extreme position, tighten the adjusting screw at the bottom of the housing until a slight load is felt on the steering wheel when turning; then check in the other extreme position. NOTE: Use care when making this adjustment, so as to avoid backing out the adjusting screw too far, which may cause the worm bearings to get out of line. When the adjustment is made, tighten the lock nut.

Turn the gear to its extreme end position, just off the stop. Hook a spring scale to a spoke of the steering wheel at the rim. The load on the worm bearings should not exceed 1⅛ pounds.

SECTOR SHAFT END PLAY, ADJUST

Tighten the four machine screws which hold the side cover to the housing. Loosen the adjusting screw lock nut at the side of the housing, next to the engine and turn the adjusting screw to the right by hand until all end play is removed. Tighten the lock nut securely, being careful not to allow the adjusting screw to turn while tightening the nut. Do not tighten the adjusting screw with a wrench.

Turn the gear to each extreme, but not against the stops, and check to make sure that the adjustment has not caused binding in the sector shaft.

WORM & SECTOR BACKLASH, ADJUST

Center the steering gear, then move the pitman arm back and forth to determine the amount of lash between the worm and sector. Loosen the lash adjuster lock screw and with a soft hammer, tap lightly on the lash adjuster in the direction indicated by the arrow which is cut out of the adjuster. Do not move the adjuster more than 1/16" at a time.

Rotate the steering wheel to the right or left to see whether or not it passes through the center position freely. If it does not, it will be necessary to tap the adjuster back just enough to allow the wheel to be turned through the center position without binding. Tighten the lash adjuster lock screw securely.

When the steering gear is properly adjusted, the load required to turn the gear through the center position should be from 1¼ to 2½ pounds as measured by a spring scale hooked to one of the spokes of the steering wheel. The gear should be without backlash in the straight ahead position only. Check this by moving the pitman arm. There should be no fore and aft movement at this point.

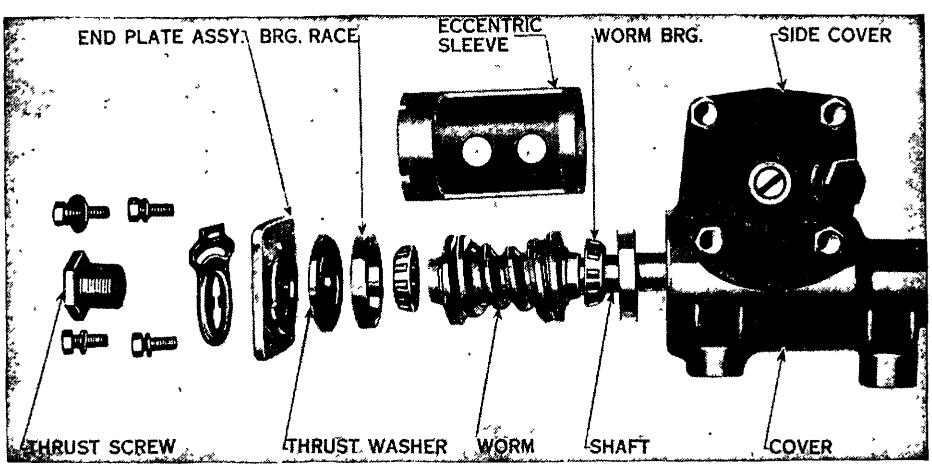


Fig. 12 Saginaw w rm and roll r gear

STEERING GEAR, OVERHAUL

After removing the gear assembly from the car, loosen the lock nut on the sector shaft end play adjustment screw. Remove the four machine screws from housing side cover and remove the cover and gasket. Now, remove the sector shaft, thrust washer and housing bushing.

Loosen the lock nut on the worm shaft end play adjustment screw. Remove the three machine screws and the lash adjuster lock screw from the end cover and remove the cover.

Tap the end of the worm shaft lightly with a soft hammer. Then remove the thrust washer, lower bearing race and bearing, worm and shaft, and the upper bearing.

The eccentric sleeve may now be removed from the housing with the fingers. Remove the upper bearing race from the eccentric sleeve. Remove the oil seal and retainer from the housing and wash all parts thoroughly with clean gasoline.

INSPECTION—Examine the worm and shaft for worn or damaged bearing surfaces. Check the fit of the sector shaft in the side cover bushing. If this bushing is worn, the side cover with the bushing will have to be replaced. Check the fit of the sector shaft floating bushing on the shaft and in the housing. Examine the worm and inner bearing cones for wear or damage, and also all bearings and races.

NOTE—The thick side of the eccentric sleeve should be toward the sector shaft, to provide worm and sector clearance when assembling. Make sure that the upper worm bearing seats properly in its race when installing the worm and shaft.

When installing the worm thrust washer, be sure to place the concaved side toward the worm. Make sure the lugs of the adjuster plate engage the notches of the eccentric sleeve.

Make the adjustments as described in the preceding paragraphs and install the assembly in the car.

SAGINAW [3]

WORM & ROLLER

Fig. 13. Before making the adjustment, loosen the frame mounting bolts ¾ turn and loosen the steering column bracket at the instrument panel.

WORM END PLAY, ADJUST

Loosen the gear housing clamp bolt. See that the column jacket clamp bolt is pulled up tightly. Grip the column jacket clamp with a wrench and rotate the column jacket clockwise until a slight load is felt on the steering wheel with the gear near its extreme position. The column jacket must be turned clock-

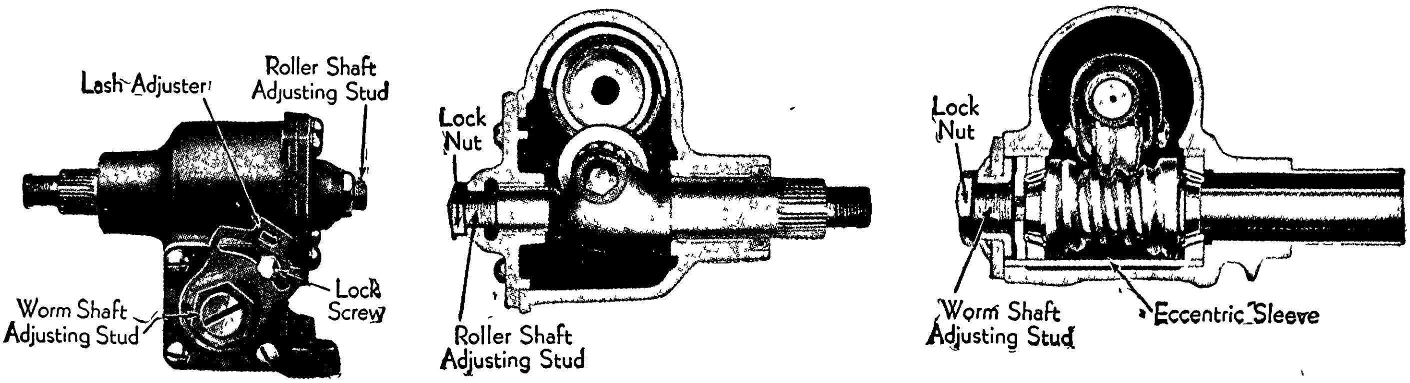


Fig. 13 Adjusting points of Saginaw worm and roller gear

wise only, as the bearing adjusting nut must be in positive contact with the bearing when the adjustment is completed.

Tighten the housing clamp bolt and loosen the column jacket clamp bolt. Rotate the column jacket to the left until the horn wire is at the bottom. Tighten the column jacket clamp bolt.

When the adjustment is completed, the load on the worm bearings should not exceed 1¼ pounds when measured at the rim of the steering wheel with a spring scale. The check should be made with the gear turned to its extreme positions, but just off its stops.

CROSS SHAFT END PLAY, ADJUST

Turn the steering wheel to its extreme left position and loosen the cross shaft adjusting screw lock nut. Turn the cross shaft adjusting screw clockwise, just enough to remove the end play and tighten the nut.

Turn the gear to each extreme position, but just off its stop, and move the pitman arm to see that the adjustment has not caused excessive binding in the cross shaft.

WORM & ROLLER BACKLASH, ADJUST

Center the steering gear so that the steering wheel is in the straight ahead position, with approximately the same number of wheel turns to the right and left of this position.

Loosen the frame mounting bolts ¼ turn and loosen the eccentric lock nut ½ turn. With one wrench on the eccentric bolt and another on the eccentric sleeve, turn the eccentric bolt clockwise, and at the same time, turn the eccentric sleeve counter-clockwise very gradually. Check the result by moving the pitman arm after each movement, and use care at the final stages to turn both just enough to remove the backlash, and have a slight load when turning the steering wheel through its center position. A tighter adjustment will cause damage to the gear. In most cases, ⅛ turn of the eccentric bolt and the eccentric sleeve is sufficient.

Rotate the steering wheel to the right and left to see if there are any tight spots. If so, it will be necessary to loosen the eccentric adjustment only enough to allow the steering wheel to be turned through these spots without excessive binding.

Tighten the frame mounting bolts and the eccentric bolt nut. With the gear properly adjusted, the load required to turn the gear through its center position should not exceed 2¼ pounds, measured with a spring scale at the rim of the steering wheel.

Check the backlash with the gear in its straight ahead position by feeling the pitman arm. There should be no movement of the pitman arm in the straight ahead position, unless tight spots are encountered.

STEERING GEAR, OVERHAUL

The overhaul procedure for this gear is similar to that which is described for the Saginaw (1) and the same precautions should be observed when inspecting parts.

SAGINAW [4]

The adjustments and repairs are the same as described for the Saginaw (3), except for the manner in which the worm end play is removed.

To remove the worm end play, loosen the housing clamp bolt. Rotate the column adjusting nut clockwise until a slight load is felt at the steering wheel when turning it close to its extreme positions.

When making this adjustment, use care, for the adjusting nut should only be turned clockwise, so that it will be in positive contact with the bearing race when the adjustment is complete. Tighten the housing clamp bolt.

SAGINAW [5]

The adjustments and repairs are the same as for the Saginaw (4) models already mentioned except that the adjustment for worm end play is at the bottom of the steering gear housing.

To make the adjustment, it is necessary to loosen the lower clamp and turn the plug.

Backlash between the worm and roller is adjusted by turning the eccentric sleeve, which is carried out of the top of the housing as a hexagon nut.

SAGINAW [6]

Turn the steering gear as far as it will go in both directions. The gear should be free except for a possible 1¾ pound load at the center position. If stiffness occurs and is not due to the roller shaft adjustment, or the worm adjustment being too tight, loosen all bolts holding the steering gear in the frame bracket. If this overcomes the binding, it will be necessary to shim the frame bracket when the mounting bolts are tightened.

WORM SHAFT END PLAY, ADJUST

Loosen the worm adjusting stud lock nut and tighten the stud until a slight load is felt on the steering wheel when the gear reaches its extreme positions. Use care when making this adjustment to see that the stud is not backed out enough to permit the bearings to get out of line. The load on the worm bearings should not exceed one pound, measured at the rim of the wheel with a spring scale. This check should be made with the gear turned to the extreme ends, just free of the stops.

ROLLER SHAFT END PLAY, ADJUST

Tighten the four screws which hold the side cover to the housing. Loosen the roller shaft adjusting stud lock nut and turn the stud down by hand, and back it off 5 to 15 degrees. Tighten the lock nut securely.

Turn the gear to each extreme, but not against its stop, and check by moving the pitman arm to see that the adjustment has not caused binding in the roller shaft.

WORM & ROLLER BACKLASH, ADJUST

Tighen the screws which hold the cover to the housing. Center the steering gear and, when in this position, move the pitman arm back and forth to determine the amount of lash between the worm and the roller. Loosen the lash adjuster lock screw. Tap the lash adjuster lightly with a soft hammer to turn it in the direction of the arrow. The adjuster should not be moved more than $\frac{7}{16}$" at a time with relation to its clamp screw.

Rotate the steering wheel to the right

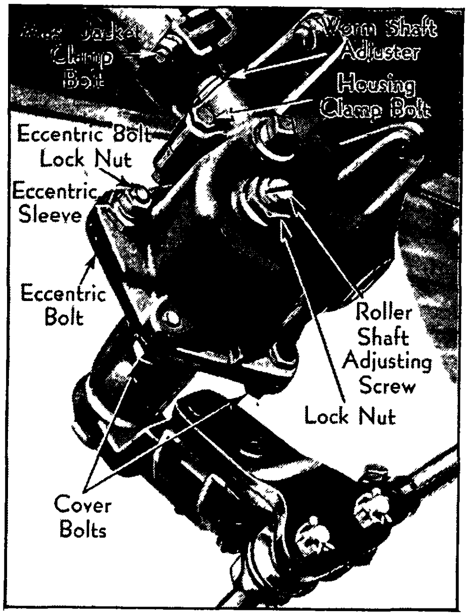


Fig. 13A Steering gear adjustment points. Chevr l t 1939-48 with knee action

and left to see if there are any tight spots. If so, it will be necessary to tap the adjuster back just enough to allow the wheel to be turned through these spots without excessive binding. Tighten the lock screw and the load required to turn the wheel through its center position should not exceed 1¾ to 2 pounds as measured with a spring scale hooked to the rim of the steering wheel.

STEERING GEAR, OVERHAUL

The repairs for this gear are similar to that which are already described for the Saginaw (1), and the same precautions should be observed when inspecting parts.

SAGINAW [7]

Adjustments and repairs for this gear are made exactly the same as described for Saginaw (1), except that when adjusting the worm end play, it is possible to turn the mast jacket clamp nut in either direction which eliminates the necessity of disassembling the steering gear if the nut is turned too far.

SAGINAW [8]

All steering gear-to-frame mounting bolts should be tightened and the pitman arm removed before any adjustments are made. Make adjustments in the order given below and refer to Fig. 13A for adjustment points.

WORM SHAFT END PLAY—To remove worm shaft end play, proceed as follows:

1. Loosen mast jacket clamp bolt at housing.

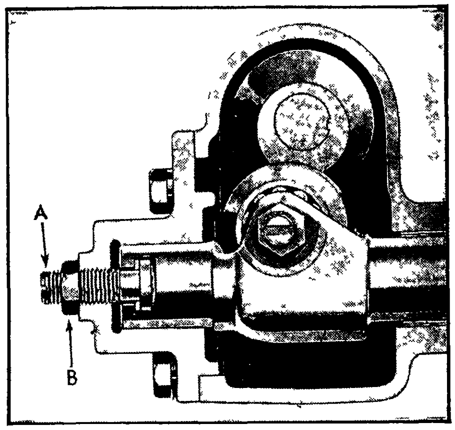


Fig. 13B Chevrolet 1949-52. Roller Shaft adjusting screw (A) and lock nut (B)

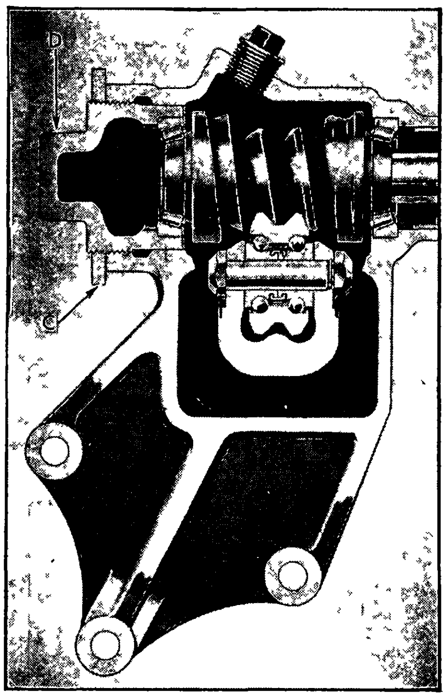


Fig. 13C Chevrolet 1949-52. Worm bearing adjusting cup (D) and lock nut (C)

2. Loosen housing clamp bolt to relieve tension on threads of adjuster.

3. Check to make certain that there is backlash between worm and roller.

4. With a suitable wrench, turn worm shaft adjuster clockwise, checking load on worm shaft bearings with a steering gear checking scale hooked at right angles to a spoke on the steering wheel as you proceed; the proper load for this adjustment is ½ pound.

5. Tighten housing clamp bolt.

6. Tighten mast jacket clamp bolt at housing.

ROLLER SHAFT END PLAY—

1. Loosen roller shaft adjusting screw lock nut.

2. Turn adjusting screw down tight and then back it off until free. Then turn adjusting screw until it lightly contacts end of roller shaft.

3. Hold adjusting screw in this position with a screwdriver and tighten lock nut securely.

BACKLASH BETWEEN WORM & ROLLER—

1. Locate steering wheel in its straight-ahead position.

2. Move roller shaft back and forth to determine amount of backlash between worm and roller.

3. Loosen three cover-to-housing bolts ¼ turn, and eccentric bolt lock nut ½ turn.

4. With one wrench on eccentric bolt and another on eccentric sleeve, turn in opposite directions by gradual stages, noting result by moving roller shaft at each stage. Care should be taken during the final stage to make certain the eccentric bolt and sleeve are turned just enough to remove all backlash, **but no more.** If eccentric bolt and sleeve are turned more than necessary, damage to the steering gear will result. In most cases, ⅛ of a turn of the eccentric bolt and sleeve should be sufficient.

5. Tighten the eccentric bolt lock nut while holding the bolt from turning. Tighten the four housing bolts and, with the steering gear in the straight-ahead position, recheck the backlash in the roller shaft. In the straight-ahead position, the steering gear should have no backlash but should be perfectly free. Hook the spring scale at right angles to a spoke of the steering wheel at the rim. The load required to pull the gear through the center position should not exceed 1⅜ pounds.

6. Reassemble the pitman arm in the proper position of the roller shaft. Replace the lock-washer and nut, turn the wheels to the extreme left position and tighten the pitman arm nut with an 18" wrench.

SAGINAW [9]

There are only two adjustments to be made on this type gear but the following procedure must be followed step-by-step in the order given.

1. Disconnect steering connecting rod from pitman arm, taking care to note relative positions of steering connecting rod parts before disturbing them.

2. Remove sheet metal splash guard covering steering gear housing.

3. Loosen lock nut, Fig. 13B, and turn adjuster a few turns in a counter-clockwise direction. This removes from the worm bearings the load imposed by close meshing of worm and roller teeth. Turn steering wheel gently in one direction until stopped by gear, then back away about one turn.

4. Using a steering gear checking scale, measure the pull at the rim of the wheel which is required to keep the wheel in motion. This should be between ⅜ and ⅝ pounds. When making this check, it is important that the line of the spring scale be kept tangent to the rim of the wheel. If the pull necessary to move the wheel does not lie between the limits given above, adjustment of the worm bearings is necessary.

5. To adjust worm bearings, loosen lock nut, Fig. 13C, and turn the adjusting cup until there is no perceptible end play in the worm. Check pull at wheel rim as outlined above, readjusting if necessary.

6. After proper adjustment of worm is obtained, and all mounting bolts tightened, adjust the cross shaft, Fig. 13B. First place the steering wheel in its exact center (straight-ahead) position. Remove the steering wheel ornamental cap or horn button and note the position of the mark on the end of the steering shaft. This mark should be at the top of the shaft.

7. Mark the wheel at top or bottom center with tape and turn the cross shaft adjusting screw clockwise to take out all lash and tighten lock nut.

8. Turn steering wheel off the high spot and check the pull at the wheel rim with checking scale as before, taking the highest reading as the wheel is turned through its center position. This should be between ⅞ and 1⅞ pounds.

9. If the reading is not within the above limits, turn the wheel a half turn off the high spot and either tighten or loosen the adjuster as necessary. Recheck the adjustment with the scale; the final adjustment should be between ⅞ and 1⅞ pounds.

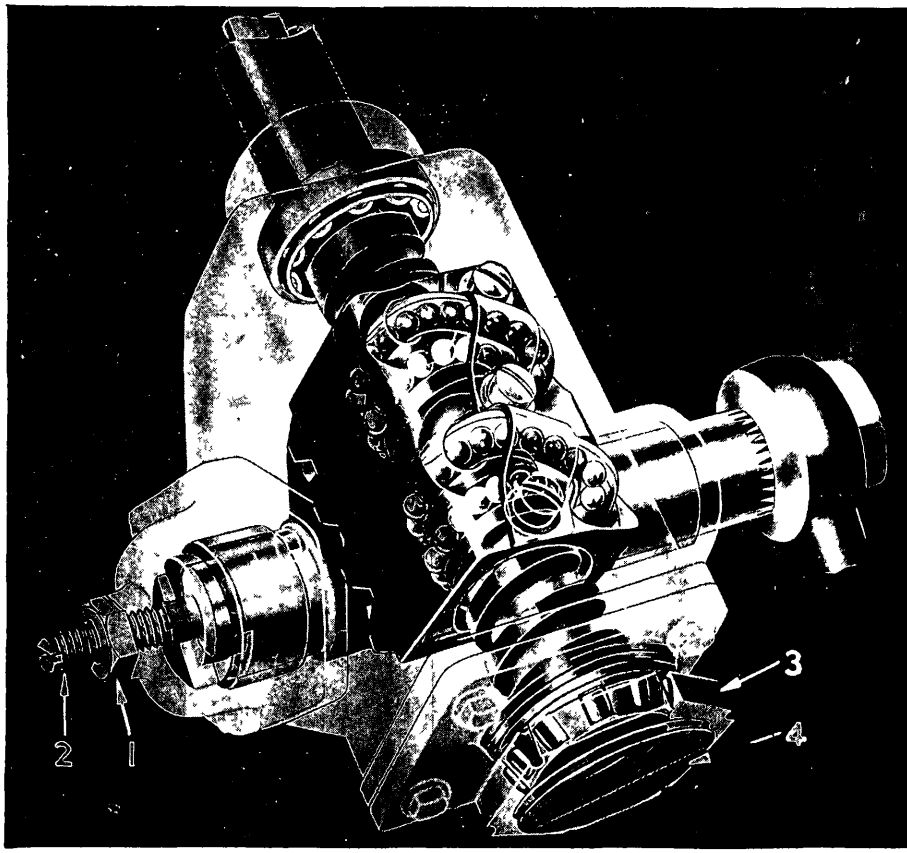


Fig. 14 Phantom view of Saginaw recirculating ball and nut g ar

SAGINAW [10]

RECIRCULATING BALL & NUT

Figs. 14 and 15. Rotation of the worm causes the nut to rise or fall and the balls provide an almost friction-less rolling contact.

When the steering gear is turned to the left, the worm turns in the same direction and moves the nut downward. The balls, meanwhile, roll between the worm and the nut, working their way up the steering shaft. As they reach the top of the nut, they enter one of the two return chambers through which they are directed downward, to be reintroduced to a lower point. When a right turn is made, the nut moves upward and the balls circulate in the reverse direction.

To overhaul the gear, proceed as follows:

After the gear has been removed from the car, loosen the lock nut on the end of the cross shaft and back off the lash adjuster a few turns to remove the load from the bearings. Loosen the lock nut on the worm bearing thrust screw and turn this screw out a few turns.

After removing the nuts, pull the side cover and cross shaft from the housing. If the sector does not clear the opening in the housing easily, turn the worm shaft by hand until it does.

Remove the worm and cover and draw the worm shaft and nut assembly from the housing. Lay this assembly flat on the work bench and wrap a piece of friction tape around each end of the worm so that the nut will not thread off either end. If the nut is allowed to rotate until it is stopped by either end of the worm, the ends of the ball guides are likely to become damaged.

If the nut assembly is perfectly free without any indication of tightness, it need not be disassembled. However, if there is such an indication, remove the ball guide clamps and draw the guides out of the nut. Then, while holding it over a clean pan, turn the nut upside down and rotate the worm shaft back and forth until all the balls have dropped out of the nut into the pan. With the balls removed, pull the nut endwise off the worm.

INSPECTION — After all parts have been cleaned and dried, use a magnifying glass, if available, to inspect the roller bearing cones, worm and nut grooves, and the surfaces of all balls for any indication of damage. Inspect the sector teeth and the mating teeth of the worm nut for chipping, wear, score marks or nicks. Inspect the fit of the pilot on the end of the cross shaft in its bushing in the side cover. If this bushing is worn, a new side cover and bushing assembly should be installed, as it is not practical to replace this bushing due to the special tools required. Check the ball guides for any damage at the ends where they deflect or pick the balls from their helical path. Damaged guides should be replaced.

ASSEMBLE — With the worm shaft placed flat on the bench, slip the nut over the worm with the ball guide holes facing upward, Fig. 16. Align the grooves in the worm and nut by sighting through the bottom of the ball guide holes.

Count out exactly half the total number of balls and place in a suitable container—which is the proper number of balls for one circuit. Drop the counted balls into one of the guide holes while turning the worm gradually away from that guide hole. Continue until the ball circuit is full from the bottom of one guide hole to the bottom of the other, or until stopped by reaching the end of the worm. NOTE—In cases where the balls are stopped by the end of the worm, hold down those balls already dropped into the nut with a clean rod or punch, Fig. 16, and turn the worm in the reverse direction a few turns. The filling of the circuit can then be continued. It may be necessary to work the worm back and forth, holding the balls down first in one hole and then the other, to close up the spaces between the balls and fill the circuit completely and solidly.

Lay one half of a ball guide on the bench with the groove side up, Fig. 17, and place in it the remaining balls from the counted container — which should just fill the guide. Close this half of the guide with the other half. Hold the two halves together and plug each open end with clear vaseline or heavy grease to prevent the balls from dropping out. Push the guide into the guide holes of the nut. If the guide does not push into the holes easily, tap it lightly with a hammer handle.

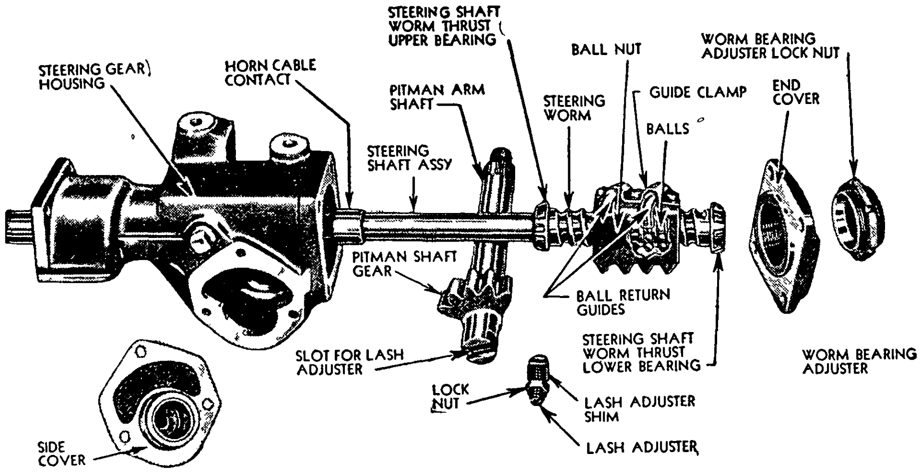


Fig. 15 Details of Saginaw recirculating ball and nut gear

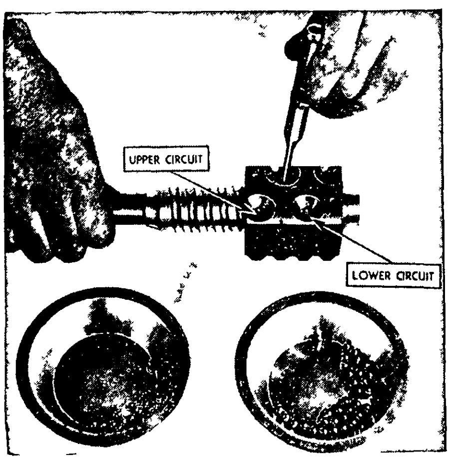


Fig. 16 Method of filling circuits in ball nut

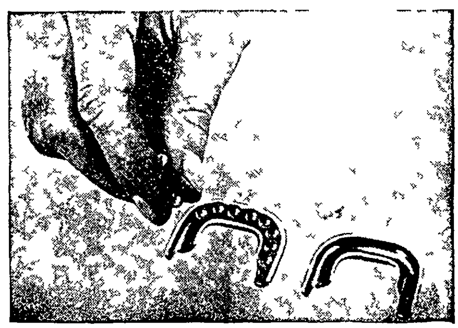


Fig. 17 Filling ball guides

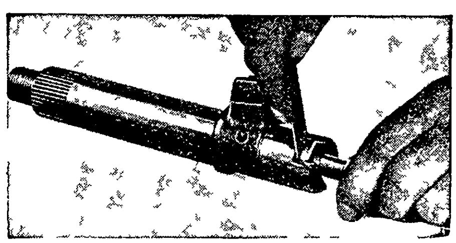


Fig. 18 Checking lash adjuster clearance

This completes the assembly of one ball circuit Fill the second ball circuit in the same manner and assemble the ball guide clamp to the nut, being sure to use lock washers under the clamp screws

Check the assembly for freedom of operation by rotating the nut on the worm If there is any indication of binding or "stickiness," some slight damage to the end of the ball guides may have been overlooked

Lay the worm shaft and nut assembly flat on the bench Place the upper worm bearing over the worm shaft and thread the worm shaft into the gear housing Install the lower bearing on the worm and assemble the end cover to the housing, being sure the worm bearing thrust screw is backed far enough out of the cover to permit the cover to be tightened securely

Assemble the lash adjuster and shim in the slot in the end of the cross shaft and check the end clearance as shown in Fig 18 This clearance should not exceed 002′, and for this purpose, shims of varying thicknesses are available

After the lash adjuster end clearance has been corrected, start the lash adjuster end of the cross shaft into the side cover. Then, using a screwdriver through the hole in the cover, turn the lash adjuster to the left (counter-clockwise) to pull the cross shaft pilot into its bushing as far as it will go

Rotate the worm shaft by hand until the ball nut is about in the center of its travel This is to make sure the rack and sector will engage properly—with the center tooth of the sector entering the center tooth space of the nut

Push the side cover and cross shaft assembly into place, but before tightening the cover, make sure the lash adjuster is backed out enough so that it will not bear against the cross shaft when the cover is being tightened

ADJUSTMENTS — There are only two adjustments on this type gear Namely, worm bearing end play, and cross shaft end play The worm bearing adjustment is correct when there is no end play and there is a pull of about one pound at the rim of the steering wheel

The cross shaft adjustment is correct when there is no end play and there is a steering wheel rim pull of about two pounds

To eliminate end play in either case turn the thrust screw to the right (clockwise) When tightening the lock nuts, be sure the adjustment is not altered

PACKARD

Fig 19 There are the only two adjustments for this type gear 1—Worm end play 2—Roller mesh Before making the adjustments, check the alignment of the steering column If, after loosening and tightening the frame bracket bolts and the instrument panel bracket, it appears that the column is strained, it will be necessary to shim the bracket or elongate the mounting holes or both, if necessary, and retighten.

WORM END PLAY, ADJUST

Turn the steering wheel to either extreme and then back ⅛ turn Loosen the worm cover screws at the base of the housing and remove one thin gasket, being careful not to mutilate the others Tighten the cover screws and check The pull at the rim of the steering wheel should be from 1½ to 2 pounds

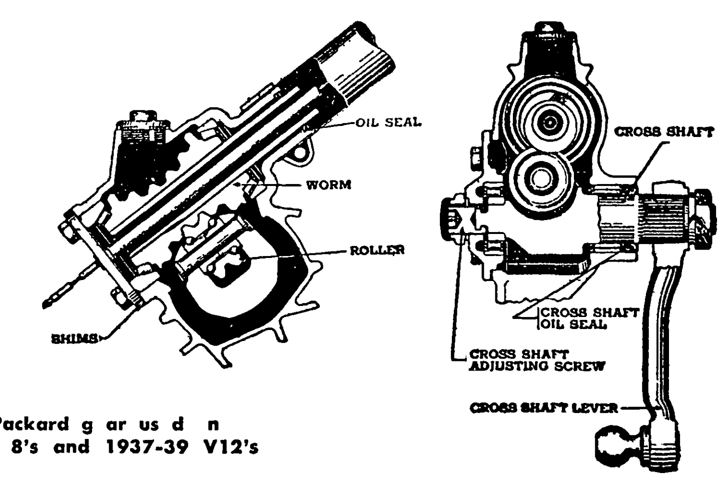


Fig. 19 Packard g ar us d n 1937-38 Super 8's and 1937-39 V12's

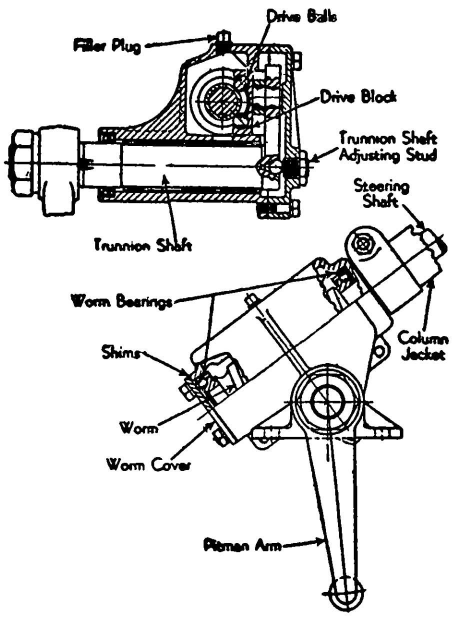


Fig. 20 Lavine steering gear

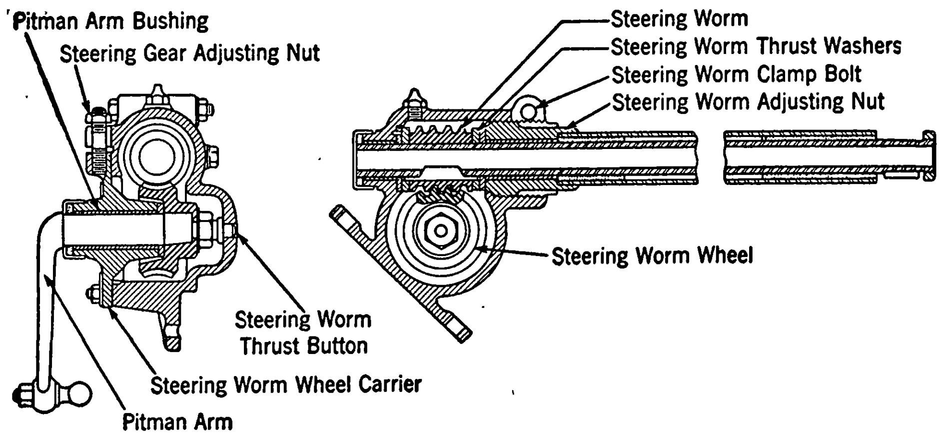


Fig. 21 Saylor worm and gear type

ROLLER MESH, ADJUST

Turn the steering wheel to its exact center position. If the intermediate steering arm is not now on the lengthwise center line of the car, turn the adjustable drag link ends until it is properly centered.

Loosen the capped lock nut on the adjusting screw enough to allow the special lockwasher to be disengaged from the housing boss. Using a screwdriver, tap the lockwasher (which will turn the adjusting screw plug) in a clockwise direction until a pull of from 3½ to 4 pounds at the rim of the steering wheel is required to move the wheel through the steering gear high spot, with the drag link disconnected. Reengage the lock washer without changing the position of the adjusting screw plug, then tighten the cap nut.

LAVINE

Fig. 20. This gear has two adjustments: 1—Drive block adjustment for eliminating steering wheel play. 2—Worm bearing adjustment for eliminating worm shaft end play. Proceed with the adjustment as follows:

DRIVE BLOCK, ADJUST

Disconnect the drag link from the pitman arm. Loosen the lock nut from the adjustment screw at the engine side of the gear housing. Turn the adjusting screw to the right sufficiently until all excess steering wheel play has been removed. Rotate the steering wheel to the right and left extremes to see that the operation is sufficiently free at all points. If not, it will be necessary to loosen the adjustment slightly. Tighten the lock nut and make sure that the adjusting screw has not been moved after the lock nut is secured.

WORM SHAFT END PLAY, ADJUST

With the drag link disconnected, grasp the steering wheel rim firmly, and raise it up and down. If end play is felt, remove the four cover screws from the bottom of the gear housing. Remove sufficient shims to eliminate the end play and replace the cover. After the cover has been tightened in position, rotate the gear to the right and left extremes to see that no drag exists on the worm shaft bearings.

When properly adjusted, the gear should be without backlash in the straight ahead position, and should have free movement over the complete travel of its range.

SAYLOR

WORM & GEAR

Fig. 21. There are two adjustments for this gear. 1—End play in the steering column. 2—End play of the cross shaft. Proceed to adjust as follows:

STEERING COLUMN, ADJUST

Loosen the column locking set screw and the steering worm clamp bolt. Turn the adjusting sleeve until the end play is removed, but not so tight as to cause any stiffness in the gear when turned throughout its complete range of travel. Tighten the clamp bolt and the lock screw securely.

CROSS SHAFT END PLAY, ADJUST

Loosen the three nuts holding the steering worm wheel carrier to the worm housing. Turn the adjusting nut so as to draw the cover and wheel slightly toward the worm. Try to adjust the teeth so that there will be about ⅜" play at the rim of the worm wheel. If the play is less than ⅜", the steering gear will bind. Tighten the nuts on the worm wheel carrier and test the gear to see that there is no bind when turned throughout its range.

WHEEL ALIGNMENT

FRONT wheel alignment is the mechanics of keeping all inter-related parts affecting steering in proper adjustment. Correct alignment is essential to keep the front wheels in their true running position for easy and efficient steering and the prevention of abnormal tire wear.

The elements involved in front wheel alignment are caster, camber with the inclination of the steering knuckle kingpins, toe-in and toe-out on turns. These elements are all related and dependent upon each other. In addition to these elements, there are several other factors that affect the alignment of the wheels, namely: tire inflation, wheel wobble, wheel and tire balance, straightness of wheel suspension parts and the frame, adjustment of the wheel and steering knuckle bearings, the steering gear and connections, adjustment and proper lubrication of the shock absorbers.

No set rule can be given for the sequence of operations in checking and correcting front wheel alignment. Neither can the exact cause of any form of misalignment be given, as much depends upon the age of the car, and consequently, the condition of the parts. The factors affecting alignment and the elements of alignment should, however, be checked in the following order as closely as possible.

FACTORS AFFECTING ALIGNMENT

1—Tire inflation: Checking and inflating the tires to the proper pressure is

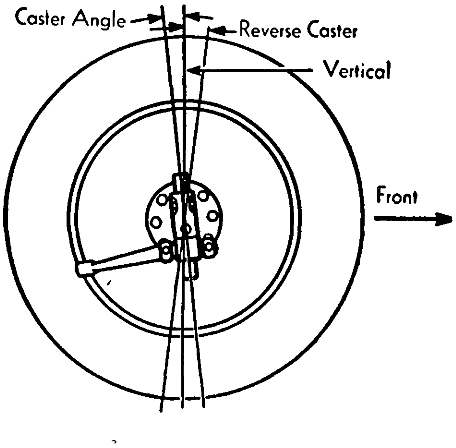


Fig. 1 Fr nt wheel caster

the very first operation of any wheel alignment job. 2—Running of wheels such as out of true, out of balance and not tracking. 3—Adjustment of front wheel bearings. 4—Condition of shock absorbers. 5—Adjustment of steering gear and connections.

ELEMENTS OF ALIGNMENT

After checking and adjusting the factors referred to in the preceding paragraph, continue with the elements of alignment in the following order:

1—Caster angle of the steering knuckle support. 2—Camber angle and kingpin inclination. 3—Toe-in of front wheels in straight-ahead position. 4—Toe-out of front wheels on turns.

NOTE—All alignment checks should be made with the weight of the car on the wheels.

TIRE PRESSURE

One of the most important factors in the maintenance of good steering and in the prevention of excessive tire wear is proper inflation of the tires. Low tire pressure not only causes hard steering and undue tire wear, but it also aggravates any tendency of the front wheels to shimmy or tramp. The use of tires of different make, design or size, may also contribute to wheel misalignment.

When a tire is soft or under-inflated, a broad surface is formed at the bottom where it contacts with the ground, which results in excessive tire friction and hard steering. A condition of slight misalignment is also caused by under-inflation which tends to result in erratic performance of the wheels, and consequently the steering system.

WHEEL WOBBLE

Wheel wobble must be corrected or eliminated as much as possible before checking the elements of alignment. Any remaining wobble or high spot on the tire should be marked with chalk, to aid in locating the wheels in the proper position when checking the alignment angles.

Excessive wobble will cause spotty tire wear and prevent correct alignment of the axle assembly.

WHEEL ECCENTRICITY

The wheels and tires should also run as nearly concentric as possible with the steering knuckle spindle. Aside from causing unnecessary tire wear, eccentricity in wheels and tires also tends to set up a vertical movement in them which is closely associated with shimmy and tramp.

WHEEL & TIRE BALANCE

Proper balance of the front wheels, tires and brake drums, is another essential factor in the maintenance of good steering. Each wheel assembly should be properly balanced in order to avoid the possibility of tramp or high-speed shimmy. Tire balance also affects tire wear. Likewise, the rear wheels should be balanced, as an unbalanced condition will set up vibrations which will affect the performance of the front wheel suspension system, as well as the riding quality of the car.

TRACKING OF WHEELS

Another essential factor in the maintenance of good steering and in the prevention of excessive tire wear is the tracking of the rear wheels with the front ones. Failure of the wheels to track is usually quite obvious when following the car on the highway.

It is very important to check the position of the rear axle on the springs, and to make sure that the spring center bolts are not sheared, as these bolts serve to keep the axle in place. If the wheels do not track, and the axle is straight and in the proper position, the wrong type of spring may be in use, the spring eye may be partly straightened out, or the frame may be bent.

WHEEL BEARINGS

Correct adjustment of the front wheel bearings is essential for the proper performance of the front wheel suspension system, and consequently, efficient steering. Adjust the bearings as advised by the car manufacturer.

SHOCK ABSORBERS

Good steering is more or less dependent on the proper performance of the shock absorbers. Front wheel shimmy and wheel tramp are often traceable to shock absorbers that are incorrectly or unevenly adjusted, improperly lubricated or inoperative. It is important that the shock absorbers be checked and properly serviced when found to be out of order. They should also be checked for equal performance and proper lubrication.

STEERING GEAR & CONNECTIONS

Another important factor in maintaining good steering is the proper adjustment and lubrication of the steering gear and connections. An incorrectly adjusted steering system may cause any of the steering complaints, even though the front wheels are in correct alignment.

Before any attempt is made to adjust the steering gear, the steering connections should be checked and readjusted,

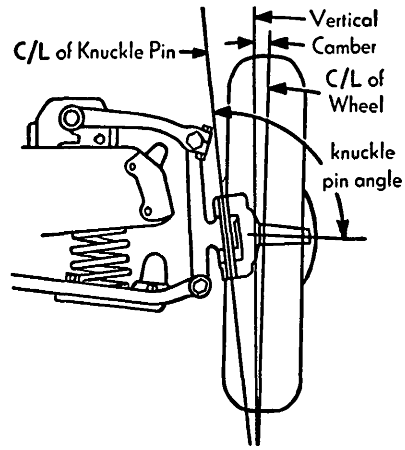


Fig. 2 Front whe l camber

or new parts installed if necessary. Binding or excessive looseness in the connections should be tested for by raising the front wheels off the floor and moving the connections by hand.

Correct lubrication of the steering system is also necessary to good steering. The recommendations of the car manufacturer should be followed.

CASTER ANGLE

Fig. 1. Caster is the angle of the backward inclination between the steering knuckle kingpin and the vertical plane. The caster angle is obtained by tilting the top of the steering knuckle support back, and is established by the design of the front wheel suspension system.

Only a slight amount of caster is necessary to stabilize steering. Excessive caster causes hard steering due, among other factors, to the increasing tendency of the front wheels to toe-in. Too much caster is also undesirable, as the weight of the car then has a tendency to turn the wheels in, at the front, around their respective kingpins, resulting in wheel shimmy.

Insufficient caster results in car wander, which makes it difficult to keep a car traveling ahead in a straight course. Reverse caster results in erratic steering. A car under this condition will tend to go from one side of the road to the other, will turn curves easily but will be difficult to straighten out at the end of the curve.

Before checking the caster angle, it is important to remove all extras, such as shimmying dampening devices, etc., from the front wheel suspension system. The car is then lowered to bring all the weight of the car on the wheels, after which, it should be moved back and forth a full turn of the wheels to relieve the tire tension.

The caster angle should come within the limits specified by the car manufacturer. Equal caster, or the same within ½ degree, on both sides of the car is extremely important. Unbalanced caster will cause a car to pull to one side, usu-

ally toward the side with the least amount of caster, causing undue tire wear, hard steering and wheel shimmy.

The caster adjustment on cars utilizing the independent front wheel suspension should be accomplished according to the instructions as given by the car manufacturer, which can be found under their respective chapters.

For cars using the leaf type front spring suspension, caster is given to the front end by means of its mounting to the front springs, except on cars using a transverse front spring, in which case it is controlled by radius rods. Usually the spring seat on the front axle is machined to a 90 degree angle with the kingpin, but on some cars the spring seat slopes. In either case, however, it is bolted to the spring to give the proper when the curvature of the front spring changes, the axle caster will also change. Front wheel brakes may also change the caster, for when they are applied, they tend to roll the axle forward. Should the spring clips be loose, this action can actually take place.

If the spring has permanently changed its contour, or the angle is twisted, the caster will be wrong. If it is out only one or two degrees, the insertion of tapered shims between the spring seat on the axle and the spring, will form a new seat for the spring, and restore the caster angle. Changing the caster alters the camber and toe-in, and therefore must be the first adjustment.

CAMBER & KINGPIN INCLINATION

Fig. 2. Camber is the outward tilt of the front wheels at the top and results in the bottom of the wheels coming more nearly under the load. The purpose of camber is to support the greater part of the car weight on the inner wheel bearings, to reduce side thrust on the kingpins, to compensate for looseness and wear in the steering knuckle and wheel bearings, and to bring the point of pivot near the center of the tire tread in contact with the road for center point steering.

The many advantages of camber, however, are partially offset by the undesirable effect it has on the tire contact with the road. With cambered wheels, the outer edge of the tread rolls on a smaller circumference than the inner edge, and this condition increases with an increase in camber, or a decrease in the tire inflation pressure. Since the wheel moves straight ahead, a portion of the tire must slip under this condition, causing excessive wear. This is one of the many reasons why the tires should be kept inflated to the recommended pressure.

Reverse camber also causes excessive tire wear, due to the inner edge of the tread rolling on the smaller circumference.

Since too much camber is undesirable, some other means is necessary to give the effect of camber which is required for easy steering and minimum wear of parts. This condition is obtained by inclination of the kingpin. It is obvious, therefore, that the angle or inclination of the kingpin is closely associated with wheel camber in its effect on steering. The angle of the kingpins is determined by the design of the front wheel suspension system, and varies in different car models.

When checking the camber, Fig. 3, the front wheels should be turned on their bearings to bring the high spot on the side of the tires in the horizontal plane toward the front or rear of the car.

The camber angle should come within the limits specified by the car manufacturer, and should be the same on both sides of the car within ½ degree. Unequal camber may cause a car to pull to one side, usually the side having the greatest camber, thus contributing to wheel shimmy and spotty tire wear.

When the camber angle is found incorrect on knee-action cars, the inclination of the kingpin should also be checked, because the knuckle or the knuckle support may be bent and not the suspension arms. Incorrect inclination of the kingpin indicates bent suspension arms or steering knuckle support, while wrong camber may be due either to a bent knuckle support or suspension arms, or to a bent steering knuckle.

An error in camber, when due to bent parts should be corrected by the use of new parts.

Changing the camber by the installation of new parts also affects slightly the turning angle of the wheels. Therefore, the toe-out of the wheels on turns should also be checked after making the camber correction. This is discussed in a following chapter.

It is also advisable, after making a camber correction, to change the tires, putting the front ones on the rear wheels and the rear ones on the front. to provide a normal contact on the tires on the front wheels with the ground.

Follow the instructions for adjusting camber on cars utilizing the independent front wheel suspension system as given under the various car chapters.

For cars using the solid type front axle with leaf springs, the camber measurement usually shows if the axle is bent. Equipment is available for straightening axles cold and without removing them from the car. If the camber is only slightly incorrect on this type suspension, replacing the kingpins and bushings, or perhaps wheel bearings will correct the condition.

TOE-IN

The setting or adjustment of the front wheels so that the distance between them is less at the front than at the rear is called toe-in. Toe-in is necessary as camber tends to cause the wheels to run out or separate at the front. Sufficient toe-in is necessary, therefore, to compensate for this tendency, and make the wheels roll straight ahead.

Excessive toe-in or toe-out will cause abnormal tire wear. Too much toe-in will cause the tread section to wear with a feathered edge at the inner side of the tire. Insufficient toe-in or toe-out of the wheels in the straight-ahead position, will cause the tread to wear with the feathered edges toward the outside.

Before checking the toe-in, however, the wheels and tires should be made to run as nearly true as possible, regardless of the type of equipment used for measuring the toe-in.

To check the toe-in, the front wheels should be in the straight-ahead position and when the measurements are taken from the side of the tire, the wheels should be turned on their bearings to bring the high spot on the side of the tires in a vertical plane at the top or bottom. The toe-in dimensions should be as specified by the car manufacturer.

TOE-OUT ON TURNS

In addition to the front wheel settings previously described, there is another important action of the front wheels which has a great effect on tire wear. This action is toe-out on turns. In other words, when the front wheels are turned to the right or left, they separate slightly at the front, depending on the amount of deflection from the straight-ahead course, instead of retaining their toe-in relation. The wheel making the inside, or smaller circle, turns a greater angle than the outside wheel, thus making toe-out necessary on curves. The amount of toe-out increases as the turn increases, due to the increasing angle between the wheels.

Toe-out of the front wheels is a result of steering knuckle arm design, and is dependent on the alignment of these arms. The setting of the arms is at an angle with one another, and with the center line of the car, instead of straight

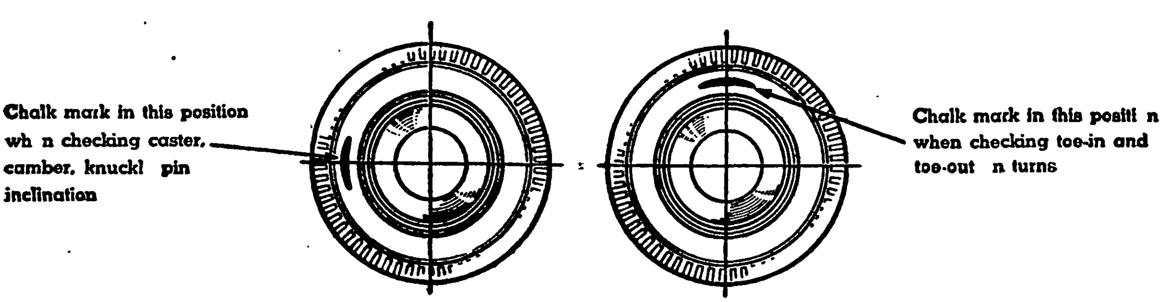


Fig. 3 L cati n f p int f greatest wheel run- ut when ch cking alignment fact rs

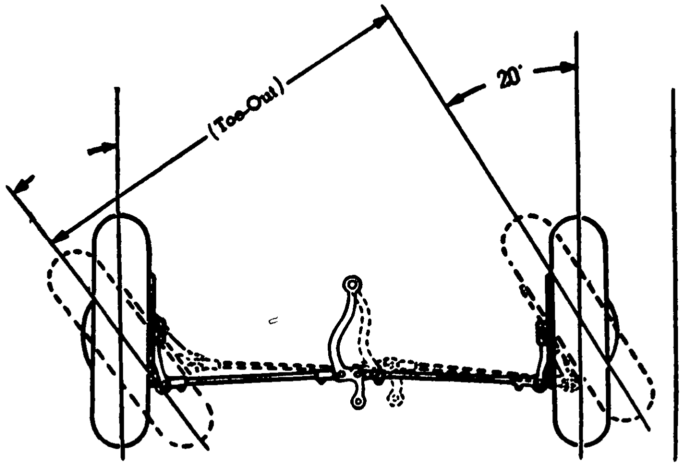


Fig. 4 With one wheel set to an angle of 20° as shown, th other wheel should conform to toe-out specifications. If not, bent steering arms are indicated

back, in order to maintain the proper relation of the front wheels on turns. In other words, if these arms were extended back far enough toward the rear of the car, they would intersect, or cross at a point in front of the rear axle, varying with the wheelbase of the bar. The angle of these arms depends upon their length, the wheelbase of the car and the distance between the kingpins.

The toe-out is checked by turning the wheels to the right or left, locating the outside wheel in a definite position, Fig. 4. With the outside wheel located at this position, the setting of the inside wheel should be as specified by the car manufacturer.

Errors in the setting of the inside wheel are due to bent steering arms. When these arms are bent, the wheels will not turn in the proper relation on curves, which condition will affect the toe-out and result in excessive tire wear. Bent arms, however, will not necessarily affect the straight ahead driving.

When the steering arms are found to be bent, or sprung out of line, they should be replaced with new ones. Before discarding them, however, a careful check should be made to make sure that the steering knuckle support or suspension arms are not bent; see that the camber and caster are correct, and the same on both sides; the toe-in is correct and the front and rear wheels are parallel.

REAR WHEEL ALIGNMENT

Rear wheel alignment is comparatively simple since there should be neither camber nor toe-in, but it is important that the relationship of the rear wheels to the front wheels be correct so that they will follow the front end in a parallel position and retain the original steering radius. This is known as tracking.

There are four causes of improper tracking: a swung rear end, a swung front end, a swayed frame and a diamond frame. Each will cause tire scuffing and difficult steering. Their presence can be determined by measuring the wheelbase, the distance from the front axle to the end of the frame, and the distance from the rear axle to the end of the frame on each side of the car.

When the measurements at the front axle check while the measurements at the rear axle and the wheelbases do not check, it indicates a swung rear end. A swung rear end can be caused by the rear axle housing slipping on the spring, weak or broken springs or one of the rear frame members being bent at the horn. This condition causes the car to be continually steered and because the wheels are in an improper position scuffing results on both front tires and possibly all four.

When the measurements at the rear axle check while the measurements at the front axle and the wheelbases do not check, it indicates a swung front end. This is often caused by bumping the right wheel against the curb when parking. In time this practice causes the front axle to slip on the spring. A weak or broken spring or a bent frame horn may also cause this condition. With this condition the car must be continually steered and usually both front tires will show considerable wear.

When the measurements at the rear axle and the front axle check while the wheelbases do not check it indicates a swayed frame. This also causes the car to pull toward one side, resulting in constant steering and severe tire scuffing. It is usually the result of a collision.

When all the measurements check, yet the tracking is not correct, check the wheels with a straight edge to make sure that they are in parallel planes or else measure the diagonals to make sure that they are the same. If they are found to be out the frame is diamond. When this condition is present the direction of the car might remain true but all four tires would be severely scuffed and show rapid wear.

SHOCK ABSORBERS

AN INOPERATIVE shock absorber, or one requiring fluid, does not control the body movement of the car properly, which results in continuous up and down movement, or short, jerky movements which diminish the riding qualities of the car with its attendant passenger discomfort.

Rear wheels bouncing over small bumps spin while in the air, causing the rubber to scuff off when they again contact the ground. There is also a loss of traction which affects gasoline economy.

Good steering is more or less dependent on the proper performance of the shock absorbers. Front wheel shimmy and wheel tramp are often traceable to shock absorbers that are incorrectly or unevenly adjusted, or improperly lubricated or inoperative. It is important that the shock absorbers be checked and properly serviced when found to be out of order.

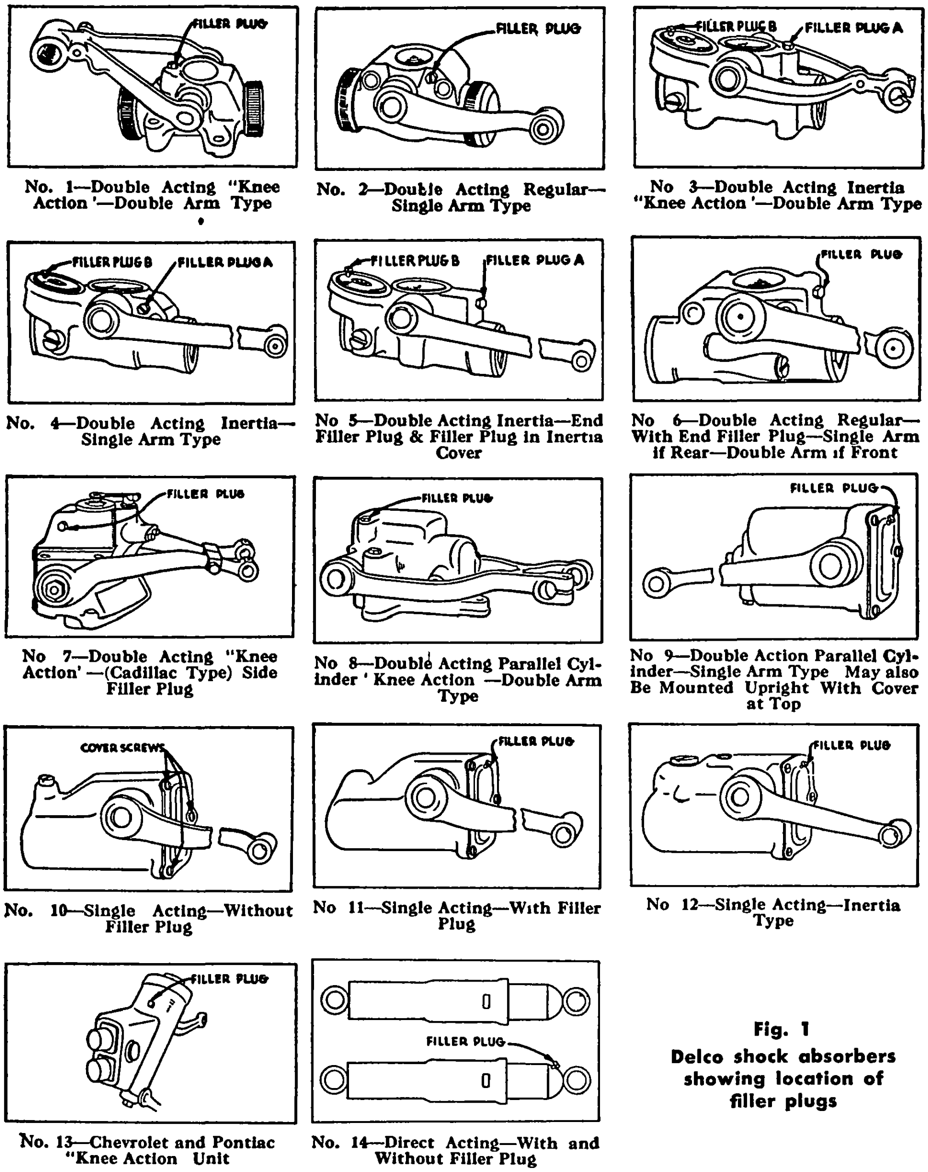
Shock absorbers should dampen the jar a front wheel receives upon hitting a sharp bump. Inoperative absorbers permit this jar to be transmitted to the steering wheel, which results in steering wheel whip or "fight."

EMPTY OR LOW FLUID

To check the unit for low fluid, determine if there is a uniform resistance through the complete stroke of the absorber movement. A quick check can be made by bouncing each corner of the car up and down. If the unit is in need of service, the car will continue to bounce after the weight exerted to bounce the car is released.

If this check does not indicate a need for service, a more positive check can be made by disconnecting and moving the absorber or its arm through the complete stroke. Do not disconnect the "Knee Action" type absorbers.

The fluid level should be checked about twice a year to make sure that they are controlling the car movement properly. If the fluid is allowed to be-



No. 1—Double Acting "Knee Action"—Double Arm Type

No. 2—Double Acting Regular—Single Arm Type

No 3—Double Acting Inertia "Knee Action"—Double Arm Type

No. 4—Double Acting Inertia—Single Arm Type

No 5—Double Acting Inertia—End Filler Plug & Filler Plug in Inertia Cover

No 6—Double Acting Regular—With End Filler Plug—Single Arm if Rear—Double Arm if Front

No 7—Double Acting "Knee Action"—(Cadillac Type) Side Filler Plug

No 8—Double Acting Parallel Cylinder "Knee Action"—Double Arm Type

No 9—Double Action Parallel Cylinder—Single Arm Type May also Be Mounted Upright With Cover at Top

No. 10—Single Acting—Without Filler Plug

No 11—Single Acting—With Filler Plug

No 12—Single Acting—Inertia Type

No. 13—Chevrolet and Pontiac "Knee Action" Unit

No. 14—Direct Acting—With and Without Filler Plug

Fig. 1
Delco shock absorbers showing location of filler plugs

come low, air pockets may form in the working chambers and destroy the action of the shock absorbers

FLUID LEAKAGE

Leakage of the fluid can be determined by the presence of excessive fluid around the outside of the shock absorber body To locate the leak, clean off the entire outside of the body thoroughly and fill the unit to its proper level

Drive over a rough road for a short distance, and then inspect the gaskets, especially the end cap gasket on double acting units at the inner side, and the filler plug

A slight leak at the seal on single and double acting units, where the shock absorber arm goes through the housing, just after the shock absorber has been filled is of little consequence, and is due to initial expansion

However, if there is a leak at any of the end caps or valves, new gaskets should be installed, and the unit should be cleaned and tested again

The slightest leak at the end cap will empty the shock absorber within a few miles Packing washers on units which have been operated with the fluid below the proper level, are apt to become worn, causing leaks around the shaft Such leaks can only be corrected by replacing the shock absorber

INOPERATIVE ABSORBERS

A broken or inoperative shock absorber can readily be detected by the lack of absorber resistance, or too much resistance Check the resistance as described in checking for low fluid

Too much resistance may be caused by broken internal parts, clogged valves or frozen pistons No resistance may indicate a lack of fluid, dirt holding a valve open, a broken cam, or other broken internal parts Check the absorber body to see that it is not cracked or broken

NOISY OPERATION

Noisy operation is usually caused by looseness somewhere in the shock absorber linkage However, when investigating the cause of this trouble, check and tighten the entire shock absorber mechanism Check the shock absorber brackets to make sure they are tight, and see that the shock absorber is not striking or rubbing on the frame or other parts of the body or axle

Check the rubber mounting bushings and replace if worn Also make sure that the shock absorber arm is tight on its splined shaft

Noise which is attributed to the shock absorbers, may be caused by worn or broken links or bushings, absorbers empty or low on fluid, stabilizer links and bushings, loose brake rods, loose tools in the trunk, broken internal shock absorber parts, car spring shackles or spring covers, loose metal parts such as fenders or bumpers, and loose shock absorber mountings

If it is definitely determined that the shock absorber is at fault, it must be disassembled and the necessary parts replaced If the necessary equipment is not available for making repairs efficiently, they may be exchanged for rebuilt units This is especially important in servicing direct acting units.

RIDING COMPLAINTS

In handling riding complaints, do not make any valve changes before checking the amount of fluid in the shock absorbers Also check the tire pressure, and see that the springs and spring bolts are properly lubricated and work freely

DELCO

DOUBLE ACTING WITH INTERNAL VALVES

Fig 2 An adjustment in the control of the shock absorber can only be made by changing the compression and rebound valves, as they control the flow of the fluid

The shock absorbers must be removed and disassembled to make this change To disassemble the unit, remove the end caps from the housing, using a special tool for this purpose, otherwise the end caps may become distorted and may impair the efficiency of the unit

Drain out all the fluid and with a screwdriver, remove the ring that holds the valve in the piston This will allow removal and replacement of the valve assembly.

REFILLING

KNEE ACTION TYPE — Clean all dirt from around the filler plug and remove the plug Do not disconnect the shock absorber arms Fill the unit to capacity, which is at the bottom of the filler plug hole

Bounce the front end of the car up and down so as to expel all the air from the unit, and add more fluid until filled

SINGLE ARM TYPE — Disconnect the link at the lower end Remove all dirt from around the filler plug before removing Fill the unit to capacity, and work the arm up and down slowly while adding the fluid to expel all the air in the unit and allow the working chambers to be filled.

DELCO

DOUBLE ACTING WITH INTERNAL VALVES AND REVERSED CAM

Fig 3 The service and refilling instructions for this unit are the same as described for Delco (1) The main difference being that the cam is reversed which places the shock absorber arm below the pistons.

DELCO

DOUBLE ACTING WITH EXTERNAL VALVES

Figs 4 and 5 An adjustment in the control can be made by changing the compression and rebound valves after removing the screws in which they are mounted When reinstalling the valve cap screws, use new gaskets and if the new valves are of a different code, use new screws or re-stamp the original, which will prevent confusion when it becomes necessary to change the valves again Be sure to refill the absorber after the unit is assembled

REFILLING — This procedure is the same as already described for the double acting internal valve type

DELCO

DOUBLE ACTING WITH PARALLEL CYLINDERS

Fig 6 The only service that can be made on this unit is to change the compression and rebound valves To do this, all that is necessary is to remove the screws in which they are mounted

REFILLING

KNEE ACTION TYPE — Remove the filler plug, but do not disconnect the shock absorber arms Fill the unit to capacity Bounce the car up and down to expel all of the air from the unit, and add more fluid until filled

SINGLE ARM TYPE — Disconnect the link at the lower end and remove the filler plug Fill the unit to capacity, and work the arm up and down while adding fluid Replace the plug and connect the link.

DELCO

DOUBLE ACTING WITH EXTERNAL VALVES & RIDE CONTROL

Fig 7 If it becomes necessary to change the rebound and compression valves, it only requires the removal of the screws in which they are mounted. Service on the intake valves, which are located in the pistons, requires the disassembly of the unit

RIDE CONTROL

CADILLAC 1935, 36-90, 37-90 — The shock absorbers are controlled manually by a lever mounted on the dash, which, operating through a system of levers and rods, regulates the spring pressure on the control valves in the shock absorbers.

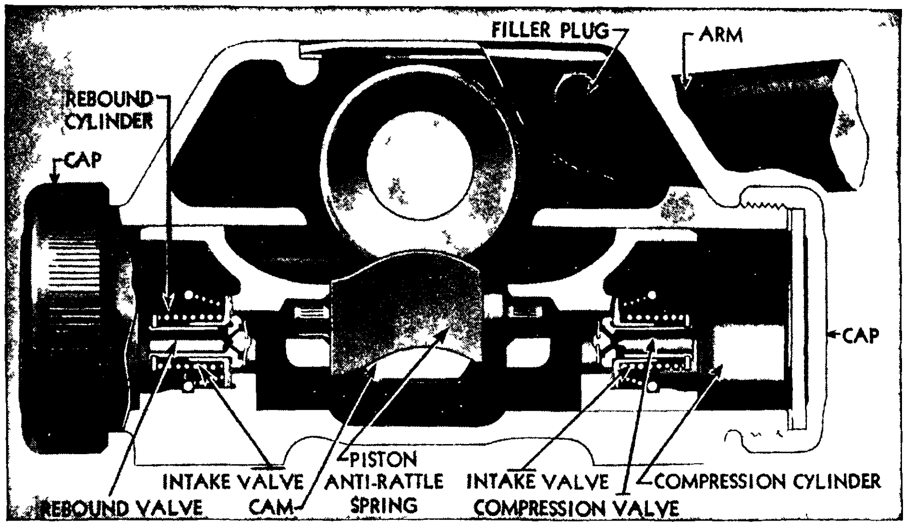


Fig. 2 Delco double acting with internal valves

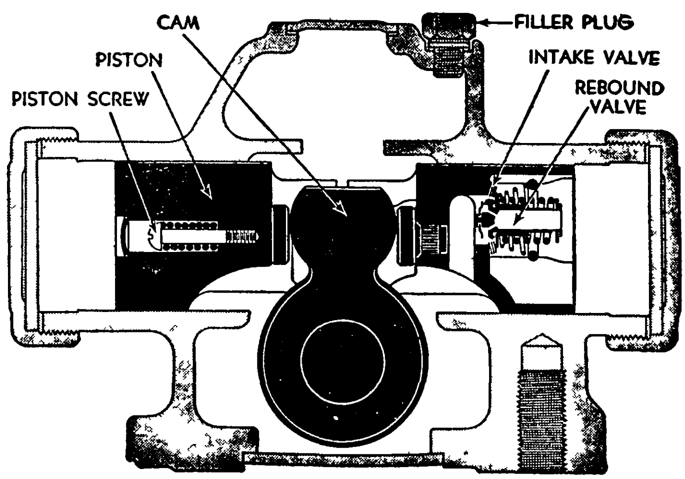


Fig. 3 Delco double acting with reverse cam and internal valves

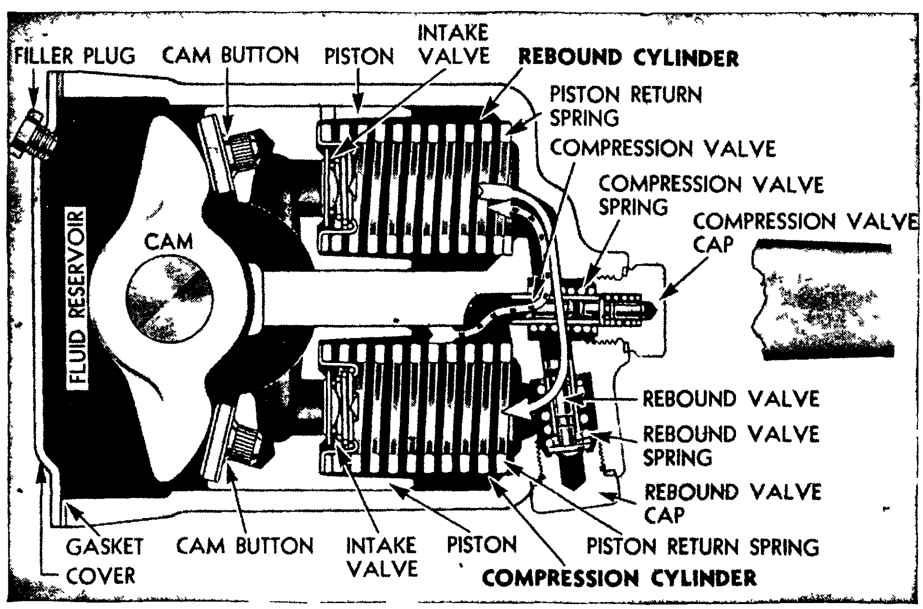


Fig. 6 D lc d uble acting with parall l cylind rs

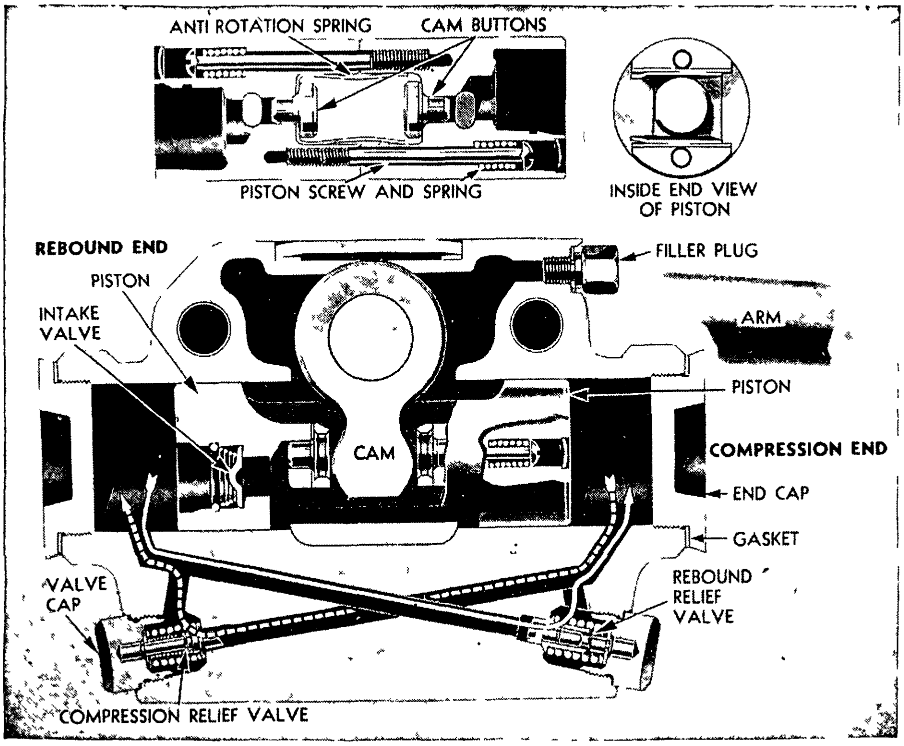


Fig. 4 Delco double acting with external valves

The dash lever is adjustable to different positions. With the control lever in the "Free," or down position, a soft ride is obtained. The "Firm" position, which is when the lever is up, gives the maximum control necessary for high speed and severe operating conditions.

The ride control connections are correctly adjusted if the control valve at each shock absorber is in the fully closed position when the control lever is in the "Firm" position. To secure this adjustment, proceed as follows:

With the ride control lever in the "Firm," or up position, disconnect the rod from the control lever at each of the four shock absorbers. Turn each control lever to the fully closed or compressed position. If any of the control levers are not in the correct position, loosen the control lever locking screw and position the lever correctly.

The ride control pull rods should be adjusted so that when the dash control lever is moved from its up position to its down position, and then back to its extreme up position, the control levers at the shock absorbers should be fully closed in the compressed position.

CADILLAC 1939-40, Series 75 & 90—To make the adjustment on these units push up on the locking cap and turn the adjustment operating shaft with a screwdriver until the desired ride position is secured.

The shaft has three positions and is marked: "S" for a soft ride, "M" for medium, and "F" gives a firm ride. The firm position is with the operating shaft turned in a clockwise direction to the "F" position.

Any complaints of bottoming at high speeds, or under severe operating conditions, can be corrected by setting the shaft in the "F" position. It is important that both shock absorbers be adjusted to the same position.

REFILLING. (All) — Procedure is the same as described for this type unit without the ride control. The level is at the bottom of the filler plug hole.

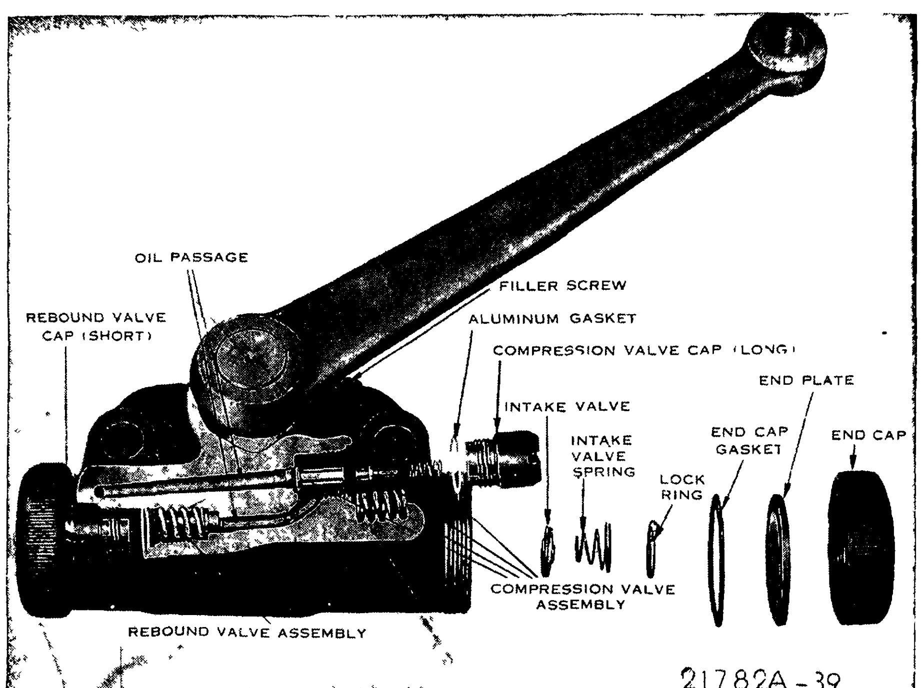


Fig. 5 Delc d uble acting with external valves

DELCO

DOUBLE ACTING WITH INERTIA CONTROL & RIDE CONTROL

Fig. 8. When it becomes necessary to change any of the valves, except the intake valves which are located in the pistons, it only requires the removal of their respective mounting screws

RIDE CONTROL — This adjustment is made exactly the same as described for the Cadillac 40-75.

REFILLING—This unit is provided with two filler plugs; one in the inertia weight cover and the other in the absorber body.

Disconnect the link at the lower end, and clean all dirt from around both filler plugs before removing Add fluid through the filler hole in the absorber body while working the shock absorber arm up and down until all air is expelled from the unit and the fluid has filled the working chambers. Replace the filler plug in the body. Add more fluid through the filler hole in the inertia weight cover until it is filled. Replace plug and connect link.

DELCO

DOUBLE ACTING WITH INERTIA CONTROL

Fig. 9. The operation of this unit is the same as described for the inertia control type with manual control. However, to change the adjustment, it is necessary to disassemble the unit in order to make any valve changes, except the static valve, which can be changed by removing the screw in which it is mounted.

REFILLING—There are two filler plugs provided in this unit; one in the shock

absorber body and the other in the inertia weight cover.

Clean all dirt from around both filler plugs before removing. Do not disconnect the shock absorber arms. Fill the shock absorber to capacity in the absorber body first, and bounce the car up and down to expel all the air from the unit. Add more fluid until filled, and replace the plug. Add more fluid through the filler hole in the inertia weight cover until filled, and replace this plug.

DELCO

SINGLE ACTING WITH EXTERNAL RELIEF VALVE

Fig. 10. This type absorber provides control of the rebound only. The method is similar to the double acting type. The control valve is in the body of the shock absorber, and the intake valve is located inside the head of the piston.

REFILLING—If the unit being serviced is not provided with a filler plug, it will be quicker and easier to replace the cover with one having a filler hole and plug, which can be obtained especially for the purpose.

To make this change, clean all dirt away from the shock absorber cover and the car frame with a wire brush, so that the dirt will not get into the absorber when the cover is removed. Do not disconnect the link until the cover with the filler plug hole has been installed.

Use an offset screwdriver to remove the cover screws. Pry off the cover and allow the old fluid to drain out. Scrape off the old gasket, and install the new cover and gasket, tightening the cover screws securely.

Disconnect the link at the lower end, and refill the shock absorber through the filler hole, and work the arm up and down slowly while filling.

If this new cover is not convenient to obtain, the unit may be filled by removing the relief valve retaining screw.

DELCO

SINGLE ACTING WITH INTERNAL RELIEF VALVE

Fig. 11. The unit is the same as the single acting external relief valve type except the intake and relief valves are in a single assembly in the piston, which necessitates the disassembly of the unit to change the control.

REFILLING—Disconnect the link at the lower end, and remove the filler plug. Fill the unit to capacity, and work the arm up and down slowly, while filling.

DELCO

DUBONNET TYPE KNEE ACTION UNIT

Fig. 12. The shock absorber which is built into the knee action unit is similar to the conventional double acting shock absorber. The upper shock absorber (compression) cushions the upward wheel travel, and the lower (rebound) cushions the downward travel.

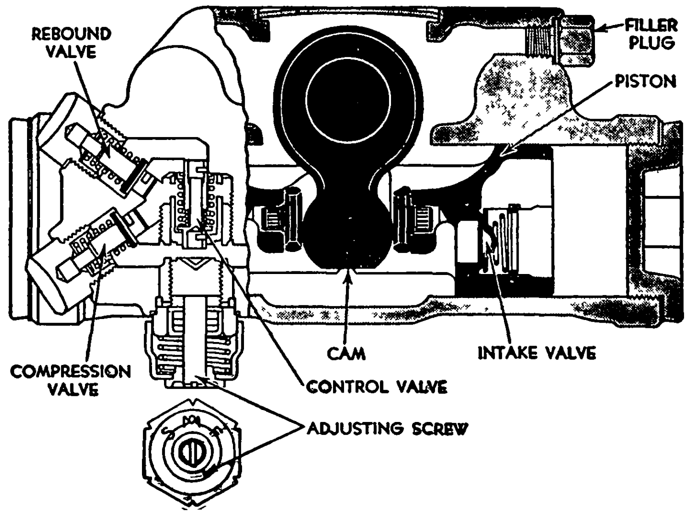


Fig. 7
Delco double acting with external valves and ride control

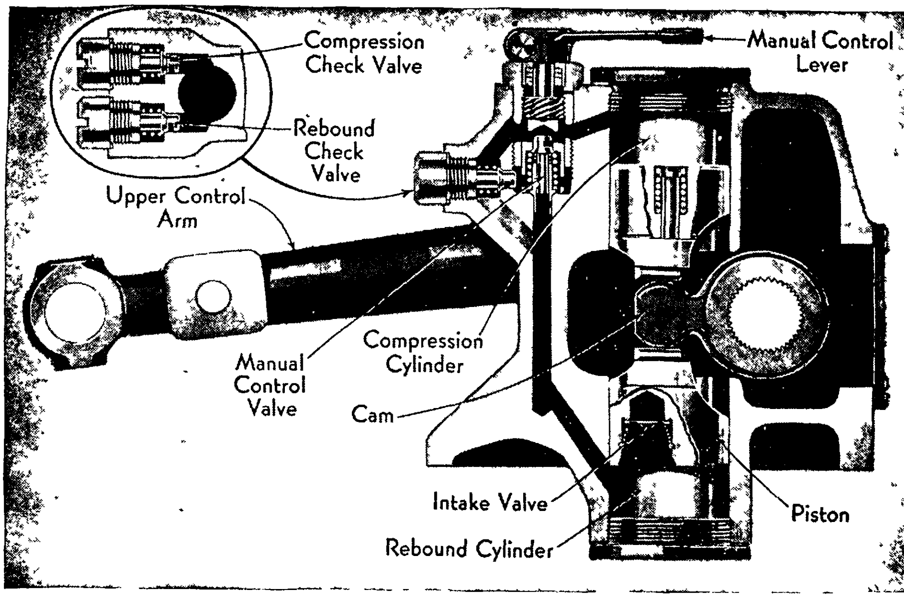


Fig. 8 Delco double acting with external check valves and ride c ntr l

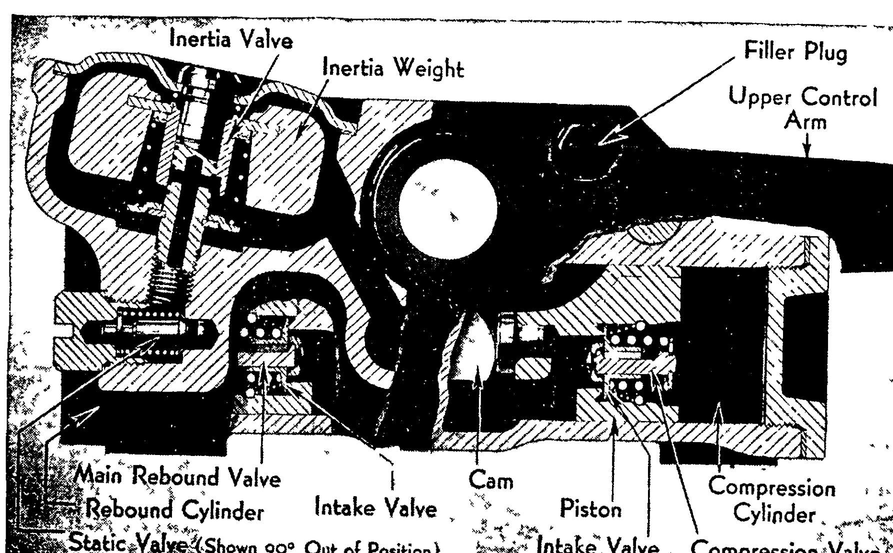


Fig. 9 Delco d uble acting with inertia c ntr l

REFILLING—The fluid used in the knee action unit also supplies the shock absorber. This unit should be kept filled to the level of the filler hole with the recommended fluid.

Remove all dirt from around the filler plug before removing, and add fluid. Bounce the front end of the car up and down, and add more fluid if necessary.

DELCO

DIRECT ACTING

ABSORBERS WITHOUT FILLER PLUGS, REFILL

Fig. 13. It is of extreme importance that the absorber be refilled with the exact quantity of fluid recommended. Consult the Delco Direct Acting Capacity table for the unit being serviced.

When assembling the unit, see that the valve parts are installed perfectly flat, and they must be free from nicks and burrs. All parts must be thoroughly cleaned.

To disassemble the unit, clamp its lower end in a vise and pull out the absorber to its fully extended position. Do not clamp on the tube. Insert the lugs of a spanner wrench through the small holes in the dust shield so that they engage the slots in the piston rod guide inside of the absorber.

After disassembling the dust shield and reservoir tube from the pressure tube, tap out the compression valve assembly, while keeping the pressure tube extended. The compression valve is a press fit in the end of the pressure tube.

Empty the old fluid out of both the pressure tube and the reservoir tube. Place the dust shield and pressure tube in a vise. Fill a measuring cup with the exact quantity of fluid required (see capacity table) and pour the fluid into the pressure tube until it is filled.

Replace the compression valve in the end of the pressure tube, keeping the pressure tube extended. Pour the balance of the fluid from the measuring cup into the reservoir tube, with the reservoir tube in an upright position.

Place the reservoir tube in a vise and assemble the dust shield and pressure tube to the reservoir tube, keeping the pressure tube extended. Be sure to use a new rod guide retainer gasket. This gasket fits around the inside of the reservoir tube, and should be soaked in the fluid before assembling. Tighten both halves of the absorber with the spanner wrench securely.

ABSORBERS WITH FILLER PLUGS, REFILL

Consult the Delco Direct Acting Capacity table for the exact quantity of fluid for the unit being serviced. Be sure that all the old fluid is drained out before refilling, as an excessive amount of fluid will damage the shock absorber.

Before removing the unit from the car, note the position of the filler plug, which should be at the bottom and to the rear.

After removing the unit, clean all dirt from around the filler plug; pull out the shock absorber to its fully extended position and remove the filler plug.

Pump the piston back and forth until the absorber is completely empty of fluid. Clamp the fluid plug base in a vise, with the filler hole up. Be sure that the absorber is in a horizontal position, or on a slant, with the end which is not clamped in a lower position.

Use a special funnel which screws into the filler plug hole. Refer to the capacity table for the fluid capacity of the unit being serviced, and pour this exact amount into a measuring cup. Pour the fluid from the measuring cup into the funnel, and pull out the absorber to its fully extended position. Work the absorber back and forth until all fluid is worked into the unit, and replace the filler plug.

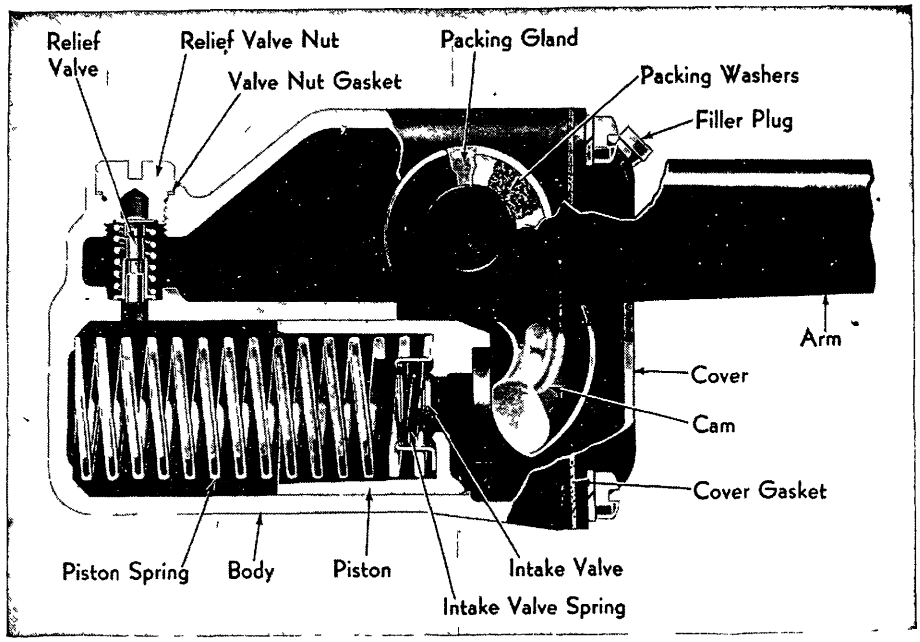


Fig. 10 Delco single acting with external relief valve

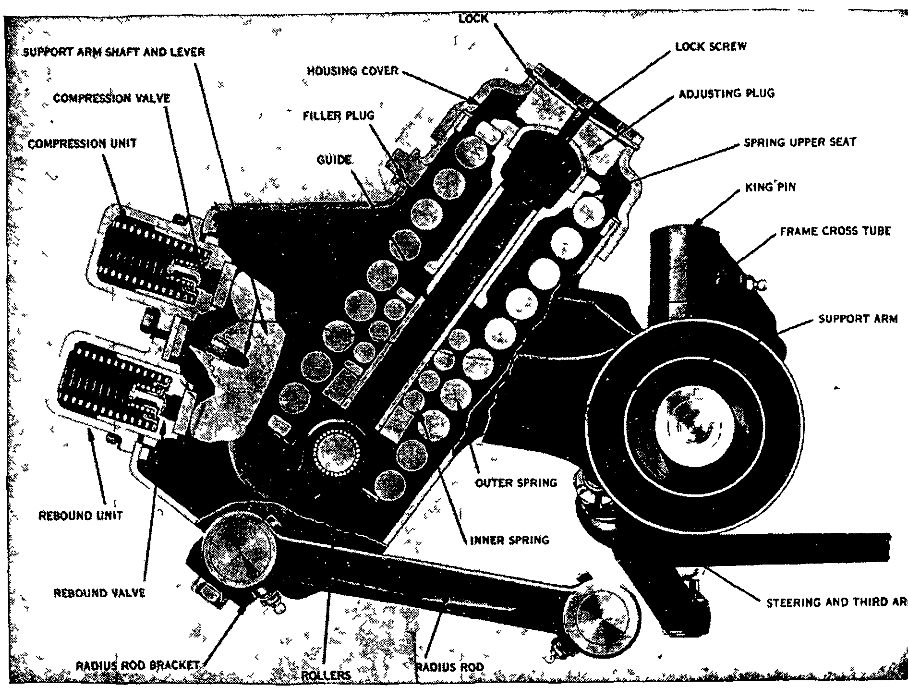


Fig. 12 Delco knee action unit

Before mounting the absorber on the car, place the absorber in a vise in an upright position (same as when mounted on the car) and work the unit up and down to expel any air pockets which may be present in the unit.

DELCO DIRECT ACTING FLUID CAPACITY

The part number and the valve code is stamped on the outer tube of the absorber The letter immediately following the part number indicates the fluid capacity of the absorber. For example, if

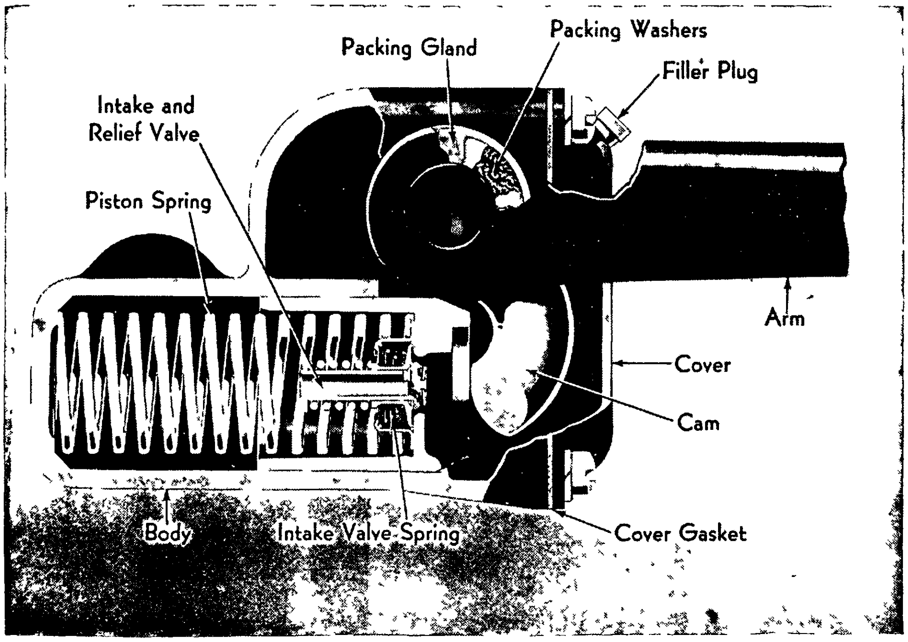


Fig. 11 Delco single acting with internal relief valve

the part number stamped on the unit is 1474D-2-G-5-C2, the D following the 1474 indicates the capacity to be 4 ounces. The symbols following the D designate the valve code.

ABSORBERS WITH FILLER PLUGS

Suffix Letter	Fluid Capacity, oz.
*A	3½ or 4¾
*B	3⅝ or 5¼
*C	3⅞ or 5¼
D	4
DD	8¼
*E	4¼ or 6¾
F	4⅜
G	4½
H	4¾
J	4⅞
K	5⅛
**L	5¼ or 8¾
M	5½
N	5⅝
P	5¾
Q	6
R	6⅛
**S	6¼ or 10½
**T	6½ or 11⅛
U	6⅝
V	6⅞
**W	7 or 12
X	7¼
**Y	7¾ or 12⅝
Z	7½

* If the absorber has a hex head filler plug, it is a Spicer unit; use largest capacity shown.
** If the absorber is the large type (outer tube 2⅝″ diameter) use largest capacity shown.

ABSORBERS WITHOUT FILLER PLUGS

Suffix Letter	Fluid Capacity, oz.
A	3½
AA	7½
B	3⅝
BB	7¾
C	3¾
CC	8
D	4
DD	8⅛
E	4⅛
EE	8¼
F	4¼
FF	8⅜
G	4½
H	4⅝
J	4⅞
K	5
L	5⅛
M	5⅜
N	5½
P	5⅝
Q	5⅞
R	6
S	6¼
T	6⅜
U	6½
V	6¾
W	7
X	7⅛
Y	7¼
Z	7⅜

The fluid capacity of the Delco direct acting shock absorbers can also be determined by measuring the collapsed length of the unit. These measurements are given in the following tables.

EYE TYPE ABSORBERS

The collapsed length of the eye type shock absorbers should be measured from the center line of the upper eye to the center line of the lower eye.

Collapsed Length, in.	Fluid Capacity, oz.
8	3½
8¼	3½
8½	3⅝
8¾	3⅞
** 9	4 or 6¾
9¼	4¼
9½	4⅜
9¾	4⅝
10	4¾
*10¼	5 or 4⅜
**10½	5½ or 8¾
10 11/16	5⅛
10¾	5½
11	5½
11¼	5⅝
11 5/16	5¼
11 7/16	5¾
11½	5⅞
*11¾	6 or 5¼
**12	6⅛ or 10½
12¼	6⅜
12 7/16	6¼
12½	6⅝
12¾	6¾
12 11/16	6½
**13	6⅞ or 12
13¼	7⅛
**13½	7¼ or 12⅝
13¾	7⅜
13 15/16	7⅜
14 3/16	7½
14 7/16	7¾
14 11/16	8
14 15/16	8⅛
15 3/16	8¼
15 7/16	8⅜

* If absorber has hex head filler plug, it is a Spicer unit. Use smallest capacity shown.
** If absorber is large type (2⅝″ diameter) use largest capacity shown.

BAYONET TYPE ABSORBERS

The collapsed length of the bayonet type shock absorbers should be measured from the base of the stem (at the shoulder) to the base of the other stem (at the shoulder). If the unit is equipped with one stem and an eye, take the measurement from the centerline of the eye to the base of the stem (at the shoulder).

Collapsed Length, in.	Fluid Capacity, oz.
7¼	3½
7½	3⅝
7¾	3⅝
8	3⅞
8¼	4
8½	4¼
8¾	4⅜
9	4½
9¼	4¾
9½	5
9¾	5⅛
10	5⅜
10¼	5⅝
10½	5¾
10¾	5⅞
11	6
11 1/16	6¼
11¼	6⅛
11 7/16	6⅛
11½	6¼
11¾	6½
12	6⅝
12¼	6⅞
12½	7
12¾	7¼
13	7⅜
13¼	7½
13½	7¾
13¾	8
14	8⅛
14¼	8¼
14½	8⅜

GABRIEL

HYDRAULIC WITH THERMO-STATIC CONTROL

This shock absorber, like any hydraulic type, functions by causing fluid to flow through a small opening under pressure.

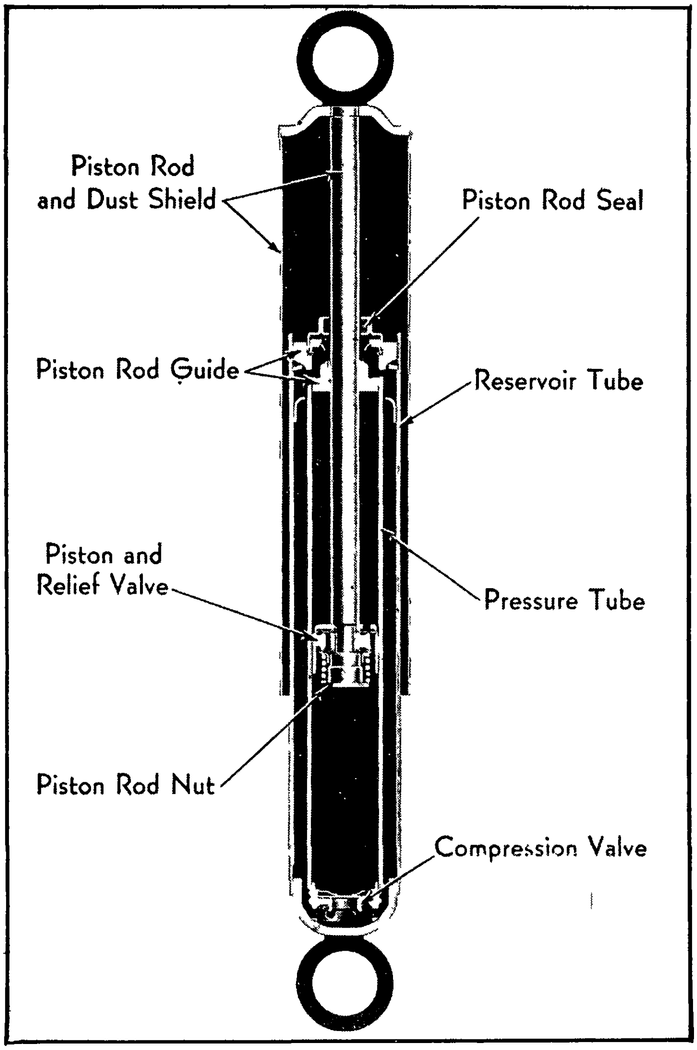


FIG. 13 Delco direct acting

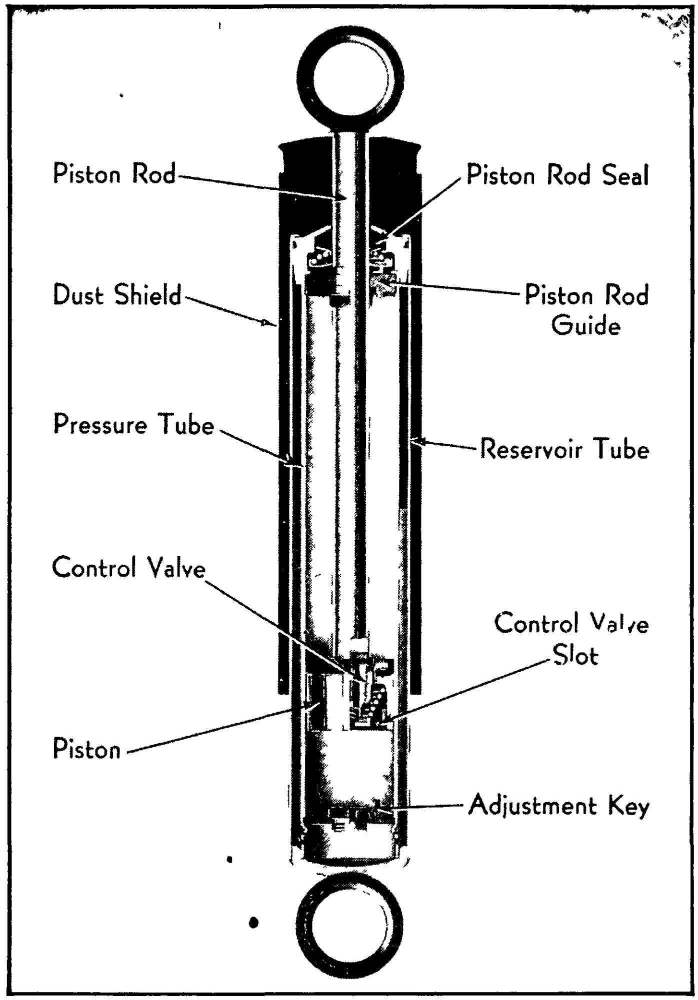


Fig. 14 Gabriel direct acting

The thermostatic device, automatically adjusts the shock absorbers, and keeps the control uniform regardless of temperature changes. When the adjustment is set for proper car control at a normal temperature of 70 degrees F., the thermostatic control automatically closes off the adjusting valve a pre-determined amount with each degree of rise in temperature. Likewise, it opens the adjusting valve an equal amount with each lowered degree of temperature, thus furnishing the same uniform brake action regardless of temperature changes from zero degrees to 120 degrees F.

ADJUSTMENT—Remove the filler plug and insert the special adjusting wrench. Turn the adjusting screw to the right (clockwise) until the screw is down. Note the position of the wrench and turn it to the left (counter-clockwise) the number of turns as given in the following table. The adjustment must be kept within these limits to allow the thermostat to function between the limits of average temperatures encountered.

	Front	Rear
Hupmobile 427T, 527T	2	2½
Hupmobile 518D, 618D	1¾	2
Lafayette 3510	2	2¾
Lafayette 3610	3	2½
Lafayette 3710	2½	2⅝
Nash 3520	2½	3
Nash 3580	2⅜	3
Nash 3640	3	2½
Nash 3680	2⅜	3
Nash 3720	2¼	2
Nash 3780	2¾	2⅛

REFILLING — The oil level in the reserve chamber should be checked about every 5000 miles. The fluid in the reserve chamber should be on a level with the filler plug hole. There is a ball check valve in the bearing plate between the reserve chamber and the working chamber to keep the working chamber filled always.

GABRIEL

DIRECT ACTING

Fig. 14. This unit is similar to the Delco direct acting shock absorber already described, but the fluid is sealed within the unit, there being no filler plug and the unit itself cannot be disassembled. The fluid capacity is about 8½ ounces.

There is an adjustment for control, however, and normally, for average requirements, this adjustment is set at one turn open. If any change of adjustment is desired, make certain that the tires are inflated to the recommended pressure, and that the springs and shackles are lubricated and in good condition.

To make the adjustment, press the upper and lower cylinders together as far as they will go. If the unit is on the car, disconnect the lower mounting, otherwise a complete collapse cannot be obtained.

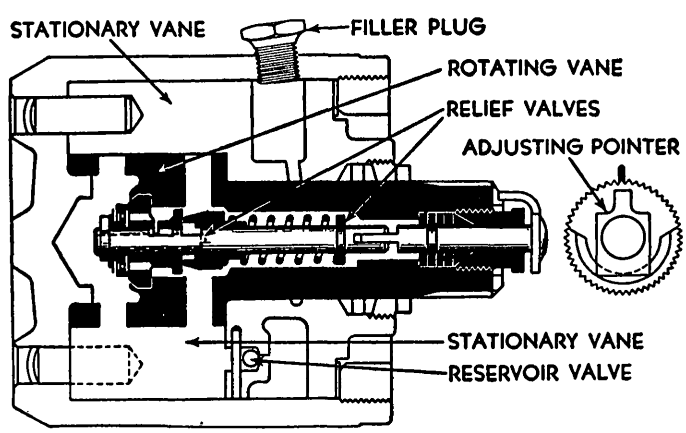


Fig. 15 Houdaille external adjustment type

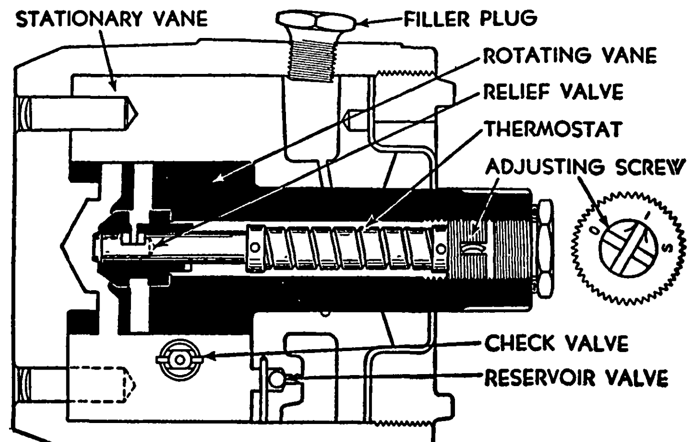


Fig. 16 Houdaille internal adjustment typ

When the unit is fully collapsed, keep the cylinders pressed together and turn slowly by hand to the right until the adjusting nut key can be felt slipping into the valve adjusting nut. Continue turning to the right until you feel a stop. This will probably require one turn, but never more than two turns.

The adjustable valve is now closed. Turn toward the left to open, the valve. For a very firm to firm control, turn from ¼ to 1 turn from the closed position. For average control 1 to 1½ turns from the closed position, and for a soft ride, from 1½ to 2 turns open.

NOTE—When performing this operation, use the hands only and do not force beyond the closed position. The adjustment valve should be left at least ¼ turn open. If fully closed, would give a very firm ride and damage the mountings. Do not try to force the stop positions.

HOUDAILLE

EXTERNAL ADJUSTMENT TYPE

Fig. 15. The reservoir should be filled to the level of the bottom of the filler plug hole.

The adjusting point is set at the factory to meet the demands for average driving conditions. This position is indicated by a punch mark on the end of the shaft between the shoulder stops.

The resistance of the shock absorber can be adjusted by turning the pointer between the two shoulders. Turning the pointer clockwise increases the resistance until, when it contacts the shoulder, the valve is shut.

When the pointer is turned counterclockwise the resistance is reduced until the pointer contacts the shoulder, when the valve is fully opened.

A slight movement of the pointer produces considerable change in the resistance, and therefore, it should not be moved more than $\frac{1}{16}$" to ⅛" at a time.

HOUDAILLE

STABILIZER SHOCK ABSORBER

To check the unit, fasten it in a vise in such a manner that the filler plug is in the same position as when installed on the car. The arm should show considerable resistance and no free travel if the unit is functioning properly. If free travel exists, move the arm up and down through two full strokes to expel air.

If the free travel is not eliminated, fill the unit with the specified lubricant to the bottom of the filler plug hole and again move the arm through two full strokes. If the free travel still exists, replace the unit.

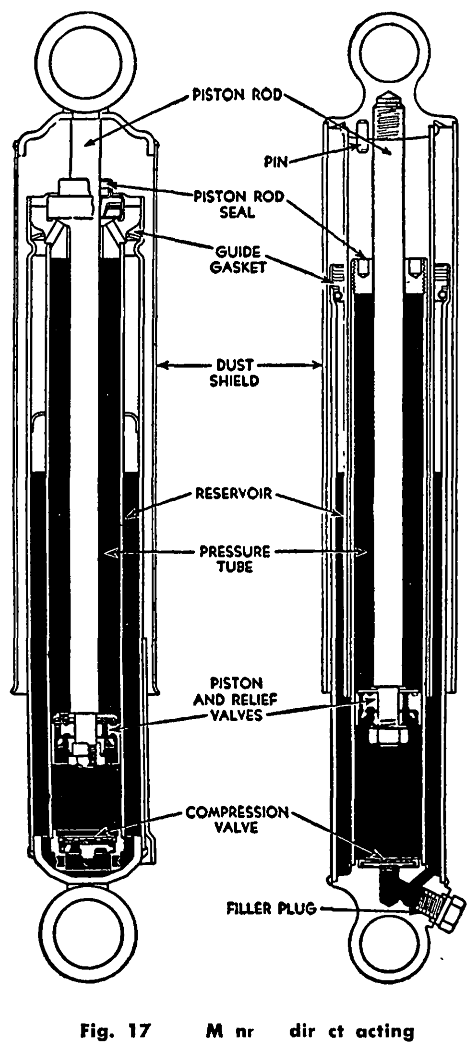


Fig. 17 M nr dir ct acting

If the free travel has been corrected, check the resistance of the unit as follows: With the arm at the top of its travel, hang a 50-pound weight on the arm and observe the number of seconds that the arm requires to move downward to its bottom limit of travel. At normal room temperature, it should not require more than 24 seconds, nor less than 18 seconds. If not within these limits, adjust the valve in or out until the desired result is obtained. Be sure that the packing nut around the valve is tight, otherwise a leak may result.

HOUDAILLE

INTERNAL ADJUSTMENT WITH THERMOSTATIC CONTROL

Fig. 16. This unit is the same as the external adjustment type except that a thermostatic valve is fitted which automatically controls the absorber for uniform operation through all temperature changes. In addition, as the fluid passes through the orifice in the moving wing, it strikes the flat portion of the valve.

When the car is driven on smooth roads, the valve retains its position as set by the thermostat.

When the car is driven on rough roads, the impact of the fluid on the flat portion of the valve closes the valve in proportion to the pressure of the fluid, to give an automatic ride control.

ADJUSTMENT—The adjusting head is set for average driving conditions but can be adjusted to meet some special requirement.

To make an adjustment, remove the valve cap nut from the end of the shaft. This will expose the adjusting screw and the letters indicating the position of the valve.

The head of the adjusting screw has two slots; the deep slot with the arrowed indicator is used to stake the valve to the shaft through the means of a small shim inserted in the slot. The wide slot is the one which should be used when making an adjustment. Unless the shock absorber has already been adjusted, the arrow will be directly in line with the punch mark located between the letters O and S on the end of

the shaft The letter O indicates that the valve is open, with the unit giving its least resistance The letter S indicates that the valve is shut, with the unit giving its greatest resistance

A special tool is available which will fit the wide slot and permit adjusting the valve without damaging the soft brass head Two wire horns extend from the shank of the tool to indicate the position of the arrowed slot while making an adjustment

The full range of adjustment lies between the letters O and S, and the valve should never be turned beyond these points

Turning the valve clockwise increases the resistance of the shock absorber, and counter-clockwise, decreases the resistance Adjustments beyond the S mark will cause excessive pressure and leakage

A slight movement of the valve produces considerable change in resistance, and therefore, the valve should not be moved more than $\frac{1}{16}$" to ⅛" at a time.

REFILLING—The reservoir should be filled to a level just below the bottom of the filler plug hole

MONROE

DIRECT ACTING

Fig 17 There are no points of adjustment and if a change in the ride is required, the valve and piston assembly must be changed The pressure at which the valve opens is determined by the weight of the spring steel disc which is permanently assembled to the piston By replacing the piston assembly with one having a spring disc of a different weight the ride control can be changed Three assemblies are available, standard control, heavy control and light control The assemblies used in front and rear units are not interchangeable The shock absorber must be disassembled to replace a piston assembly

To disassemble the unit, hold the base securely in a vise and compress the top Rotate the top until the pin in it drops into the hole in the piston rod bushing Now the piston rod bushing can be unscrewed and the unit pulled apart The piston rod nut, the piston and the piston rod bushing can then be removed Reverse this order to assemble Make sure that the piston rod bushing is assembled with the hole pointing toward the top. The nut at the bottom of the piston rod should be securely tightened and staked

If leaks occur at the filler plug, it is merely necessary to replace the filler plug gasket or tighten the plug securely The reserve chamber is permanently assembled and if leakage develops there, the unit should be replaced

The shock absorbers should be removed from the car, cleaned, inspected and refilled every 5,000 miles or at least twice a year The shock absorber must be removed from the car for refilling Clean all dirt from around the filler plug and remove the filler plug Pump all old fluid out of the unit Clamp the base in a vise with the filler hole up Compress the unit and screw the special filler cup which is available from Monroe into the filler plug hole Pour the exact amount of fluid into the unit and pull the shock absorber to its extended position, drawing in the fluid After all the fluid has been drawn in, force all air out by compressing the unit until the fluid level comes to the top of the filler plug hole Replace the filler plug using a new gasket When installing the rear units on the car make sure that the gravel shield welded to the lower tube is toward the front of the car

WINDSHIELD WIPERS

AUTO-LITE ELECTRIC

Fig 1 This wiper is a two-pole shunt-wound electric motor, with two wiper arm pivots and the necessary linkage to connect the pivots to the motor Its operation is controlled by a dash mounted switch and a fuse is installed in the circuit between the switch B terminal and the battery

Some units use a 14-ampere fuse while a 20-ampere fuse is used on others A fuse substitute or a fuse of a higher capacity from that specified should never be used In some cases, this fuse is in the line between the switch B terminal and the ignition switch In others, it is built into the switch

In each pivot assembly is a friction clutch which allows the motor to operate without moving the arm in the event that movement of the arm is affected by heavy sleet, snow, etc This clutch also permits the arm to be moved so that the windshield glass may be cleaned The design of the clutch is such that a pull of from two to three pounds applied at the end of the wiper arm will allow it to slip

It is essential that the motor, linkage and drive pivots be assembled so that they will operate freely, otherwise noisy operation or even failure will result

Electrical Circuit: When the switch is turned on, the connection between the B and C terminals in the switch is closed, allowing current to flow through the motor armature and the relay magnet coil, closing the relay points and passing current through the motor field circuit, thus allowing the motor to start When the switch is turned off, the motor will continue to run until the parking position is reached This action takes place because the cam is not touching the armature controlling contact H and the current continues to flow to the motor until the cam opens the contacts G and H and in so doing closes contacts H and J The closing of these contacts grounds the armature circuit and with current momentarily still flowing in the field circuit, acts as a dynamic brake to park the wiper arms For an instant after contacts H and J close, current flows in the relay series coil, providing additional magnetic attraction to the relay armature and so retarding the opening of the relay contacts as the electric brake is applied, thus resulting in a more positive stop of the motor

Lubrication: The gear box should be three-quarters filled before assembly with gear lubricant The crank cross shaft should be greased along its entire length with this same lubricant before assembly in the housing Care must be exercised that no grease or oil is allowed to get on the commutator or any of the contact points.

Test Data: The field current draw is 1 5 to 1.7 amperes at 6 volts. Amperage draw, running light, 3 to 4 5 amperes at 5 8 volts Motor to start under load at 4 0 volts Relay point gap should be 020" to 025" and is adjusted by bending the relay point stop Never bend the relay armature hinge lug Relay points close at 4 volts maximum With the points closed the armature is to be seated flat against the top of the core The relay points open at 0 2 volt minimum to 0 5 maximum The relay shunt coil should have a resistance of 21 to 25 ohms at 80 degrees The resistance of the series coil should be 0 035 ohms at 80 degrees

Bearings: After the motor is completely assembled and before it is run, the frame should be given several sharp blows with a rawhide hammer to align properly the commutator end and drive end bearings with the armature shaft If it is necessary to install thrust washers to reduce the end play of the armature to eliminate noise due to excessive end motion, it must not be reduced to less than $\frac{1}{32}$ inch This can be measured by removing the gear case cover and moving the crank arm back and forth

The parking position is controlled by the relationship between the cam on the crank arm and the armature on which the contact H is mounted It can be adjusted by loosening the lock screw and turning the adjusting screw until the angle is correct When correctly adjusted there must be a gap of .025" minimum

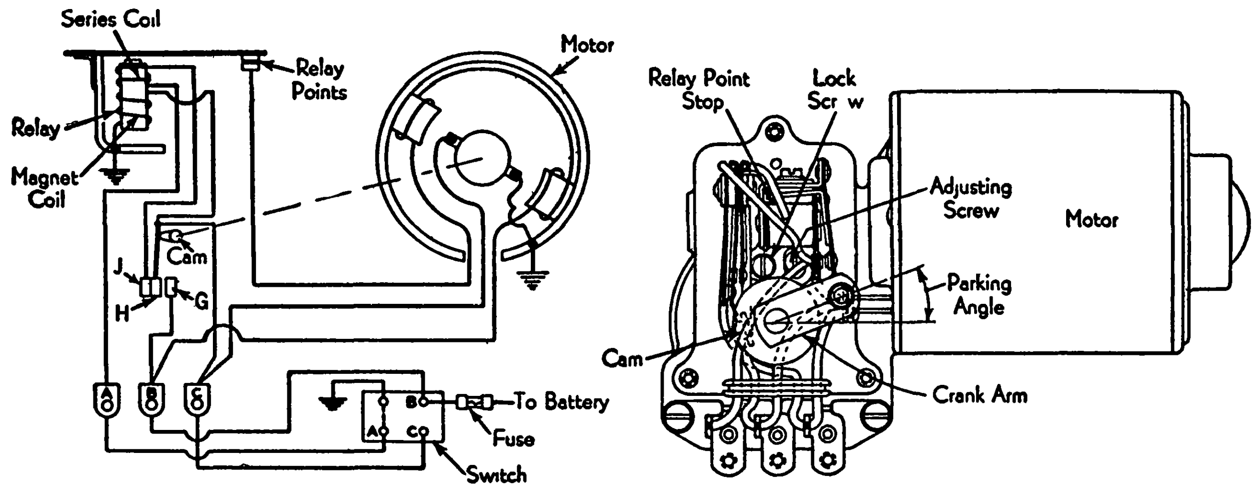


Fig. 1 Auto-Lite Electric wiper. Wiring diagram shown at left; parking angle adjustment shown at right

between contact points G and H with the unit stopped in the parked position The contact pressure of these points at this position should be 2 ounces minimum Under load the parking angle should be 21 degrees

TROUBLE SHOOTING

Trouble: Motor will not start

Cause: Blown fuse

Remedy: If the relay points are dirty, clean them with carbon tetrachloride on a narrow strip of clean linen tape After cleaning the points, draw a dry piece of tape between the points to remove any residue that may be on the contact surface The points can also be cleaned with a file After filing, the points should be cleaned with carbon tetrachloride

If the connections are poorly soldered they should be cleaned and resoldered

If the wiper ground strap is loose, its screws should be tightened

If the battery is discharged so that its voltage is too low to operate the relay, the battery should be recharged or replaced

If the field or armature connections are grounded where the wires pass through the drive end head into the frame and field a sleeve should be placed around these wires to protect them from sharp edge of die casting

If the pivot clutch is inoperative, it should be replaced

If the pivot shaft is frozen due to a bend or improper lubrication, the pivot assembly should be replaced

Cause: Loose connections in the external circuit.

Remedy: Check and tighten the wiring between the ignition switch and the wiper control switch and also between the control switch and the wiper motor.

Cause: Crankshaft not free

Remedy: Replace the drive end head, being sure that the crank cross shaft is greased for its entire length before assembling in the housing, Care must be used to see that all soldered connections are clean and tight

Cause: Linkage not free.

Remedy: Check linkage to be sure it is operating freely

Trouble: Motor will not stop

Cause: Incorrect relay operation

Remedy: On units manufactured before December 1, 1938, the complete motor should be replaced On units manufactured after that date, code letter S12, check the relay to be sure it is operating within specifications If it is not correct the relay should be replaced or adjusted When replacing a relay be sure that the single lead which emerges on the lower side of the relay is connected to the A terminal and the two leads on the other side of the winding are connected as shown

Cause: Loose connections at the control switch

Remedy: Tighten either the connection at the switch A terminal or at the switch ground connection

Cause: Parking mechanism out of adjustment

Remedy: Adjust the parking mechanism so that it operates according to specifications

Trouble: Overtravel of the right-hand wiper arm

Cause: Movement of the right-hand pivot assembly in its mounting

Remedy: Install a new right-hand pivot and pivot support assembly

Cause: Excessive clearance in the bearings of the right-hand pivot assembly

Remedy: Install a new right-hand pivot assembly If the vehicle does not have welded supports on the body or the pivot support assembly, assemble a late type pivot support assembly

Cause: Insufficient tension of the wiper arm and blade against the glass

Remedy: Increase the spring tension to 5 to 6 ounces by bending the lower spring holding lug. This tension to be measured with the wiper blade and arm assembled on the vehicle and the reading taken as the blade leaves the glass

Cause: Excessive side play between the wiper arm and blade

Remedy: Press the two blades holding fingers on the wiper arm together to provide a press fit between the wiper arm and the blade To facilitate the assembly of these two parts it is also necessary to bend the ends of the fingers as shown in the illustration

STEWART-WARNER ELECTRIC

Fig 2 This wiper has two speeds. The wiper motor is connected through the ignition switch so that the ignition must be on for the wiper motor to operate When the wiper switch is in its first "on" position the wiper is in high speed, and when it is in its second "on" position the wiper is in its low speed The ignition switch must be on before the wiper will operate Power is transmitted from the wiper motor to the wiper arms by means of a worm gear, fibre driven gear, crank, linkage and the transmission to which the wiper arms are attached

When the wiper switch is turned off, the motor continues to operate until the blades are parked at the bottom of their stroke When turned off, the wiper automatically goes into high speed to finish the stroke to the parked position Parking is accomplished by automatic parking mechanism inside the drive unit which conducts current until the blades are parked The parking mechanism declutches from the motor simultaneously with cutting off current from the motor, allowing the motor to coast to a stop

To adjust the parking position of the blade, turn on ignition and the wiper switch Then turn off the wiper switch, allowing the blades to park before turning off the ignition switch Loosen the wiper arm nut several turns and loosen the arm on the shaft Move the wiper blade to its proper parking position and tighten the slotted head nut securely

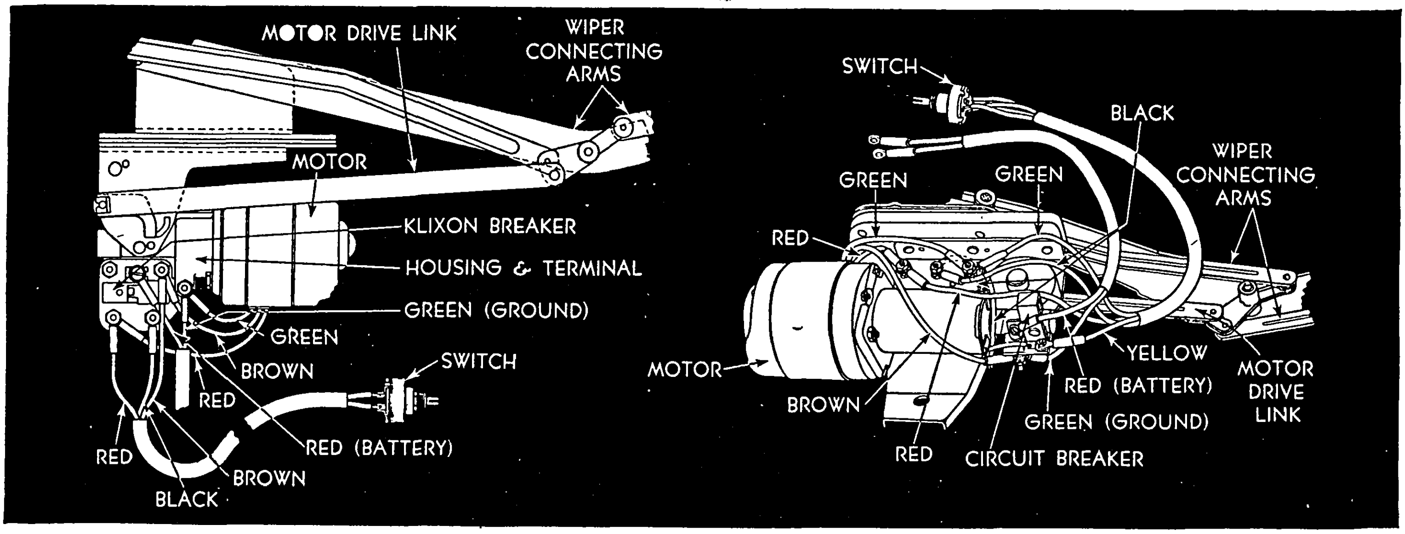


Fig. 2 Stewart-Warner two-speed electric wiper. Two applications shown

Lubrication: The motor bearings require no lubrication and the drive and driven gears are lubricated for life when assembled. After a year or more of use, a few drops of oil should be put on the felt washers at the various linkage bearings. When replacing the bracket, driven gear and crank assembly, place a small amount of graphite grease on the fibre driven gear. Do not over-lubricate, causing grease to run out.

In order to replace any of the wiper parts located under the cowl except the wires, it is, advisable to remove the entire wiper from the vehicle.

To remove the entire wiper from the vehicle, pull off the control switch knob and remove the switch mounting nut. Disconnect the red and green wires at the switch. Remove the wiper arms by taking out the slotted head nuts. Remove the octagon nut and lift off the fibre washer, spacer and rubber gasket. Remove the nut holding the unit to the mounting stud. This allows all the wiper parts under the cowl to be removed as an assembly, provided nothing else, such as a glove compartment, radio or heater is in the way.

To replace the circuit breaker, disconnect the red, green and brown wires at the circuit breaker. Unsolder the short black wire between the motor and the circuit breaker at the circuit breaker. Remove the nut at the bottom of the circuit breaker. Install a new circuit breaker by reversing this procedure.

TROUBLE SHOOTING

Trouble: Wiper does not change speed when turned from first to second "on" positions or wiper runs excessively fast.

Cause: Loose or broken resistor connections.

Remedy: Check resistor connections without removing wiper from vehicle.

Cause: Defective switch.

Remedy: Disconnect four wires leading to switch and connect new switch and cable assembly to the wiper. Then test to see if wiper changes speed when new switch is operated.

Cause: Burned out resistor.

Remedy: Entire wiper assembly must be removed from the vehicle and resistor replaced. Remove the entire drive unit from the bracket by taking out two screws. Unsolder the lead wires at either end of the resistor. Solder a new resistor in place. Attach the drive unit to the bracket with two screws and lock washers. Be sure that the small washer is over the driven gear shaft and that the gasket is in place.

Trouble: Wiper motor runs when switch is on but wiper crank does not operate.

Cause: Defect in motor drive shaft, springs or drive clutch.

Remedy: Remove the entire wiper from the vehicle, disconnect the motor from the drive unit housing and remove all parts inside drive unit. Examine the motor drive shaft, springs and drive clutch and replace any defective parts. Make sure that the arm on the drive clutch is not worn and swings freely on its pivot. Also examine the ears of the clutch member attached to the coil assembly.

Cause: Defective or worn coil, shaft and contact assembly.

Remedy: Test the coil by connecting one terminal of a regular 6-volt storage battery to the case of the coil and the other battery terminal to the coil terminal onto which the wire is soldered. The clutch member of the coil should be drawn down to position shown by the dotted lines when this is done. Hold the coil assembly in the position shown with the cross pin of the clutch member in its slot when making this test. If the clutch member does not move, replace the entire coil, shaft and contact assembly.

Cause: Contacts inside drive unit housing dirty or bent.

Remedy: See that contacts inside drive unit housing are clean, that terminals of connecting leaf springs on end of coil are clean and are not bent out of position. These springs are normally parallel with coil face.

Cause: Stripped drive or driven gear.

Remedy: If drive gear is stripped, the housing, drive gear, resistor and breaker assembly must be replaced. If the driven gear is stripped, the bracket, driven gear and crank assembly must be replaced as described.

Trouble: Wiper does not run when switch is on.

Cause: Loose connections at ignition and wiper switch which must be fixed.

Remedy: Check all wire terminals to make sure that connections are tight.

Cause: Defective circuit breaker.

Remedy: Check circuit breaker by shorting across terminals B and C. If wiper operates when this is done, the trouble is in the circuit breaker and it must be replaced.

Cause: Defective switch and cable assembly.

Remedy: Connect new switch and cable assembly to wiper and test. If wiper operates, switch and cable assembly must be replaced.

Cause: Defective motor.

Remedy: Test motor by connecting the red and the green motor lead wires to one terminal of a 6-volt storage battery, and the brown lead to the other battery terminal. If the motor does not run, replace with a new unit. If the motor operates, check for dead spots in the motor. To do this, detach the motor from the housing. Place a screwdriver in the slot in the motor drive shaft and, while the motor is connected to the battery, allow the drive shaft to revolve very slowly until it has made at least one complete revolution. If a dead spot is found, a new motor must be installed.

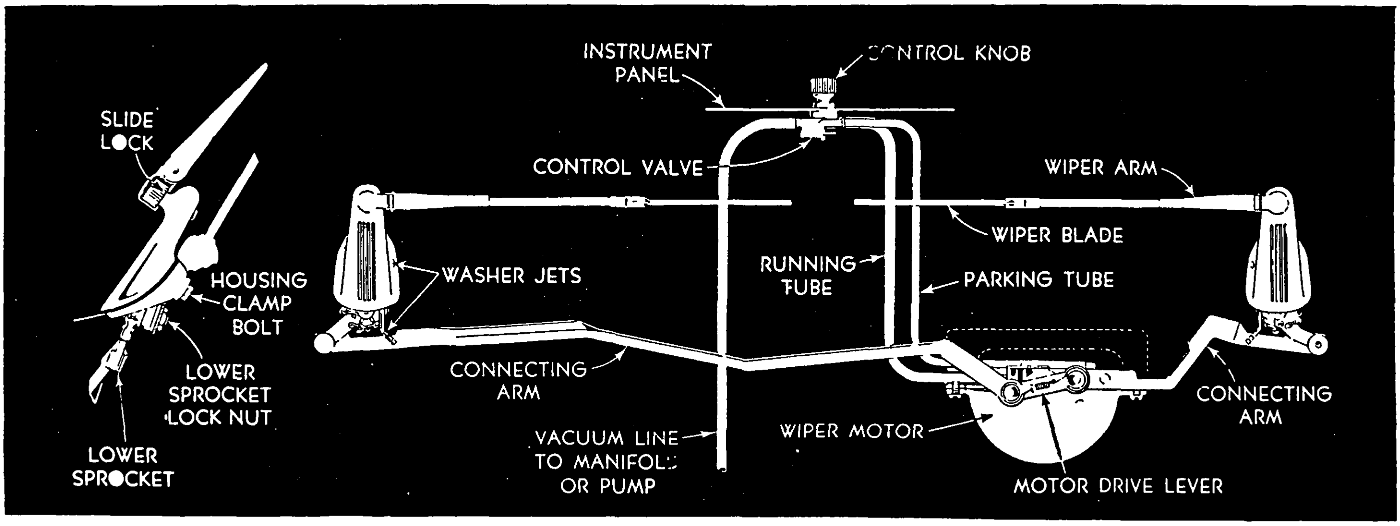


Fig. 3 Trico vacuum wiper operated with remote control valve. Side view of housing shown at 1 ft

TRICO VACUUM

Fig. 3. These wipers consist of vacuum-operated motor connected to one or two wiper blades through connecting arms and chain driven pivots. The vacuum for the motor is obtained either from the intake manifold or a vacuum pump built into the fuel pump. In the motor is a single piston upon which the drive lever is mounted. The vacuum is directed to alternate sides of the piston to move it back and forth by a kicker valve which is mounted on the piston shaft.

A new remote control valve used on late production units, utilizes three tube outlets. One tube leads to the intake manifold and the other two to the wiper motor. The tubes to the wiper are two sizes. The larger tube for use when running and the smaller tube for use when parked. To operate this wiper, the control is turned in exactly the same manner as the direct type used on other models. Movement of the knob regulates the flow of air to the wiper and provides for a wider range of speed adjustment than obtained in some direct or straight mechanical types. It also permits positioning of the control several inches or feet away from the wiper motor without sacrificing the positive blade parking feature. This positive parking is accomplisshed by means of a differential valve built into the motor cover. When the control valve is turned to the "off" position, it changes the course of the vacuum from the running line to the parking line and causes the differential valve of the motor to close off the running port, thus placing full vacuum on the parking piston.

Some remote control governors include a built-in governor which provides for more uniform speed of the wiper. With this type, the valve stem is pulled out to turn on the wiper, pushed in to shut it to parking position and turned to regulate the speed.

The Snap-On-Type of wiper arm attachment insures positive positioning on the shaft and simplifies the installation. On earlier wipers the arm was held to the shaft by means of a nut. The new design embodies a serrated shaft with matching serrations in the arm head. The attachment is made by simply flexing the arm at the hinge and pushing it onto the shaft and allowing the locking finger to extend back of the serrated section to prevent the arm from coming off. It also permits quick repositioning on the windshield when necessary. To change the position of the arm it is necessary only to flex it at the hinge so as to release the finger lock and pull the arm off. Then swing the arm to the new position on the glass and slip it back on to the shaft.

The motor is sealed with grease when manufactured and should require no further lubrication. The brass bearing at the driving end of the motor shaft is lubricated with the motor and requires no further attention. The pivot shaft and connecting arm joints are fitted with oiled felts. To oil felts, remove wiper arms and blades and inject a little oil around each shaft at the joints.

Service: To check the vacuum line for leakage, disconnect the fitting at the manifold, slip the hose from the wiper and stop up one end of the tube by holding the thumb over it. Blow cigaret smoke into the other end of the tube. Smoke will appear at any point in the hose where there is leakage. If the hose is in good condition, see that all connections are tight. Inspect the line to make sure that the tube is not pinched or kinked and that it is not plugged. Oil soaked, porus or hose which is defective from any other cause should be replaced. The hose should be kept away from the exhaust manifold or excessive heat from any other source. See that the tubing does not come in contact with moving parts of the engine or the wiper, for it might cause wear or an unpleasant rattle.

If the vacuum line is connected to a vacuum pump, test for a leaky diaphragm. With the engine running, slip the hose from the wiper motor and place your thumb over the end of the hose. If the diaphragm is okeh, a steady suction will be felt. If a pulsation is felt or if there is no suction at all, and the line is not plugged or does not leak, it indicates a leaky pump diaphragm which should be replaced.

In some cases the fitting screwed into the intake manifold may become clogged with carbon. When this occurs, remove the fitting and scrape the carbon from the inner edge of the hole.

To check the operation of the wiper motor, disconnect the linkage from the motor drive lever. Now, with the engine running, turn on the wiper. If the motor does not operate, it should be replaced. If the motor operates satisfactorily, try operating the blades by moving the connecting arms by hand. First operate one side and then the other to see that there is no binding or interference with other parts of the vehicle under the instrument panel. See that the motor is properly centered on the mounting bracket and that it has not shifted to an angle which might put a bind on the connecting arm where it attaches to the motor drive lever. The driven end of the connecting arm is fitted with a ball joint which helps to compensate for any misalignment in the installation but the end which is attached to the stud on the motor lever is snug fitting and any undue twist or bend here may cause a bind which will slow down the motor.

The chain drive transmission housing clamping bolt must be tightened firmly to prevent any looseness or rocking of the casting during wiper operation. This will also insure against possible leakage around the gasket. To test the chain for looseness, stop the engine while the wiper is running. Then move the blades by hand to their vertical position on the windshield. Hold the connecting arm under the cowl firmly and move the wiper arm from side to side slightly. If correct, the end of the blade should not travel more than approximately 1½ inches before power is transmitted to the connecting arm. If the wiper arm can be moved more than this, it indicates that the chain is loose. The chain can be tightened by loosening the lower sprocket lock nut. Then pull down the lower sprocket, and while holding it taut,

tighten the lock nut securely. In some cases it may be necessary to remove the linkage from the vehicle to do this.

The early type of Snap-On-Arm included a separate wirelock. When this type is used see that the end of the wire is hooked firmly over the back of the driving burr. See that the arm travel does not permit pounding of the blade against the windshield at either side. If the blades do not park properly, or if the cleaning arc is not central, remove the wiper arms from their shafts. With the engine running, turn off the wiper to bring the shafts into their parked position. Then, place arms in their parked position on the windshield and slip them over the shafts as already described. If the blade has excessive travel after doing this it indicates that the wiper motor is off center. To correct this condition, the motor mounting screws should be loosened and the motor shifted slightly to the right or left until the blade is equalized on both sides of the windshield. Then tighten the mounting screws securely. Further reduction of the blade sweep can be accomplished by changing the valve kicker in the motor. Also see that the arm clip is not bent and that the blade flops back and forth at each stroke of the arm so that the arm will pull, not push, the wiper blade.

BODY SERVICE

THE THREE basic steps in body repair are: aligning and roughing, bumping and metal finishing. Tools for these jobs range from simple hand tools to a wide variety of power equipment. Skill with tools, however, is not sufficient to guarantee a good body repair job. Some of the characteristcs of the steel in today's cars should be understood in order to acquire the know-how of reworking it.

Body panels and fenders are formed of deep drawn steels on dies. Giant presses shape and stretch the flat steel to conform with the dies. The forming dies set up stresses within the metal which tend to hold the panel in shape.

Some body panels, if pushed slightly by hand, will spring back into shape when the pressure is removed. If the panel is pushed too far, new strains will be set up within the panel. These may form a locking point or ridge around or beyond the area of pressure and will tend to prevent the metal from springing back into shape.

In reshaping the metal the most important thing to remember is to unlock the strains and unroll the damaged metal, beginning with the furthermost transmitted damage and working toward the area of direct impact. *In other words, start the repairs where the damage stopped* Any impact to the body or fender sheet metal will set up damage strains. If the force of the impact is such that it pushes the metal beyond its elastic limit, locking ridges or buckles may extend around or beyond the area of collision.

Before starting the actual work, analyze the over-all damage to the car and try to visualize the direction and force of the impacts. Each impact sets up strains which must be traced as far as they extend. For example, a car that has rolled over while in forward motion might reveal sideward strain, caused by rolling; backward strain from forward motion; downward strain, resulting from falling. Further inspection might show that sideward strain buckled the center of the roof; backward strain transmitted buckles toward the rear; downward strain to the top caused the quarter panel to bulge outward. This indirect damage could be traced to the direct impacts.

After analyzing the damaged sheet metal check the chassis frame for "squareness" and "sag." The body cannot be aligned to a distorted frame.

Damaged doors should be checked to determine whether they are suitable for use as templates when aligning a distorted body assembly. The condition of the door and quarter window openings and glass also should be inspected to see whether it is such that they can be used in checking corrections to the body shell.

When a car shows evidence of related direct impacts the body shell must be examined to determine the sequence in which the impacts occurred. Similarly, relationship between all indirect damage and the direct impacts causing them should be established. Analysis of damage caused by one car sideswiping another might show evidence of impacts caused by bumper, fender, hub cap and wheel of the colliding car.

ALIGNING AND ROUGHING

The damaged body, particularly the reinforced framework, is restored through aligning and roughing operations, but reshaping must be done without additional stretching or buckling of the metal. This requires knowledge of the order in which

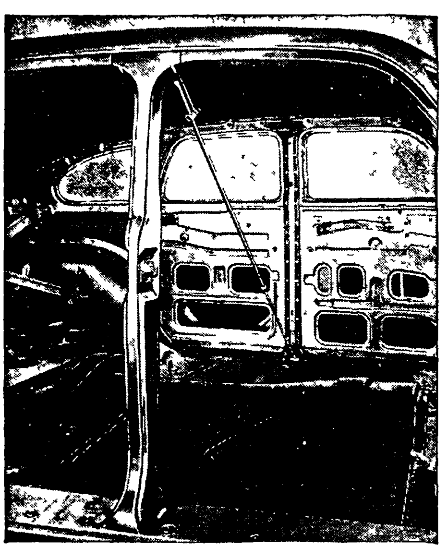


Fig. 1 Checking alignment across center section of body

Fig. 2 Checking alignment of front section of body

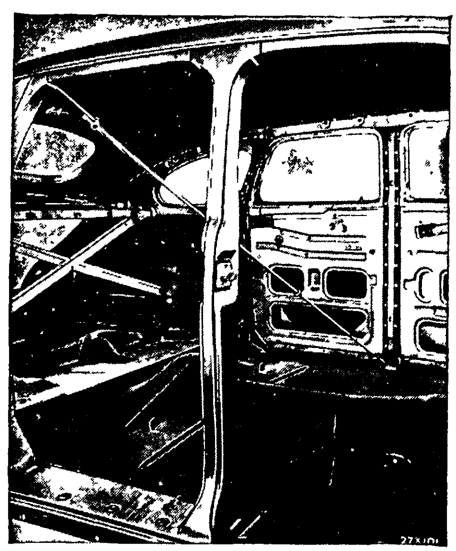


Fig. 3 Cross checking of rear section of body

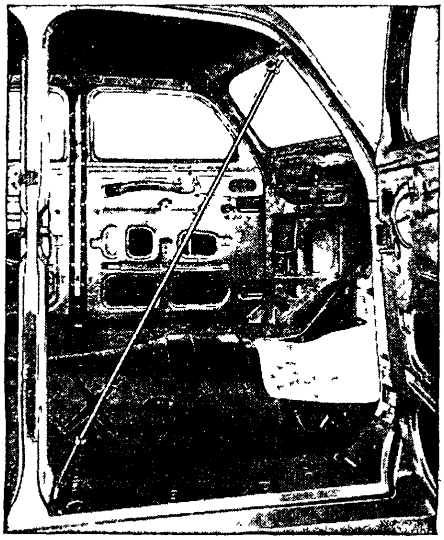


Fig. 4 Ch cking door opening

Fig. 5 Aligning front section of body

Fig. 7 Aligning rear secti n f b dy

the buckles occurred, metal structure, body construction and tool application.

After the order in which the buckles occurred has been determined they should be removed in the reverse order. In this way strains, set up and extended by previously formed buckles, will be relieved. All of the damage caused by each impact should be corrected in a single aligning and roughing operation. Bumping is usually required in both aligning and roughing and metal finishing operations.

Metal Structure — Metal structure and the nature of each dent should be considered before starting repairs. Bending or buckling sheet metal stiffens it at the point of bend. The sharper the bend or buckle the greater the stiffness. Dents or depressions are usually locked by buckles, ridges or channels located at the innermost point of the dent, at the edge of the caved-in section, or extending beyond the immediate area of impact.

A depression in a low crown panel which springs back into shape when pressure is removed is known as an oil-can dent. Some minor dents, other than the oil-can type, will spring back into shape when their slight locking ridge is worked.

A buckle with a single locking point or area of stiffness at the point of direct impact can be roughed out by pressure applied below the direct impact damage.

If a buckle has two locking points or areas of stiffness and a sharp or angular ridge, pressure should be applied alternately to the direct and indirect damage until the entire area has been gradually raised. The depression may be locked at the point of impact and also at the end of the angular ridge which carried the force to an indirect part and set up a second locking point.

If a buckle has several locking points or areas of stiffness with sharp angular ridges, low pressure should be maintained below the direct impact. At the same time pressure should be used alternately along the inclined ridges. This operation unlocks all ridges or areas of stiffness simultaneously.

In die forming, certain sections of

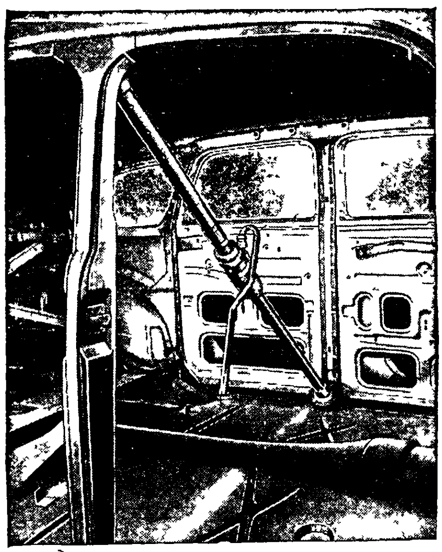


Fig. 6 Aligning center section of body

panels, such as moldings, high crown areas or roof rails, are rendered non-elastic. When damage occurs to these areas, pressure should be maintained at the center of the dent and at the same time applied to both ridges and slopes of the buckle.

Body Construction—Sections of the body panel reinforced by inner panels, braces, moldings and flanges are the most difficult to repair because they are the most rigid. Pressure must be applied first to the locking point of the buckle in the reinforced section, even if buckles in the surrounding open or non-reinforced panel are deeper.

Sufficient pressure should be used against the reinforcement to place a draw on the sections with less resistance. With the help of the draw, the buckles in the open panel will be diminished by raising the dent and lowering the ridges. Moving the pressure, as required, along the damaged area will cor-

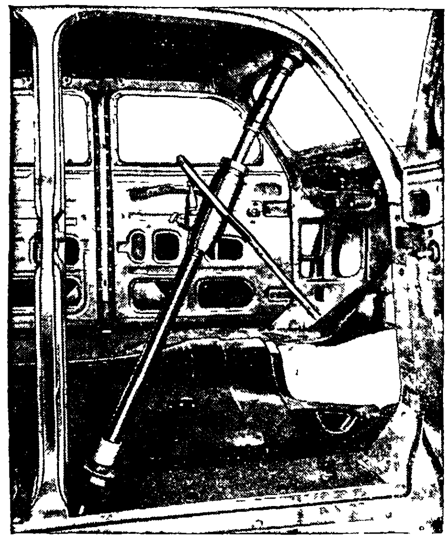


Fig. 8 Aligning d or op ning

rect both the open panel and the reinforcement without stretching.

Tool Application — In aligning and roughing operations the pressure should be spread over an area large enough to avoid tool marks. The stiffness of the buckle determines the size of the area over which the pressure should be distributed. A piece of wood under the tool head helps spread the pressure when using power tools. With a hammer, broad spoons can be used to good advantage. Spoons are also available for use with power equipment. They help in reaching tight spots and also in spreading the pressure.

Slight low spots can be lifted by striking the underside of the direct impact with the broad face of a dolly block. Pointed ends of files and pick hammers can also be used on very small dents.

Stiffer buckles in some cases can be removed by spring hammering. If the face of a broad body spoon is laid against

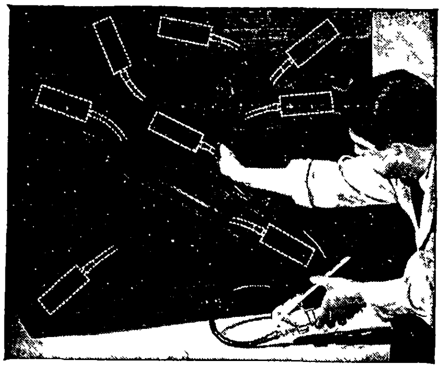


Fig. 9 Variety of inaccessibl places where hydraulic expanding wedge can be used

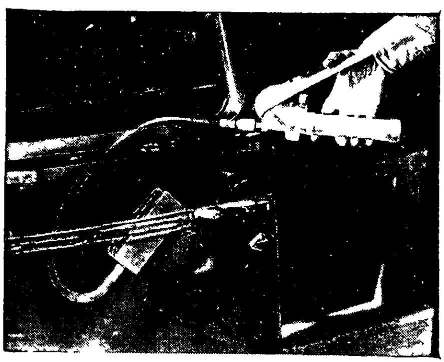


Fig. 10 Hydraulic expanding wedge used in tight spots

Fig. 11 R shaping c ntour with d r straight n r

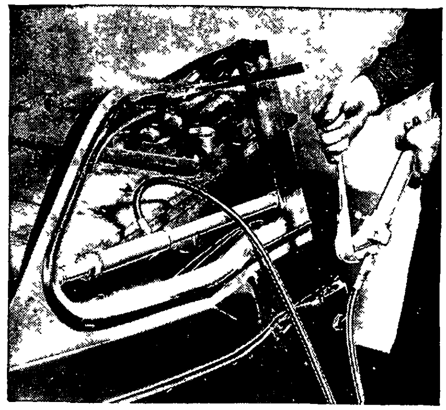


Fig. 12 Straightening upper section of door

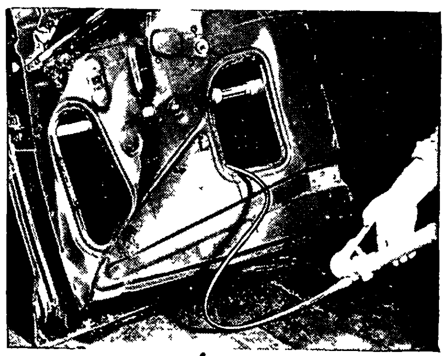


Fig. 13 Straightening lower section of door

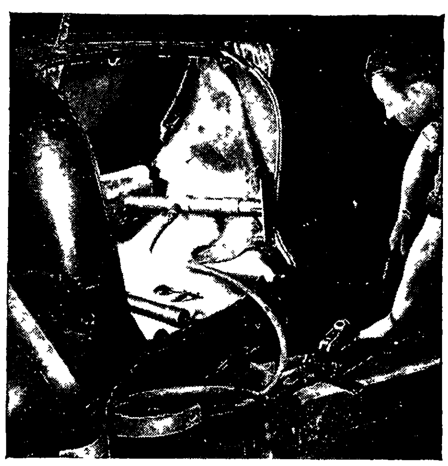


Fig. 14 Straightening trunk panel

the ridge or underside of a depression and struck with a hammer, the spoon spreads the force of the blow. No backing tool or dolly is needed for this kind of work.

When greater pressure is needed, a jack can be employed. A jack is one of the most common tools in the shop but it must be remembered that it exerts equal pressure in both directions. Therefore, the body should be protected from damage by the base of the jack, especially when very stiff buckles are being worked. Wood blocks under the base of the jack protect the body from damage. They can also be used to help spread the pressure exerted by the head of the jack. Similarly, rubber heads spread pressure against irregular surfaces, and spoon-type heads can be used on high crown surfaces or tight spots.

The jack should be set up with suitable attachments so that it can exert force against the damaged framework. This force should be applied in the direction opposite to that from which the damage came, but the bent framework should not be pushed or pulled all the way back into place. The pressure exerted by the jack should be increased gradually, when bumping or spring-hammering the locking points unrolls the damage in the panel.

Two jacks may be required to apply pressure jointly to direct and indirect buckles resulting from the same impact In some cases it may be necessary to change the tool setups so that progressive pressure can be applied in varying angles to unroll the damage.

REPAIR PROCEDURE

Badly damaged doors are best realigned and roughed by removal from the car. Trim and glass usually can be more conveniently disassembled while the door is on the car.

After removal of the door, the nature of the damage to be corrected will dictate the tool setups. Many straightening jobs require that the door be worked on the bench or floor. The use of wooden beams and C clamps greatly facilitates the correction work on some jobs and can be used to exert continual pressure while damage strains are being relieved.

Door straightening jigs have many applications while the door is on either the car or bench. Small jacks can be installed behind the door reinforcing panels to exert lateral pressure to align the forward edge of the door to the rear edge. Similarly, jacks can be used to advantage in reshaping door window openings with either pushing or pulling attachments. Distorted flanges extending around the outer edge of the door often can be corrected by using either a pull jack or a bending iron, spring hammering or a combination of the three operations.

Pressure applied by C clamps or jack against stiff misalignments should be just enough to put a draw on the buckles. Spring hammering or the use of a bending iron can then be resorted to in relieving the strains in the small buckles.

If a like make and model car is available, the damaged door can be fitted in the door opening of the undamaged body to facilitate further correction and closer alignment. After the door is restored to proper shape and aligned it can be used as a template in checking the progress of the corrections to the body. Final metal finishing of the doors will not be done until the body job is finished and the doors fitted.

Alignment and roughing of the body shell can proceed after damaged doors are restored to shape. Removal of required trim, hardware and glass allows access to the damaged metal. When extensive realigning operations are required, the windshield and rear window should be removed to prevent cracking the glass. It is a good idea to braze a brace in the center of the opening to

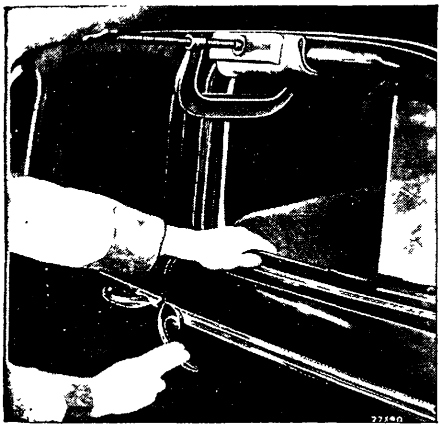


Fig. 15 Adjusting top of door

maintain its alignment while the body is being reshaped.

Tool setups should follow the reverse order to that in which the direct and indirect impacts occurred.

A tram or telescopic aligning rod should be used to check the squareness and relative alignment of the body. Accurately located body bolts establish good checking points. When the realigning operation is completed, apply slight heat and light blows with a hammer to known points of strain. This will normalize the repaired section and prevent existing strains from drawing the body out of alignment.

BUMPING

Bumping reshapes panels or fenders to their original form and is done with either a dolly block and hammer, a hammer and spoon or a power tool. The dolly block should be shaped the same as the undamaged panel as it takes the place of the forming die. The operation is carried out from the edges to the center of the buckled area.

The undamaged section of a panel or fender can be used as a guide in restoring the original contour. Constant checking by hand or sighting is required. As the damaged areas are being reformed from two sides, contours should be watched carefully so they will meet squarely. When slight dents leave the finish unmarred, the use of chamois over the hammer and dolly permit removing the dent without need of refinishing.

METAL FINISHING

Metal finishing is the final smoothing of damages before painting. A number of operations are involved, including dinging, pulling out dents, solder filling, heat shrinking, filling and grinding.

Small dents are lifted by dinging when there are no obstructions or reinforcements on the inner side of panel. A pick hammer or pointed end of a file can be used. Dinging, like bumping, is begun at the edge and worked toward the center of the damage. Here, too, the corrections are gauged by the undamaged area.

To avoid removing trim it is sometimes more practical to pull out minor dents with a looped bar of solder sweated to the low spot and hammered upward.

If minor low spots cannot be dinged out, they can be solder filled. The metal is sanded until it is entirely cleaned and then tinned. In tinning a flux is applied to the bare steel and hot solder is spread over the area being treated until the metals coalesce or bind together. On large dents a torch is used to keep the solder plastic while it is being shaped with a wooden paddle. A soldering iron imparts sufficient heat for small fills. Ridges or small bumps can be recontoured by covering with solder if they cannot be flattened by bumping or dinging.

Heat shrinkage is used to get rid of excess metal caused by stretching. The metal should be accumulated into a high spot. Cherry red heat is applied to the spot. When the metal is malleable, blows of a mallet or a broad-faced hammer will flatten the lump, and the metal is compressed within the hot or heated area. A sponge soaked in cold water should be applied to the hot metal, which causes it to contract quickly. The process is repeated as often as required to shrink the metal fully.

Filing smooths out the dinged and filled areas and marks the high and low spots. The file should be used at an angle rather than straight up and down and pushed equally hard with both hands to follow up the contour of the panel. Short, choppy strokes should never be used and only a mimimum amount of metal taken off. To prevent metal shaving sticking in the teeth of the file, turpentine should be used on the surface and on the file. Filing should be followed by sanding.

Irregularities may be located by rubbing the flat of the hand, not merely the fingertips, lengthwise over the damaged area. Larger panel areas are most efficiently finished with a power sander.

PAINTING

The three types of paint jobs are recoloring, standard refinish and complete basic refinish. The recolor job is the cheapest and one which no reputable shop should undertake and no car owner should accept if he wants the paint to stand up. It consists merely of spraying one or two coats of color directly on the old finish with not much time given to cleaning and preparation.

The standard refinish, applied over the old paint, includes a thorough sanding of the old finish, feather edging the rusted areas, spraying on a primer and surfacer and two to four coats of color. A complete basic refinishing job includes removing all the old paint by chemical solvents or sand blasting, then sanding, cleaning, priming, surfacing and painting.

PREPARATION OF SURFACE

One of the most important steps in insuring a good finish is the preparation of the surface, which should start with washing, steaming or chemically cleaning the entire car and running gear. Chrome molding or trim can then be removed.

Most cars brought in for repainting require some body work, whether it be fender straightening or replacing or patching panels eaten away by rust. Where body work has been done metal finishing results in baring the metal.

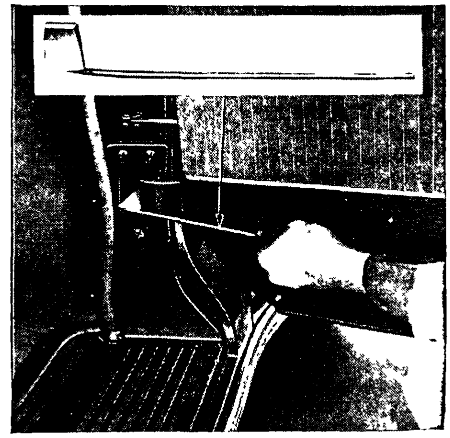


Fig. 16 Adjusting door closer t b dy. Insert shows wedge-shaped t l which can easily be made of any hard material

Bared metal must be thoroughly smoothed.

In metal finishing it is poor practice to depend too much on the disc sander to level damaged surfaces. The sanding may make the metal so thin that other troubles may develop. The good metal man first prepares the surface for painting by restoring the original contour with as few remaining dents or high spots as possible.

All surfaces to be painted should be sanded either by hand or machine. Sanding smooths the bare metal sections and roughs up the old paint so that the new finish will cling readily. All rust spots should be thoroughly cleaned, with special attention to the moldings, joints between the fender and body, bottom of the doors and edges of the hood, fenders and trunk lid.

The margins between the old paint and the bared or metal finished areas should be sanded to a smooth beveled edge. This operation is called feather edging. An electric or air driven reciprocating or vibrating sander is a timesaver in feathering out edges of the old paint where the disc sander has already been used. The applications of these machines are, however, not confined to feather edging.

Dust and abrasive particles resulting from sanding should be removed with compressed air. It is also a good plan to blow out any dust out of the inside of the body, as the doors will be opened later to spray paint around the inside door edges and door opening.

Any surfaces which are not to be painted should be protected from the spray by masking. These include such things as glass and running boards. In sectional or spot refinishing on such units as door panels the adjoining panel is masked. Similarly, the trim and moldings inside the door and door openings are covered, as the doors will be opened to apply a matching color on the edges or opening.

The bare metal surfaces should be gone over with a good rust solvent to remove invisible rust, which remains even on freshly ground surfaces. The solvent also prevents formation of new rust before the prime coat is applied and helps the primer to adhere to the metal. All the

surfaces to be repainted should be treated with a solvent to remove grease and dust particles. Either a commercial product or a 50-50 mixture of oleum spirits or gasoline and thinner may be used. This also helps the new paint to adhere. The cleaning agent should be wiped off with a clean dry cloth as it is applied. When using a commercial solvent follow the manufacturer's directions.

PREPARATION FOR PAINT

The primer coat is then sprayed on all bare metal surfaces. Its function is to adhere to the metal and form a base for the surfacer and color coats. Any delay between the completion of the grinding and the application of the primer gives an opportunity for the formation of rust on the bared surfaces. An immediate application of the primer coat also saves the metal from contact with oil, grease, dust and even perspiration from the hands, all of which make for poor adhesion. Lacquer primers merely coat over the oil or perspiration. Oil base primers can absorb a little oil but not sufficient to insure a good, lasting paint job.

Glazing material may then be applied to the sections that have been metal finished. The glaze is worked down into a thin coat with a piece of celluloid. If there are any scratches left by the disc sander the glaze fills them up, but care should be taken not to put the glaze on too thick. A thick glaze will be brittle and will crack easily. After the glaze is thoroughly dry it is sanded smooth. Some shops do not use a glazing coat and depend more or less on the surfacer or undercoat to cover any imperfections.

One or two coats of surfacer are sprayed over the entire area to be repainted. When dry it is either wet- or dry-sanded, thus providing a smooth base for the colór coats.

Wet sanding should begin at the top of the car so that dirty water will not drip over the cleaned area. Excess water and grit are removed with a rubber squeegee and the surface dried with a clean cloth.

All surfaces should be completely smooth and dry before the color coats are applied. Special care should be taken to remove any water remaining from wet sanding around the fender body joints and doors and all other cracks and edges.

SPRAYING

Matching color is important when the car is being partially refinished. It is essential that the painter be able to mix the color, as long exposure to weather sometimes causes original paint to fade. The original prepared paints may have to be blended to suit the job.

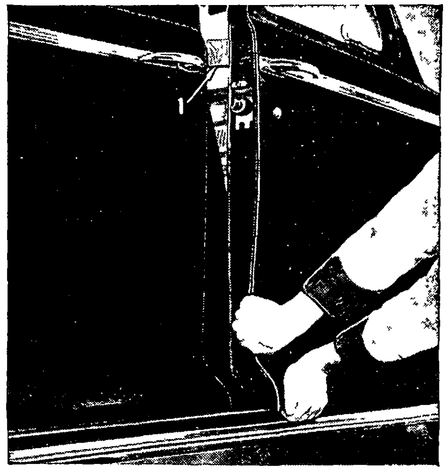


Fig. 17 Adjusting bottom of door

When applying color, start at the top and, with a free arm motion, keep the gun moving parallel to the surface of the panel. If the gun is held at an angle or moved in an arc part of the spray will be farther from the surface. The spray that travels the greater distance will be drier than that traveling the shorter distance, thus all of the paint applied will not be of the same texture. In like manner the nozzle of the gun should always be at the same distance from the panel. A good working distance is between 6 and 8 in. The ends of the strokes are feathered out by triggering.

If the panels are large they should be sprayed in sections. The color on each succeeding section must be sprayed on before the previously painted surface has dried. Each new stroke of the gun should overlap the previous stroke. Uniform color thickness is achieved by spraying crosswise and lengthwise. Spraying continues down the side of the car from top to bottom. In spot refinishing the spray should be applied beyond the surfaced area so that the new color will blend with the old paint. Successive color coats are applied in the same manner. Detail finishing touches such as door edges, openings and the like should be carefully checked. When all the color coats have been applied and the paint is throughly dry the surface should be rubbed with a compound and power polished. A few strokes of a clean soft cloth will then bring out the full luster.

SPRAYING FAULTS

ORANGE PEEL EFFECT results from (1) holding the gun too close or too far from the surface. When the gun is too close the air ripples the paint surface. If it is too far away the spray has a chance to dry somewhat before it reaches the surface. (2) Insufficient atomization. (3) Incorrect or cheap thinner that contains a high per cent of low boiling or poor solvents. (4) Material not thoroughly dissolved or agitated. (5) Synthetics may be affected by excessively low humidity. Lacquers and synthetics may also be affected by drafts in the finishing room.

STREAKS are caused by (1) tipping the gun. (2) Dirt or burrs on the air cap or fluid tip causing heavy top or bottom pattern. (3) A split spray pattern causing more material to be applied at the top and bottom than in the center.

RUNS AND SAGS are due to (1) too much material applied to the surface or the use of too much thinner. (2) Gun tilted at an angle. (3) Gun held too close.

MIST OR FOG may be caused by (1) over-atomization resulting from too high an atomizing air pressure. (2) Wrong air cap or fluid tip for material being used. (3) Too low a fluid pressure. (4) Improper use of gun, that is, incorrect stroking or the gun being held too far from the surface.

FINISH DEFECTS

Painting should not be done in a shop where grinding, sanding or other dust-forming operations are being carried on. Good refinishing demands a clean, well lighted, well ventilated, dust-free area. A spray booth which may be installed in a shop provides a section free from vapors and dust.

Other factors which may contribute to a faulty finish are (1) failure to completely eradicate rust spots. (2) Imperfect feather edging. (3) Too much time lapse between completion of grinding and application of primer coat. (4) Too thick a coat of glaze or poor quality glaze. (5) Imperfect cleaning when refinishing over old paint. (6) Failure to use an undercoat between old and new coat. (7) Presence of moisture or dampness on the surface when finishing material is applied.

High grade material, care and skill in every phase of the work will insure a job comparable to the original factory finish.

BUICK	
1940 41	Vacuum
1942	Electric
1946 52	Hydro Lectric*
CADILLAC	
1940 41	Vacuum
1942	Electric
1946 52	Hydro Lectric*
CHEVROLET	
1940 41	Vacuum
1942	Electric
1946 50	Hydro Lectric*
1951 52	Hydro Lectric†
CHRYSLER	
1940	Vacuum
1941 48	Electric
1949 52	Hydro Lectric*
DE SOTO	
1940	Vacuum
1941 48	Electric
1949 52	Hydro Lectric*
DODGE	
1940	Vacuum
1941 48	Electric
1949 52	Hydro Lectric*
FORD	
1941 48	Electric
1949 52	Hydro Lectric*
FRAZER	
1949 51	Hydro Lectric*
HUDSON	
1941 47	Hudson Hydraulic
1948 52	Hydro Lectric*
LA SALLE	
1940	Vacuum
LINCOLN	
1940	Vacuum
1941 48	Electric
1949 52	Hydro Lectric*
MERCURY	
1940	Vacuum
1941 48	Electr c
1949 52	Hydro Lectric*
NASH	
1941	Vacuum
1948	Hydro Lectric*
1950 52 Rambler	Nash Electric
OLDSMOBILE	
1940 41	Vacuum
1942	Electric
1946 50	Hydro Lectric*
1951 52 Super 88	Hydro Lectric†
1951 52 98	Hydro Lectric*
PACKARD	
1941	Vacuum
1948 52	Hydro Lectric*
PLYMOUTH	
1939 42	Vacuum
1946 50 Deluxe	Electric
1946 50 Special Deluxe	Hydro Lectric*
1951 52	Hydro Lectric*
PONTIAC	
1940 41	Vacuum
1942	Electric
1946 50	Hydro Lectric*
1951 52	Hydro Lectric†
STUDEBAKER	
1947 52	Electric

*Type with fluid system vented to the atmosphere
†Type with sealed in fluid system

VACUUM TYPE

Convertible coupe tops required a slight modification of linkage to accommodate the vacuum operating mechanism, Fig 1 Like some windshield wipers they utilize the vacuum created in the engine intake manifold when the power plant is running

The top is raised and lowered by pistons enclosed in two vacuum cylinders on each side of the car The cylinders are two-way types with vacuum lines above and below the single piston Both cylinders are connected to a two-way vacuum control valve on the left or driver's side of the dashboard

The control valve on the dashboard incorporates 'Up,' 'Down' and 'Neutral' positions A spring catch or centering device should return the control to neutral position When the valve is in the 'Up' position it opens the vacuum line to the top connections of the power cylinders, causing the pistons to rise and push up the top The 'Down' position of the control valves directs vacuum to lower end of power cylinder and draws the top down

Power tops should not be operated while the car is in motion and their control valves should be held in operating position until the opening or closing cycle is completed *On vacuum types it is necessary to have the engine running,* preferably at idling speed to develop greatest vacuum

On lowering all power-operated tops it is necessary to give the top an initial lift after unlocking toggle catches This releases the top from the windshield header dowels Similarly it is necessary to pull the top down on the dowels in the last inch or two of the closing operation

Vacuum Top Service—If the automatic vacuum top fails to operate properly with the engine idling the first thing to do is to check the system for vacuum leaks The dash control valves should operate freely and without leaks

Inspect the assembly of valve to determine if vents in the plunger or rotor line up with the holes or orifices leading to intake manifold and power cylinders Use fiber grease between rotor and valve body when reassembling to provide a good vacuum seal

The lines from the intake manifold and those going to the power cylinders should then be checked to insure that they are open and free of kinks or leaks Air pressure can be used to determine whether lines are clear

Comparison of vacuum gauge readings at the manifold and those at the ends of the lines at the power unit provide another check Attach the gauge alternately to each of the tubes entering the power cylinders When each tube is being checked the one on the opposite cylinder should be plugged to minimize leakage

Each vacuum cylinder should be checked for leaks and binding of the piston rod The piston rod seal at the top of the cylinder also should be inspected for leaks When the top is up, operation of the power units can be observed by disconnecting the piston rod from the top bracket Application of vacuum to the power units then should result in both piston rods moving up and down

If the pistons are found to be tight, detach the upper hose connection and hold a 1-oz glass full of neatsfoot oil and kerosene (50-50 solution) to that opening of the cylinders When the piston is operated downward it will draw in the lubricant

Piston leaks can be checked by disconnecting the piston rod and drawing it up, with the control valve set in the down position, or down with the control set in the up position The engine should not be running when checking piston leaks

Other things to be considered in an over-all check are tightness of the vacuum line connection and the ability of the top folding arms and bows to work freely without binding

One of the most important things to check is the bind-free movement of the piston rods in the power cylinder The power unit assemblies should be directly in line and able to rock, otherwise a bind may exist at some point of the piston's opening or closing stroke Lack of free base movement and the possibility of a resulting bind may ruin the piston rod seal and cause a leak

The power unit removal and replacement procedure are quite evident when the side trim panels in the rumble seat or rear seat of club convertibles are removed Extreme care should be used in handling vacuum cylinders Dents, kinks or bends usually result in a binding or inoperative piston.

Other precautionary installation measures include the correct position of the piston rod end to make sure it clears obstructions and to insure a direct action from cylinder mounting bolt to the piston rod to top connection Upper and lower hoses then can be securely attached to the cylinder If it is necessary to service the dash control valve it is a good plan to mark one hose to make certain it is reattached to the correct outlet.

ELECTRIC TYPE

This mechanism consists of two reversible type electric motors driving spiral threaded operating shafts through a worm gear reduction drive, Fig 2

An internally threaded sleeve fitted over the upright spiral shaft moves up or down when the motors are started The sleeve is attached to the folding top levers which in turn prevent their rotation with the spiral

The electric motors and the direction of their rotation are controlled by push-button switches on the driver's side of the instrument panel The panel switches are wired to the electric motors All makes of cars use electric motors with their lift or power screws driven through a reduction gear case

There are, however, minor differences in wiring circuits or motor drives Con-

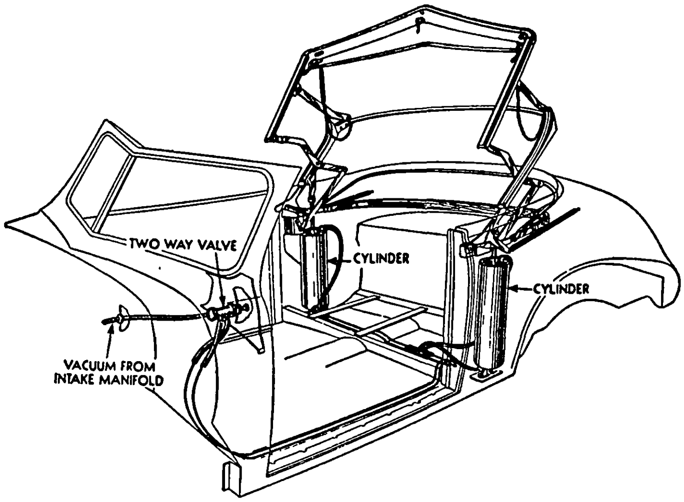


Fig. 1 Diagram of a vacuum operated top lift

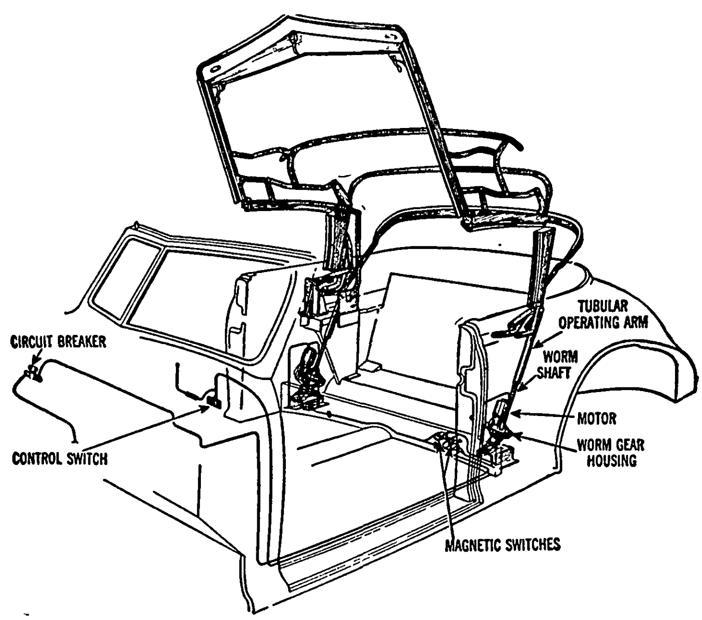


Fig. 2 Electric operat d t p

vertibles in Chrysler lines employ an automatic circuit-breaker and a differential relay in the circuit between switch and driving motors. The circuit-breaker opens the circuit when the mechanism reaches the limit of travel in either direction. The differential relay prevents damage to the top due to tilting in case one motor is loaded more than the other.

On General Motors cars the principal mechanical difference is the use of a spring-loaded centrifugal clutch between the motor and gear reduction case. The wiring circuit includes a circuit-breaker, 9-amp. fuse and two magnetic switches to control each motor.

On Ford, Mercury and Lincoln the electric top lift mechanism, like the vacuum units, is not rigidly mounted. This allows both motor and power shaft to move on their yoke or pivot mounting when the top is being opened or closed.

Mechanical Service — The folding arm assembly of the top should work freely when the operating or power screw is disconnected. The power screw also should operate easily and be free of distortion or bends.

Similarly the sleeve should operate freely on the screw. To check the operation of the screw disconnect the motor and turn the pinion shaft with a screwdriver.

On Ford, Mercury and Lincoln cars equipped with a horizontally positioned motor, a screwdriver can be inserted in the slotted end of the worm gear shaft. In this way the power shaft can be turned.

On General Motors cars, the clutch cup can be turned by hand when the motor is removed. On all units check entire assembly to determine if it is free to rock on the mounts or bases.

Removal and replacement of units requires taking off the side trim panel and in some cases necessitates removal of seat back as well as the rear seat. The top should be up when working on the unit. Of course the operation also requires removal of the wires from the motor. It is a good plan to use suitable identification on the wires to insure proper terminal positions when reinstalling unit.

Care should be used to make sure both sleeves or tubular lifts are installed in the same relative or synchronized position to obtain equal loads on both motors. This also assures equal thrust on both sides of the top when raising or lowering.

On General Motors convertibles a length adjustment is provided by turning the clutch hub between the motor and gear housing. This turns the power screw and aligns the sleeve hole with that in the top linkage.

Electric Circuit—The testing procedure is similar to that used on ordinary circuits. In most cases the ignition switch has to be turned on to bring in the top circuit. The dash control switch should be checked first, followed by an inspection of top circuit fuse. Loose connections, pinched wires and shorts should be checked.

On GM cars check the ground wire from the motor to the floor-pan mounting bracket. It should have a clean, tight ground connection. Another point to inspect is the metal cover of the solenoid switches under the rear seat. The forward edge of this cover might be grounded to the solenoid terminals or battery cable.

On Chrysler products the operation of the differential relay should be checked with the dash control switch in either up or down position. When the switch is in an operative position ground the differential relay terminals.

If the motors run, the relay is at fault. Take off the cover and check the relay points. Normally these points are closed. If it is necessary to hold the points closed to run the motors it indicates that one motor has a greater load and the relay is functioning properly. If points are pitted, they can be filed. If unit buzzes and does not stay open, the voltage coil is open.

The differential relay coils are wound in opposite directions so there is no magnetic flux present at equal motor currents. If there is a difference of 20-30 amp. draw between motors, the relay coil having the greatest amperage causes the points to open. The voltage coil then holds the points open until the dash control switch is turned off.

Solenoid switches or circuit-breakers should not be tampered with, as they are set in the factory and wiring trouble due to overloads may result.

HYDRO-LECTRIC SYSTEM

VENTED TYPE

The Hydro-Lectric system, Fig. 3, employs a single electric motor driven pump to deliver oil under pressure to the actuating cylinders. The windows and seats are held in any position by fluid trapped in the cylinders by a magnetically-operated valve, normally closed, in the bottom of each window and seat adjustment cylinder.

The cylinders for operating windows and front seat adjustment are one-way or single-acting types. Hydraulic pressure raises and holds windows and moves the seat forward. When pressure is relieved by opening the magnetic or solenoid valves, coil springs lower or retract the windows or move the seat back.

The convertible top operating cylinders are two-way or double-acting types using hydraulic pressure for both the lifting and lowering operations.

HYDRO-ELECTRIC PUMP

The electro-hydraulic power unit consists of a series wound electric motor, an internal gear rotary pump, a spring controlled maximum pressure relief valve, and a fluid reservoir. Electrically grounded to the body, it is located in the engine compartment.

The motor, pump and fluid reservoir are assembled as a single unit and a solenoid attached to the motor is the principal control. A circuit-breaker is

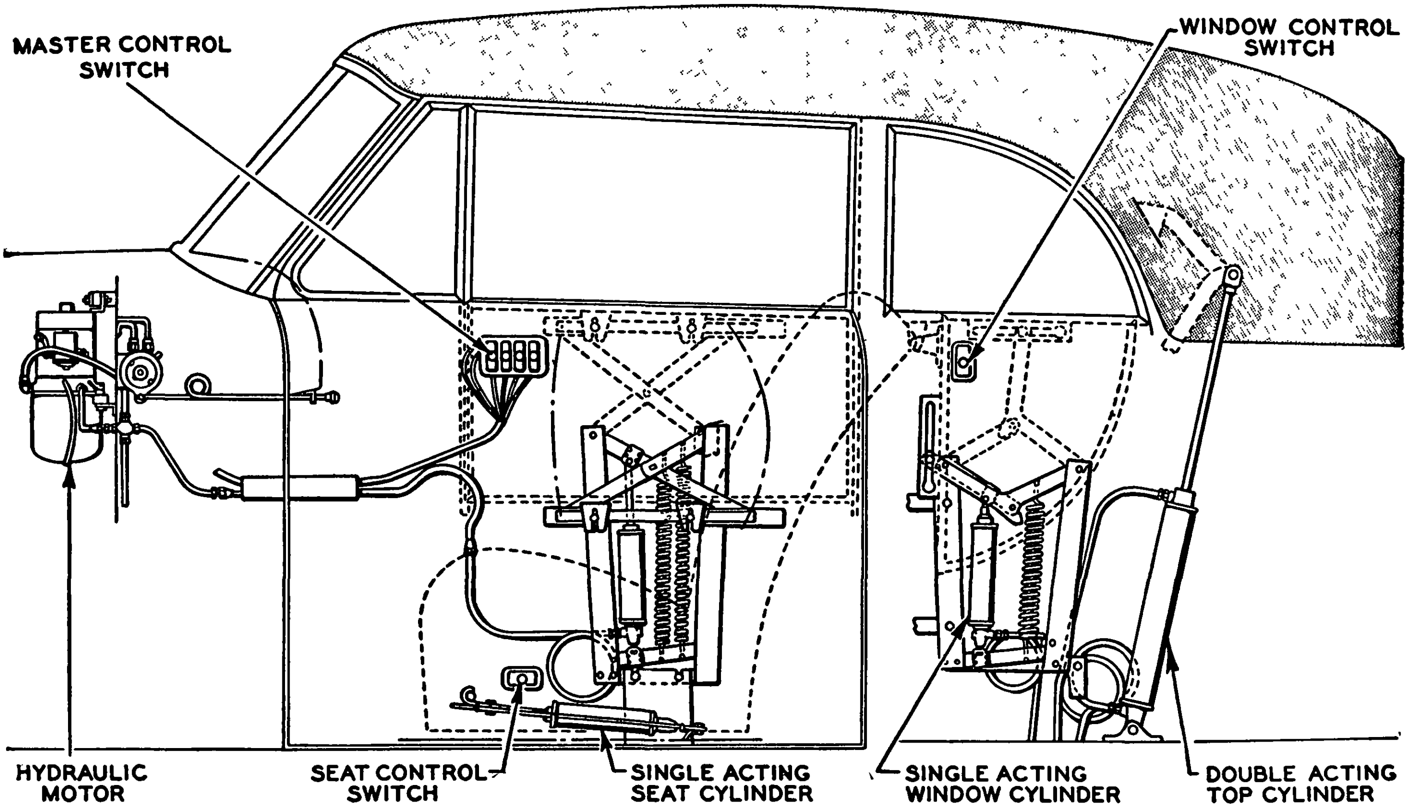


Fig. 3 Diagram showing inter-connected electric-hydraulic mechanism to operate windows, front seat and convertible top

wired to one of the solenoid terminals. The line pressure is controlled by a combination spring-loaded maximum pressure relief valve and a flow control valve of the piston type. The valve spring is adjusted to the maximum pressure and under no circumstances should it be changed to achieve higher pressure.

Two types of pumps have been used. The Dura Pump, which with modification has been used since 1946, and the Moraine Pump. The outward appearance of both pumps is similar. They differ, however, in the design of the internal pump gears and the relief and flow control valve. Their operation is similar and each may be identified by a name plate on the side of the motor.

PUMP SERVICE

TESTING PUMP PRESSURE—Faulty, erratic operation of the system may be due to lack of hydraulic fluid in the pump reservoir. For efficient operation, fluid level should be checked and additional fluid added as indicated by the fluid level markers on the side of the reservoir.

Foreign matter obstructing the pressure relief valve or internal gears of the pump may also cause low pressure, resulting in slow operation of the various hydraulic units.

Fig. 4 shows the method of testing the fluid pressure with a pressure gauge connected to the pressure port of the pump. Early pumps, such as used in 1946, operate at 210 pounds pressure maximum and are identified by a cadmium plated relief valve plug, while later pumps operate at 250 pounds mimimum to 260 pounds maximum and are identified by copper plated relief valve plugs.

MORAINE PUMP—To disassemble the pump, disconnect the battery cable and inspect the pressure relief valve by removing plug, stop washers and compression spring, Fig. 5. Pressure adjustments may be made at the valve by adding washers to increase pressure or removing washers to reduce pressure.

Remove the motor and pump assembly from its mounting after first removing the pump reservoir and wire bail. Check the reservoir gasket. Lay the motor and pump assembly on the bench and remove the five cover attaching screws and washers, "A", Fig. 6. Remove and inspect cover assembly for clogging and wear.

Fig. 7 shows the Moraine pump with pump cover removed showing the internal rotors or gears of the pump. With a small screwdriver or similar tool, carefully and uniformly pry up the outer rotor "A" of the pump. The inner rotor "B" may then be lifted off the pump motor shaft. Inspect these parts for wear as well as for presence of dirt or other foreign matter either on rotor parts or on the exposed face of the pump body assembly.

Check the ball and valve seat in the pump, Fig. 8. The ball and valve assembly may be removed by first removing the pressure relief plug, stop washers and spring. Then insert a hook type tool or stiff hooked wire into the pressure relief port and pull out the valve. Then tip the motor and pump over, allowing the ball to drop out. If the valve is seated too snugly in position, it may be removed by inserting the tool into the small hole at bottom of rotor gear well and pushing out.

To remove the pump body assembly from the motor, first place scribe marks across the junction of the motor housing and pump body assembly. Then loosen the two long bolts, "A" Fig 9, from the motor end of the unit and remove the pump body. Check motor shaft seal "B" and filter vent "C". The pump body assembly, less cover, is supplied as a unit.

Avoid disturbing armature of motor if possible. If armature is pulled out, the metal band at the motor head must be removed, the brushes separated, and the end of the armature shaft installed between brushes prior to reassembling pump.

To reassemble the pump, reverse the above procedure.

NOTE—Recent changes in thickness of inner and outer rotor gears have resulted in first and second type rotor assemblies which are not interchangeable. Corresponding rotor and pump body assemblies only may be used together. When ordering these parts, note the part number stamped on the identification plate attached to the outside of the motor housing. This number is the part number of the complete motor and pump assembly and will indicate whether it is a first or second type pump.

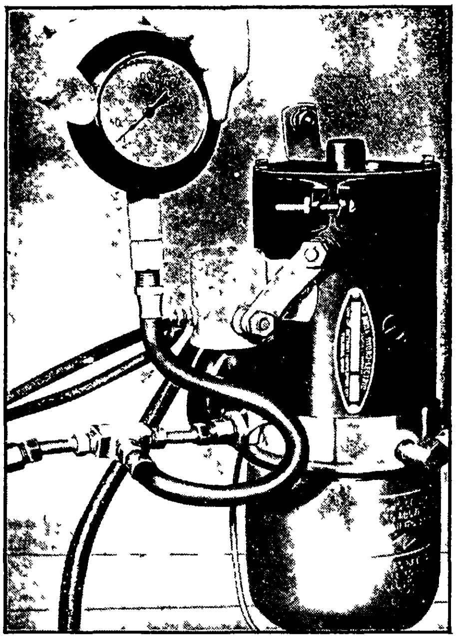


Fig. 4 M th d f checking pump pressure. Morain and Dura pumps

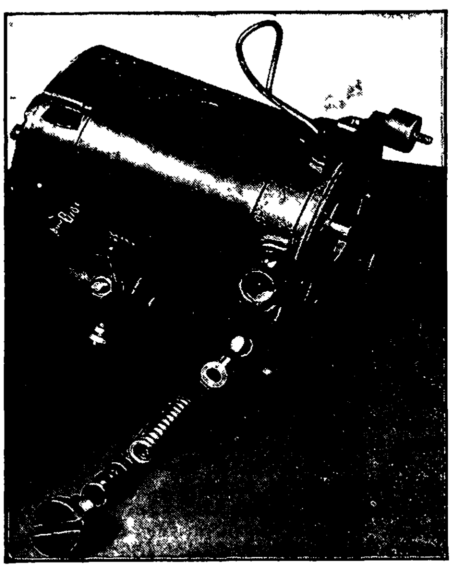


Fig. 8 Lay ut f pressure relief valve parts n Moraine pump

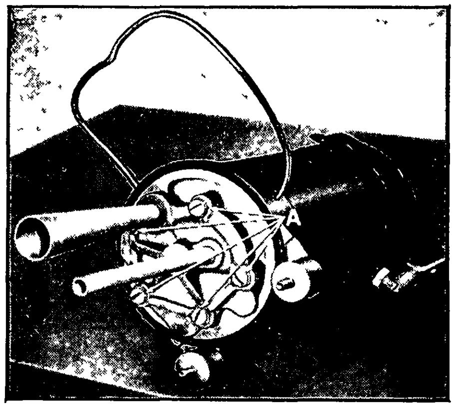


Fig. 6 Pump cover attaching screws "A" on Moraine pump

DURA PUMP—Check the pump pressure in the same manner as for the Moraine pump, Fig. 4. Then disassemble and inspect the unit as follows:

Remove the pressure relief plug, washers and compression spring, Fig. 10. Inspect this assembly for possible obstruction or damage to the spring. Check the adjustment of pressure to within operating range by varying the number of washers on the plug. Adding washers reduces pressure; removing washers increases pressure.

Disconnect the battery cable and remove the spring wire bail and pump reservoir. Remove the motor and pump from its attachment on the dash panel. Check reservoir gasket. With unit placed on the bench, remove two screws holding diffuser and retainer to bottom of intake and discharge tubes, "A" Fig. 11. Clean these parts. Next, remove the rotor pump bottom plate, "B", by taking out six screws.

Remove and check the rubber sealing ring. Then proceed to remove each of the parts in the rotor cavity as follows: Rotor plate spider spring, rotor plate, inner and outer rotor. Inspect for wear of parts and for presence of dirt or foreign material.

Remove the port plate from the bottom of the rotor cavity, Fig. 12, and inspect. If the port plate is brass or if the port plate "tab" has been damaged or sheared off, replace with a new steel port plate. When replacing, make sure tab on port plate enters the notch at the bottom of the rotor cavity as shown in Fig. 13.

CAUTION—If the tab has sheared off the original port plate, check the rotor cavity thoroughly. This small piece of metal may be lodged in the pressure outlets and if not removed, will cause further operating irregularities.

Fig. 13 shows the rotor cavity with all parts removed. Be sure and clean thoroughly. Inspect the pressure relief valve by removing plug, washers and compression spring. With a hooked wire, poke out the valve through the opening in the bottom of the cavity. Clean out any dirt or foreign matter from valve and valve seat. Note the location of the notch at the bottom of the cavity for positioning the tab on the port plate.

To remove the pump housing from the motor unit, remove four screws and washers at "A", Fig. 14, on Auto-Lite motors, or the two long bolts from the end of the motor unit on pumps equipped with Delco motors. To facilitate reassembly, scribe the relative position of pump and motor housings before removal.

To reassemble, reverse the above procedure, and tighten all screws securely.

CHECKING MOTOR OPERATION—A quick check to determine if the motor is operating, assuming battery and battery connections have been checked, is to place a jumper wire between the battery terminal of the motor solenoid switch and the terminal where the solenoid switch connector strap is attached to the motor housing. If the motor does not start, the trouble lies within the motor and this unit should be disassembled and repaired.

TOP CONTROL & SWITCH

An electrical switch and directional selector valve for the hydraulic fluid combine to form the convertible top control assembly. A self-centering spring assures that the control returns to the neutral position when the knob is released. In the neutral position the motor solenoid circuit is open and the control valve is in such a position that there is no flow of fluid through the valve.

No repairing or service can be carried out on the hydraulic portion without special tools. However, the electrical

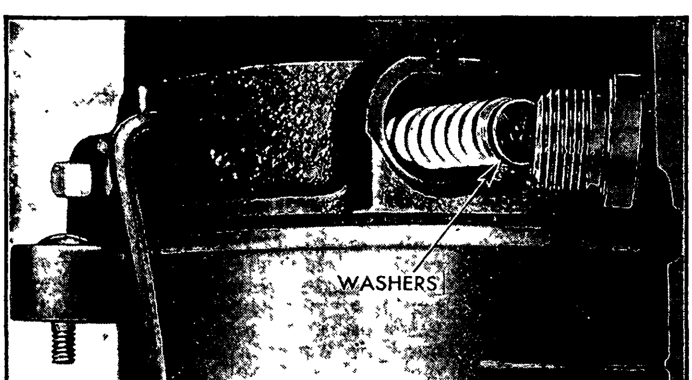


Fig. 5 R m ving pr ssure reli f valve parts fr m M rain pump. Wash rs sh wn ar f r r gulating pressur

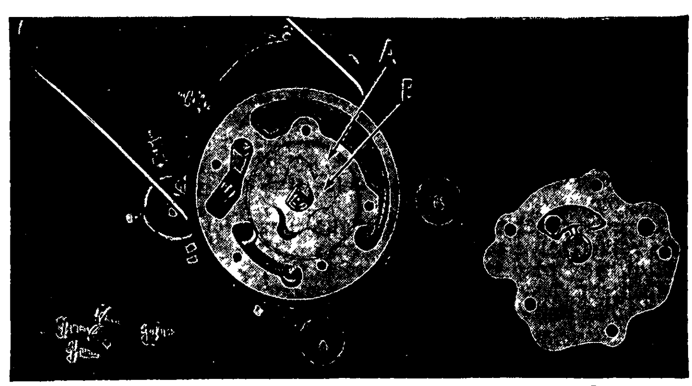


Fig. 7 Sh wing inner rotor "B" and uter r t r "A" on M raine pump

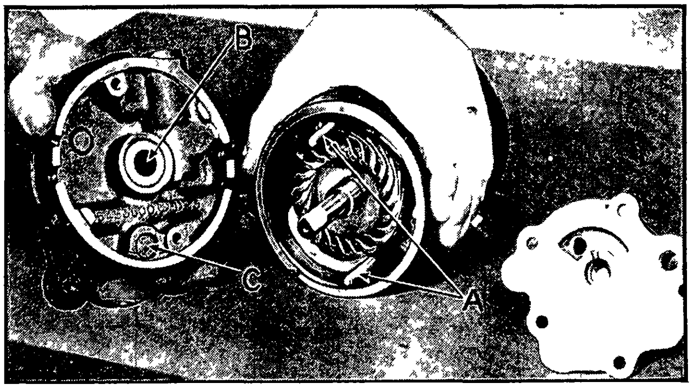


Fig. 9 M rain pump and mot r s parated. "A"—attaching b lts. "B"—m t r shaft seal. "C"—filt r vent

switch portion, consisting of a stationary center plate and a movable contact plate, can be readily serviced. If necessary the switch can be disassembled and the contacts cleaned with fine sandpaper or a rag.

When removing this unit disconnect battery and cap hydraulic lines as they are disconnected. First loosen set screw on trunnion holding control rod and remove rod. Proceed to disconnect hydraulic lines and then remove valve holding screws.

When reinstalling control rod should be free of binds to assure its return to neutral when released. Rod must be adjusted to provide at least ⅛-in. overtravel when pushed in. This is to insure that the electrical switch makes positive contact.

TOP LIFT CYLINDERS

The top operating cylinders are of steel tube construction, fitted at each end with crimped-in die castings, which, together with synthetic rubber seals, form a fluid-tight assembly.

The upper casting provides a bearing for the piston rod and a cavity for the replaceable rubber fluid seal and felt. The lower casting forms a yoke which, with a clevis pin, provides a movable anchorage to the bracket at the floor pan. One-eighth-in. pipe-threaded holes in the upper and lower castings are provided for the fluid line connections.

The piston rods of the top power cylinders should be lubricated annually in the spring with a few drops of castor oil or brake fluid. Do not, under any circumstances, use mineral oil as this will cause swelling and deterioration of the rubber seals.

Defective top lift cylinders should be replaced as a unit When removing these cylinders disconnect the battery to prevent accidental starting of the pump. Removal of seat cushion, back and quarter trim panel gives access to the cylinder. The panel switch can be left in place or disconnected.

Service Procedure—First disconnect piston rod from top link mechanism and then remove cotter pin and bolt from bottom yoke. Hydraulic fluid is injurious to trim and paint and sufficient rags should be at hand to absorb any fluid leakage before disconnecting fluid pipes at both ends of cylinder. When lines are detached pull bottom of unit forward and lift cylinder out. Here again be careful not to get any fluid on trim or paint.

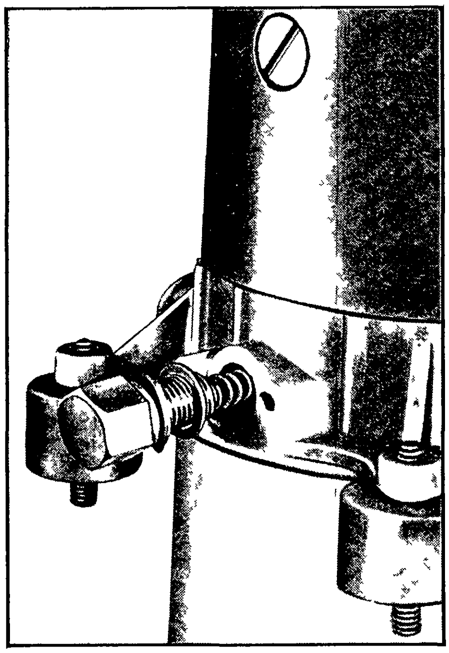


Fig. 10 Removing pressure relief valve parts on Dura pump

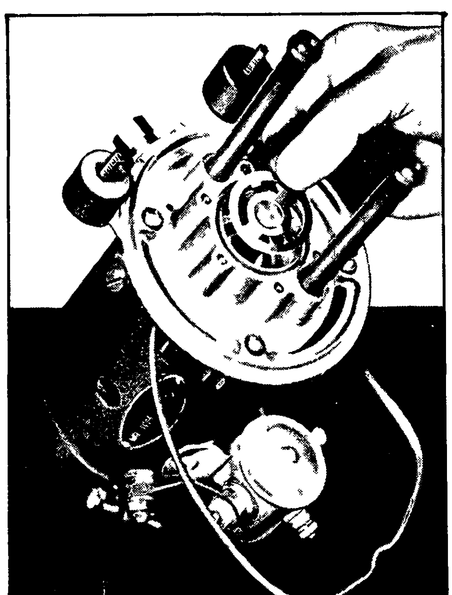


Fig. 12 Rem ving p rt plate parts fr m Dura pump

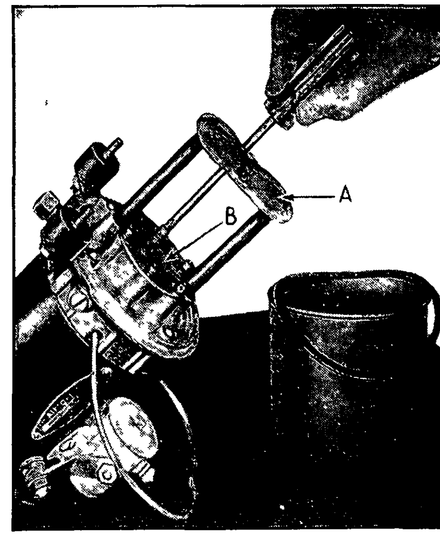


Fig. 11 Dura pump. Sh wing intake and discharg tubes "A", and rotor cavity plate "B"

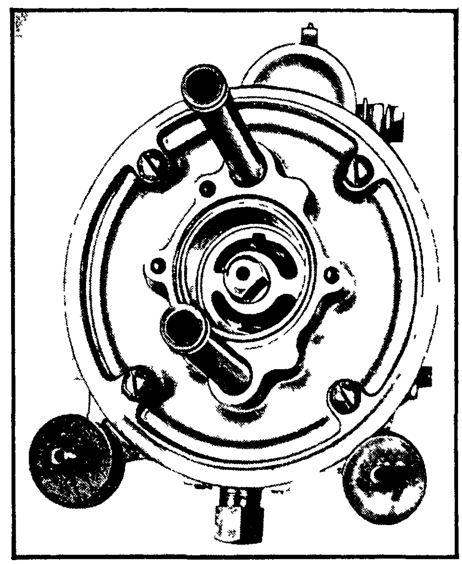


Fig. 13 Dura pump. Sh wing rotor cavity with all parts rem ved

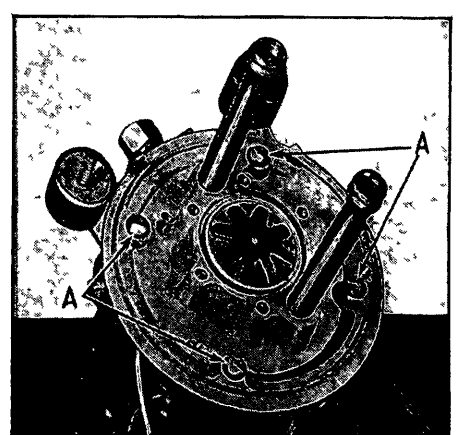


Fig. 14 Sh wing f ur screws "A" which attach pump h using t m tor n Dura pump

Reinstallation is essentially a reversal of the foregoing procedure. As is the case with window units, on completion of reinstallation, operate top, windows and seats through several cycles to bleed lines and check fluid level.

WINDOW AND SEAT UNITS

The window, seat and chauffeur partition operating units are single-action power cylinders in which pressure is always between the piston and the closed end of the cylinder. The closed end of the cylinder is fitted with a spring-seated, normally closed magnetic or solenoid valve which, when energized, opens to allow fluid to flow in or out of the cylinder.

Hydraulic pressure generated in the power unit raises the windows and moves the seat forward. Coil type retraction springs lower the windows and move the seat back.

The operation of all units is controlled by toggle type buttons. When a button is in position to raise the window it starts the pump and opens the cylinder solenoid valve. When control is in down position it merely energizes and opens the cylinder solenoid valve and the retraction springs force the oil from the cylinder and lower the window.

The window units are mounted on a frame assembly and installed vertically between the inner and outer panels of the door assembly. No internal repairs are possible on the door or seat units and if found defective they must be replaced as an assembly.

Removal and replacement procedure will vary according to the construction of the inner door panel. As with other units the battery should be disconnected. On all cars it is necessary to lower window fully, remove trim panel and disconnect hydraulic and electric connections. Tape any hot electrical connections.

The seat adjustment unit has a slightly longer horizontally installed cylinder, different arm arrangement and a ratchet mechanism which prevents any forward seat movement during an emergency stop. These units are also serviced or replaced as an assembly. The same precautions taken in removing other units should be observed in replacing seat adjusters.

CONTROL BUTTONS

Window controls or switch assemblies are mounted in plastic escutcheons. They are held in place by spring clips at the bottom and top. To remove, insert or wedge a screwdriver at the top between trim panel and plastic and push the retaining clip down to free the top. After depressing spring catch a slight twist of the screwdriver will draw escutcheon from trim panel. An upward push is needed to release the bottom clip. When removing the switches care must be taken in prying to prevent chipping or cracking the bakelite.

The hydraulic pressure in the system should be 200-210 lb. on all 1946 models and some 1947 cars. These units can be identified by a zinc-plated Hex hydraulic pressure adjusting screw on the pump.

On later models the pressure is 250-260 lb. and these pumps have a copper-plated adjustment screw for identification purposes.

Under no circumstances should a high-pressure pump be used to replace a low-pressure pump. Similarly a low-pressure unit should not be used in the high-pressure systems.

The approximate performance requirements of new units are as follows: Window regulators should raise or lower glass the full extent of travel in about 2 seconds; the convertible top operation should take 14 seconds and the front seat with 550-lb. load should move its full forward travel in 5 seconds and full rear travel in about 3 seconds.

Proper operation of the power-operated assemblies is dependent on such things as proper alignment of window glass and channels, seat tracks and top linkage as well as electrical or hydraulic factors. The correction of misalignment or binding is largely dependent on the mechanic.

The battery should be the first thing checked. Specific gravity should be at least 1.200 as the system becomes inoperative below 1.175.

FLUID SYSTEM

The supply of fluid is also a very important factor in the operation of the system. The fluid should be close to the level mark in the reservoir which is attached to the bottom of the pump by a snap on spring bail. A noisy pump is the first indication of insufficient fluid. The mechanism chatters rapidly when any of the power units are operated.

Before checking fluid level all windows should be lowered and the seat moved to its rearmost position. This discharges the fluid from the seat and window cylinders and returns oil to reservoir. If the fluid is low, fill to the level mark on the removable reservoir. Use only a good grade of hydraulic brake fluid.

IMPORTANT—All car makers recommend a change of the fluid at least once each year and oftener along the humid sea coast or where dusty or acid conditions prevail. Very serious rust and corrosion may result if this service is neglected.

About three pints of Hydro-Lectric Fluid is needed to fill the reservoir on a sedan. On a convertible with top, window and seat cylinders, about three quarts are needed.

When cleaning the system, lower windows and top and move seat to extreme rearward position. Disconnect battery, remove fluid reservoir and raise top by hand to expel any remaining fluid from system. Install clean hydraulic fluid in system, reconnect battery and operate top, windows and seat through two complete cycles. Drain fluid from system and repeat the cleaning cycle, then install clean fluid.

If alcohol is used as a cleaning agent it is not likely that all of it can be removed from the various pockets. If any remains in the system poor operation may result or the viscosity and lubricating value of the brake fluid may be affected to the point of failure. When the fluid reservoir is assembled to the power unit the rubber gasket should be installed in a flat position.

SERVICE DIAGNOSIS

The brief outline (listed below) of service difficulties along with their probable causes will suggest a general checking procedure.

If one window will not quite close check fluid level in reservoir and refill as required. Inspect window for binding or damaged felt in guide channels. In the case of two windows operating from one switch look for wires touching on the cylinder solenoid circuit, or high pump pressure forcing the cylinder valve off its seat.

Failure of windows to operate in either direction may be attributable to battery gravity reading below 1.175, corroded circuit breaker points, insufficient fluid, stuck motor solenoid, loose battery ground wire, loose or corroded terminals in control circuit, shorted armature, defective motor brushes, or dirty commutator.

Failure of One Window—The failure of one window to operate in either direction may point to a defective cylinder solenoid valve, faulty control switch, defective wire in door circuit or binding in window or operating mechanism.

If the windows all operate slowly in downward direction only it may be due to improper or congealed fluid in the system, or a pump pressure regulating valve which is stuck.

Windows found to operate slowly in upward direction only may indicate low pump pressure or a stuck regulating valve.

Correcting Low Pressure—If pressure is found to be very low, remove the power unit and prime by filling plugged hole opposite pressure side of pump with hydraulic fluid. Recheck pressure and if found low, hold top control in operative position 10-15 seconds after top is in up position. This or holding window switches in up position develops maximum pressure in system. Then check tubes and fittings for leaks. If no leaks are found power unit should be replaced.

If any operating irregularity is traced to the electrical circuit wiring, motor and cylinder solenoid and circuit breaker should be checked. A defective circuit breaker will make the entire system inoperative. A faulty motor solenoid may result in the pump motor not operating. Jumping or shorting around the solenoid is the quickest test. Cylinder solenoids, if operating properly, make a loud click when the control switch is closed.

HYDRO-LECTRIC SYSTEM

SEALED TYPE

The "Sealed" type Hydro-Lectric System differs from the "Vented" type in that it eliminates the use of the solenoid, pressure relief valve and circuit breaker used on the "Vented" type.

The self-centering top control switch, located on the instrument panel, is connected directly to the pump motor by means of two electrical leads. The motor and pump assembly is located under the folding top compartment behind the rear seat back and is accessible either through an inspection hole at the bottom of the folding top well or from the inside of the body after the rear seat back is removed.

OPERATION OF TOP

The operation of the push-pull control knob either raises or lowers the top. The directional flow of the hydraulic fluid is controlled by the reversible action of the spur gear pump.

To raise the top, the control knob is pushed forward. Electrical current then passes directly from the battery, through the top control switch, and out through a wire to the motor, Fig. 15. The motor and spur gear pump then rotate to force the hydraulic fluid under pressure through the hydraulic tubing to the lower ends of the double-acting lift cylinders.

To lower the top, the control knob is pushed rearward, allowing electrical current to pass directly from the battery, through the switch, and out through the other wire to the motor. The motor and pump then rotate in the opposite direction to force the hydraulic fluid under pressure to the top of the lift cylinders.

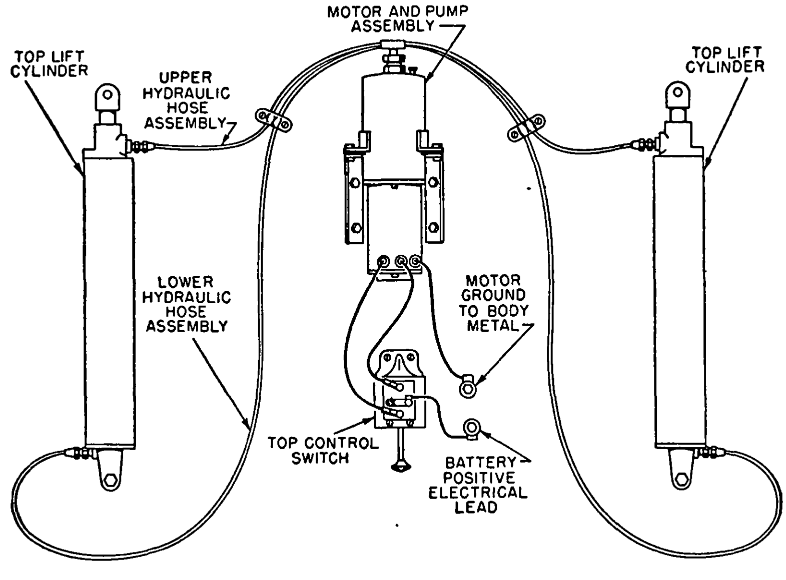


Fig. 15 Sealed type Hydro-Lectric system for operating folding t ps

SERVICING THE MECHANISM

Since the system is not vented to the atmosphere, it is not necessary to replace the hydraulic fluid periodically as is the practice with the "Vented" type. This system is "self-air bleeding". Should air become trapped in the lines due to replacement of hydraulic units, a few operational cycles of the top will expel the trapped air in the reservoir.

The six-volt D. C. motor incorporated in the Hydro-Lectric sealed-in unit requires 95 amperes when operating the pump at a fluid pressure of 230 psi (lbs. square inch).

The wiring harness used in the electrical circuit consists of heavy No. 8 stranded wire due to the large electrical load the harness must carry when the motor is operating. It is imperative that the same type wire be used for replacement of damaged portions of the circuit or for making "jumper" wire checks where the wire will carry full current flow to the motor.

The pump unit must deliver a maximum fluid pressure within the range of 220-260 psi. The operation of raising or lowering the top through its complete up and down travel cycle should not require more than 15 seconds, with a maximum fluid pressure of 250 psi.

Be careful when disconnecting hydraulic fluid lines. Make sure the electrical current is disconnected; otherwise, an accidental touch of the push-pull switch may cause pressurized fluid to squirt out the end of the disconnected tubing, causing serious damage.

In the event of fluid loss, it is important to correct the cause before bringing the hydraulic fluid up to its specified level in the pump reservoir.

Before disconnecting any fluid lines, always remove the filler cap on top of the reservoir; then replace the filler cap again before operating the system. Venting of the reservoir is necessary in this "sealed-in" system to equalize the pressure in the reservoir to that of the atmosphere and avoid the possibility of hydraulic fluid being forced under pressure from the disconnected lines.

Before working on the hydraulic system, make sure trim and parts adjacent to the working area are protected with a suitable cover. Hydraulic fluid is injurious to a car finish and its damage is almost instantaneous. Hydraulic fluid is also inflammable. Suitable cloths should be on hand to wipe up any slight drippage of fluid when lines are disconnected.

When connecting "Tees" and "Elbows" on the hydraulic tubing, make sure all connections are tight. The threads of male couplings should be coated with a suitable pipe thread sealer to insure a leak-proof .connection. In cases of chronic leaks, install a new coupling.

In no case should mineral oil be used in the system. To guard against contamination of the hydraulic fluid which may be injurious to the system, it should not be put into dirty containers or squirt cans containing mineral oil or oil residue.

In cases of emergency, the top may be raised or lowered manually. If manual operation is necessary, it should be done slowly and gradually. Too fast a movement of the top may cause the ball spring valve in the pump to close. Should this occur, slack off slightly on the tension and then carefully start the operation again.

If the electric wiring harness is disconnected for service purposes, make sure this wiring is reconnected to its proper terminals both at the hydraulic motor and the push-pull control switch at the instrument panel; otherwise, reverse operation of the system may occur. Make sure electrical "grounds" and wiring connectors are tight. In addition, both wiring harness and hydraulic tubing must be routed and secured with original retaining clips so as to avoid contact with sharp edges of body metal.

Use only approved hydraulic fluid in the system as recommended by the car manufacturer. The fluid capacity of the system is 3.86 pints. To refill the system, fill the reservoir to the prescribed level and operate the top through several cycles. Check the reservoir and add fluid, repeating the operation as often as necessary. One filling of the reservoir may not be enough as the fluid capacity of the two top cylinders is almost double that of the reservoir.

HUDSON HYDRAULIC TOP

This device, Fig. 16, consists of a pressure pump and electric motor assembly which supplies fluid under pressure to two double-acting hydraulic cylinders which raise and lower the top.

Power Unit—The power unit has a reversible electric motor in the center with a fluid reservoir on one side and two solenoids on the other. One solenoid permits clockwise rotation and the other counter-clockwise.

Hydraulic Cylinders—The two cylinders lower and raise the top. Each cylinder is double-acting, with hydraulic fluid lines connected at the upper and lower ends. These hydraulic lines lead to a valve which is attached to the gear pump mounted on the rear end of the power unit. The system is kept full of fluid by means of a reservoir connected by a single tube to the valve.

Control Switch — Control of the motor for raising the top by forcing fluid into the lower end of the cylinder and for lowering by injecting fluid into the upper end is by means of a two-way switch located on the instrument panel. The neutral position of the switch is in the center at which point it is held by springs within the switch.

Operation — Pushing in the switch all the way lowers the top and pulling it out raises the top. Because of the two-way principle of the switch it must be held out or in all during the raising or lowering operation.

The top can be lowered or raised with or without the engine running. But the car must be stationary before operating the mechanism to prevent damaging the top.

As the control switch knob is pushed in, the circuit to the rear or lowering solenoid on the power unit is closed, causing the motor to operate the gear

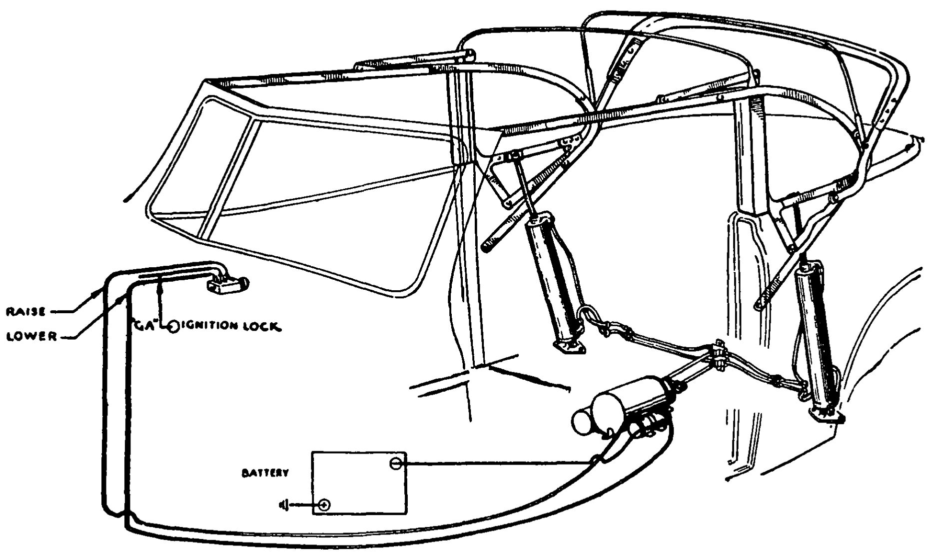


Fig. 16 Hydraulic operated top used on 1941-47 Hudson

pump. The pump draws fluid from the reservoir and pumps it from the upper connection of the valve, through the lines to the upper fittings of the hydraulic cylinders. The fluid creates a pressure against the upper surface of the piston and forces the piston rod downward into the cylinder, displacing the fluid below the piston and lowers the top.

The reverse action holds true when the top is raised. That is, the front or raising solenoid is energized, resulting in the power unit changing its direction of rotation, causing the gear pump to force the fluid through the left hand or lower connection of the valve, through the lines to the lower fittings of the cylinder, thereby displacing the fluid above the piston. This pushes the piston rod out of the top of the cylinder, causing the top to be raised.

Caution—If the power unit should become inoperative, the top may be raised or lowered by hand but the hand operation must be done slowly. Any rapid movement or unnecessary force will cause a valve action that makes the top extremely difficult to move.

SERVICING THE MECHANISM

Top Does Not Raise or Lower Freely—When lowering the top be sure the header is off the locating dowels. When raising be sure top is free. This can be checked by raising header slightly by hand.

Be sure the top iron joints are free and not binding. Check the lower connection to be sure no bind exists at this point. Check all line fittings for loose connections or fluid leaks. Check reservoir fluid level—it should be at least half full at all times.

Check all pipes and hose for kinks. Disconnect piston rod at yoke and check piston rod for alignment in upper end plate.

Top Refuses to Lower or Raise—If motor operates satisfactorily, check reservoir fluid level—it should be at least half-full. Check for possible leakage at connections or damaged pipes.

If motor operates too slowly or does not operate at all, check condition of battery. Also check feed wire from center terminal of switch to "GA" terminal of ignition switch.

If motor works one way but not the other, check front and rear terminals and leads at solenoids. Be sure all connections are tight and grounds are clean and tight.

NOTE—Removing the power unit or a hydraulic cylinder should be obvious after the necessary trim is removed to expose the units. When replacing a hydraulic cylinder, be sure the lower cylinder connection is free to permit movement of the cylinder before attaching the yoke at the upper end. Also make sure that the hose connections are secure and not kinked.

To expel air from the lines, raise the top part way and then work it back and forth slightly by alternating the position of the switch knob.

NASH RAMBLER TOP

The top is automatically raised and lowered by nylon covered cables which are powered by a reversible electric power unit, located in back of the rear seat back. A pellet swedged to each cable at a definite location is clinched into the rear half of the front bow hinge.

The cables are wound around a drum, driven by the power unit. They travel around pulleys and in stainless steel guide channels along the side roof rail.

To lower the top pull out the control switch and hold it out until the top folds completely into the top well. To raise the top, push the control switch button in and hold it there until the top is completely raised. Do not raise or lower the top while the car is in motion.

Control Switch & Wiring — The center terminal on the switch is connected to the resistor on the left side of the dash under the hood, which in turn is connected to the battery side of the starter switch.

The black wire runs from the switch terminal nearest to the switch knob to the front terminal of the power unit—which lowers the top.

The red wire runs from the switch terminal farthest from the switch knob to the rear terminal of the power unit—which raises the top.

Power Unit Removal—The cables need not be removed from the drum to remove the power unit.

After removing the pulley guards and rear seat cushion, spring the bottom of the top well down to release the ragboard panel covering the power unit.

Tape the cables securely to the drum and loosen the right and left cable tensioners. Remove the drum from the drum shaft by removing the retaining nut. Then remove the motor and worm gear assembly.

Reverse this procedure to install, making sure that the thrust washer lug fits into the recess in the drum sleeve. Lubricate the worm and needle bearings with No. 110 Lubriplate. At 5,000-mile intervals apply 3 to 5 drops of medium engine oil to the armature shaft bearing, commutator end.

Power Unit Specifications — Service on the electric motor is much the same as for a starting motor. The power unit is a reversible motor with four poles and two brushes. The bearing are absorbent bronze which should be lubricated with 3 to 5 drops of medium engine oil at 5,000-mile intervals. Brush spring tension, 42-53 ozs. End play .005 to .062 in. No load draw 5 volts, 60 amps. at 4700 rpm.

BUICK

INDEX OF SERVICE OPERATIONS

NOTE— See appendix in back of book for data on hydraulic steering and four-barrel carburetors.

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Eight	35–40	117	In Head	$3\frac{3}{32}$ x $3\frac{7}{8}$	232.8	5.45	93 @ 3200	183 @ 1900	45 @ 35
	Eight	35–50	119	In Head	$2\frac{31}{32}$ x $4\frac{1}{4}$	235.3	5.25	88 @ 3200	183 @ 1900	45 @ 35
	Eight	35–60	128	In Head	$3\frac{3}{32}$ x $4\frac{5}{8}$	278.1	5.25	100 @ 3200	183 @ 1900	45 @ 35
	Eight	35–90	136	In Head	$3\frac{5}{16}$ x 5	344.8	4.95	116 @ 3200	183 @ 1900	45 @ 35
1936	Special 8	36–40	118	In Head	$3\frac{3}{32}$ x $3\frac{7}{8}$	233.0	5.55	93 @ 3200	183 @ 1900	45 @ 35
	Century 8	36–60	122	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.45	120 @ 3200	238 @ 1600	45 @ 35
	Roadmaster 8	36–80	131	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.45	120 @ 3200	238 @ 1600	45 @ 35
	Limited 8	36–90	138	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.45	120 @ 3200	238 @ 1600	45 @ 35
1937	Special 8	37–40	122	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248 0	5.70	100 @ 3200	196 @ 2000	45 @ 35
	Century 8	37–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.75	130 @ 3400	258 @ 2000	45 @ 35
	Roadmaster 8	37–80	131	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.75	130 @ 3400	258 @ 2000	45 @ 35
	Limited 8	37–90	138	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	5.75	130 @ 3400	258 @ 2000	45 @ 35
1938	Special 8	38–40	122	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.15	107 @ 3400	203 @ 2000	45 @ 35
	Century 8	38–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
	Roadmaster 8	38–80	133	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
	Limited 8	38–90	140	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
1939	Special 8	39–40	120	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.15	107 @ 3400	203 @ 2000	45 @ 35
	Century 8	39–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
	Roadmaster 8	39–80	133	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
	Limited 8	39–90	140	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.35	141 @ 3600	269 @ 2000	45 @ 35
1940	Special 8	40–40	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.10	107 @ 3400	203 @ 2000	45 @ 35
	Super 8	40–50	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.10	107 @ 3400	203 @ 2000	45 @ 35
	Century 8	40–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.25	141 @ 3600	269 @ 2000	45 @ 35
	Roadmaster 8	40–70	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.25	141 @ 3600	269 @ 2000	45 @ 35
	Limited 8	40–80	133	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.25	141 @ 3600	269 @ 2000	45 @ 35
	Limited 8	40–90	140	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.25	141 @ 3600	269 @ 2000	45 @ 35
1941	Special 8	41–40A	118	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	B	NOTE A	210 @ 2000	45 @ 35
	Special 8	41–40B	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	B	NOTE A	210 @ 2000	45 @ 35
	Super 8	41–50	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	7.00	125 @ 3800	217 @ 2000	45 @ 35
	Century 8	41–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	7.00	165 @ 3800	278 @ 2200	45 @ 35
	Roadmaster 8	41–70	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	7.00	165 @ 3800	278 @ 2200	45 @ 35
	Limited 8	41–90	139	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	7.00	165 @ 3800	278 @ 2200	45 @ 35
1942	Special 8	42–40A	118	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	C	NOTE A	200 @ 2000	45 @ 35
	Special 8	42–40B	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	C	NOTE A	200 @ 2000	45 @ 35
	Super 8	42–50	124	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.30	125 @ 3800	200 @ 2000	45 @ 35
	Century 8	42–60	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.70	165 @ 3800	278 @ 2200	45 @ 35
	Roadmaster 8	42–70	129	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.70	165 @ 3800	278 @ 2200	45 @ 35
	Limited 8	42–90	139	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.70	165 @ 3800	278 @ 2200	45 @ 35
1946	Special 8	46–40	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	45 @ 35
	Super 8	46–50	124	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	45 @ 35
	Roadmaster 8	46–70	129	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.6	144 @ 3600	276 @ 2000	45 @ 35
1947	Special 8	47–40	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	45 @ 35
	Super 8	47–50	124	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	45 @ 35
	Roadmaster 8	47–70	129	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.6	144 @ 3600	276 @ 2000	45 @ 35
1948	Special 8	48–40	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	35 @ 35
	Super 8	48–50	124	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.6	115 @ 3600	212 @ 2000	35 @ 35
	Roadmaster 8	48–70	129	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.6	144 @ 3600	276 @ 2000	35 @ 35
	Roadmaster 8 (DYN)	48–70	129	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.9	150 @ 3600	280 @ 2000	35 @ 35
1949	Special 8	49–40	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.3	110 @ 3600	206 @ 2000	35 @ 35
	Super 8	49–50	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.6	115 @ 3600	212 @ 2000	35 @ 35
	Super 8 (DYN)	49–50	121	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.9	120 @ 3600	215 @ 2000	35 @ 35
	Roadmaster 8	49–70	126	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	6.9	150 @ 3600	280 @ 2000	35 @ 35
1950	Special 8	50–40	$121\frac{1}{2}$	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	6.6	115 @ 3600	212 @ 2000	35 @ 35
	Special 8 (DYN)	50–40	$121\frac{1}{2}$	In Head	$3\frac{3}{32}$ x $4\frac{1}{8}$	248.0	7.2	122 @ 3600	215 @ 2000	35 @ 35
	Super 8	50–50	$121\frac{1}{2}$ D	In Head	$3\frac{3}{16}$ x $4\frac{1}{8}$	263.3	6.9	124 @ 3600	220 @ 2000	35 @ 35
	Super 8 (DYN)	50–50	$121\frac{1}{2}$ D	In Head	$3\frac{3}{16}$ x $4\frac{1}{8}$	263.3	7.2	128 @ 3600	223 @ 2000	35 @ 35
	Roadmaster 8	50–70	$126\frac{1}{4}$ E	In Head	$3\frac{7}{16}$ x $4\frac{5}{16}$	320.2	7.2	152 @ 3600	280 @ 2000	35 @ 35
1951	Special 8	51–40	$121\frac{1}{2}$	In Head	$3\frac{3}{16}$ x $4\frac{1}{8}$	263.3	6.6	120 @ 3600	215 @ 2000	35 @ 35
	Special 8 (DYN)	51–40	$121\frac{1}{2}$	In Head	$3\frac{3}{16}$ x $4\frac{1}{8}$	263.3	7.2	128 @ 3600	218 @ 2000	35 @ 35
	Super 8	51–50	$121\frac{1}{2}$ D	In Head	$3\frac{3}{16}$ x $4\frac{1}{8}$	263.3	6.9	124 @ 3600	220 @ 2000	35 @ 35

Year	Model Designation	Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1951	Super 8 (DYN)..........51-50	121½ D	In Head	3 3/16 x 4 1/8	263.3	7.2	128 @ 3600	223 @ 2000	35 @ 35
	Roadmaster 8..........51-70	126¼ E	In Head	3 7/16 x 4 5/16	320.2	7.2	152 @ 3600	280 @ 2000	35 @ 35
1952	Special 8...............52-40	121½	In Head	3 3/16 x 4 1/8	263.3	6.6	120 @ 3600	215 @ 2000	35 @ 35
	Special 8 (DYN).........52-40	121½	In Head	3 3/16 x 4 1/8	263.3	7.2	128 @ 3600	225 @ 2000	35 @ 35
	Super 8................52-50	121½ D	In Head	3 3/16 x 4 1/8	263.3	6.9	124 @ 3600	220 @ 2000	35 @ 35
	Super 8 (DYN)..........52-50	121½ D	In Head	3 3/16 x 4 1/8	263.3	7.2	128 @ 3600	225 @ 2000	35 @ 35
	Roadmaster 8..........52-70	126¼ E	In Head	3 7/16 x 4 5/16	320.2	7.5	170 @ 3800	280 @ 2400	35 @ 35

A—Single carburetor, 115 @ 3500; compound carburetor, 125 @ 3800.
B—Single carburetor, 6.50; compound carburetor, 7.00.
C—Single carburetor, 6.00; compound carburetor, 6.30.
D—125½" wheelbase on model 52.
E—130¼" wheelbase on model 72.

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees (Note B)	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Transmission	Automatic Transmission	
1935-42	All	AC-46	.025	.016	21-30	16258374	A	Negative	450	...	65-70
1946-49	All	AC-48	.025	.016	21-30	16258374	A	Negative	450	450	65-70
1950-52	All	AC-46X	.025	.016	21-30	16258374	A	Negative	450	450	65-70

A—"ADV" mark on flywheel. B—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is as shown.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935	40	.008H	.008H	.008	45	4½	21	C	.0015-.0035	.002-.004	.3720	.3715
	50	.008H	.008H	.008	45	4½	30	F	.0015-.0035	.002-.004	.3720	.3715
	60, 90	.008H	.008H	.008	45	4½	30	C	.0015-.0035	.002-.004	.3720	.3715
1936	40	.015H	.015H	.015	45	8	23	D	.0015-.0035	.002-.004	.3720	.3715
	60, 80, 90	.015H	.015H	.015	45	14	25	D	.0015-.0035	.002-.004	.3720	.3715
1937-47	40, 50	.015H	.015H	.015	45	13	22	E	.0015-.0035	.002-.004	.3720	.3715
	60, 70, 80, 90	.015H	.015H	.015	45	14	25	E	.0015-.0035	.002-.004	.3720	.3715
1948	40, 50	.015H	.015H	.015	45	13	22	G	.0015-.0035	.002-.004	.3720	.3715
	70	B	B	B	45	14	25	G	.0015-.0035	.002-.004	.3720	.3715
1949	40, 50	B	B	B	45	13	22	G	.0015-.0035	.002-.004	.3720	.3715
	70	Zero	Zero	Zero	45	14	25	H	.0015-.0035	.002-.004	.3720	.3715
1950-52	40	B	B	B	45	13	22	J	.0015-.0035	.002-.004	.3720	.3715
	50	Zero	Zero	Zero	45	K	L	H	.0015-.0035	.002-.004	.3720	.3715
	70	Zero	Zero	Zero	45	14	25	H	.0015-.0035	.002-.004	.3720	.3715

A—BTDC means before top dead center; ATDC means after top dead center.
B—Engines with mechanical valve lifters .015" hot; with hydraulic lifters zero clearance.
C—Inner spring 20@ 1 21/32"; outer 35@ 1 15/16".
D—Inner spring 53@ 1 5/16"; outer 81@ 1 19/32".
E—Inner spring 45@ 1 5/16"; outer 67@ 1 19/32".
F—Inner spring 10@ 1 13/16"; outer 35@ 1 15/16".
G—Inner spring 51@ 1 5/16"; outer 77@ 1 19/32".
H—Inner spring 52@ 1 5/16"; outer 119@ 1 19/32".
J—Standard ngine see Note G. Hydraulic valve lifter engines see Note F.
K—1950-51, 13; 1952, 14.
L—1950-51, 22; 1952, 25.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935	40	Above	B	B	.010	.010	.002–.0035	.0015–.003	G	F
	50, 60, 90	Below	B	B	.010	.010	.002–.0035	.0015–.003	G	F
1936–47	All	Above	B	B	.010	.010	.0015–.003	.0015–.003	G	F
1948–52	All	Above	C	C	.010	.010(E)	.0015–.0035	.0015-.003(D)	G	F

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Piston should fall of its own weight on a .0015″ feeler, and hold on a .00225″ feeler.
C—Piston should fall of its own weight on a .0015″ feeler, and hold on a .002″ feeler.
D—Flex-Fit oil rings, .0015-.0035″.
E—No checking or fitting is required on Flex-Fit oil rings.
F—Thumb push fit with parts at 70° (normal room temperature).
G—Clamped in rod.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935	40	.002–.006	.0005–.0035	1.997–1.999	.0007–.002	.005–.010	40–45	B	.0007–.0022	.004–.007	90–100
	50	.002–.006	.0005–.0035	2.1225–2.1245	.0007–.002	.005–.010	40–45	B	.0007–.0022	.004–.007	90–100
	60	.002–.006	.0005–.0035	2.184–2.186	.0007–.002	.005–.010	60–65	B	.0007–.0022	.004–.007	90–100
	90	.002–.006	.0005–.0035	2.3715–2.3735	.0007–.002	.005–.010	60–65	D	.0007–.0022	.004–.007	90–100
1936	40	.002–.006	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0022	.004–.007	90–100
	60, 80, 90	.002–.006	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0022	.004–.007	90–100
1937	40	.004–.008	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0022	.004–.007	90–100
	60, 80, 90	.004–.008	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0022	.004–.007	90–100
1938	40	.004–.008	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0022	.004–.007	90–100
	60, 80, 90	.004–.008	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0022	.004–.008	90–100
1939	40	.004–.008	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0022	.004–.008	90–100
	60, 80, 90	.004–.008	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0022	.004–.008	90–100
1940	40, 50	.004–.008	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0022	.004–.008	90–100
	60, 70, 80, 90	.004–.008	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0022	.004–.008	90–100
1941–47	40, 50	.004–.008	.0005–.0035	1.997–1.999	.0008–.0018	.005–.010	40–45	B	.0007–.0025	.004–.008	90–100
	60, 70, 90	.004–.008	.0005–.0035	2.248–2.249	.0008–.0018	.005–.010	60–65	C	.0007–.0025	.004–.008	90–100

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1948–49	40, 50	.004–.008	.0005–.0035	F	.0005–.002	.005–.010	40–45	E	.0005–.002	.004–.008	90–100
	70	.004–.008	.0005–.0035	2.248–2.249	.0005–.002	.005–.010	60–65	C	.0005–.002	.004–.008	90–100
1950	40	.004–.008	.0005–.0035	1.998–1.999	.0005–.002	.005–.010	40–45	E	.0005–.002	.004–.008	90–100
	50	.004–.008	.0005–.0035	2.125–2.126	.0005–.002	.005–.010	40–45	2.5625–2.5635	.0005–.002	.004–.008	90–100
	70	.004–.008	.0005–.0035	2.248–2.249	.0005–.002	.005–.010	60–65	C	.0005–.002	.004–.008	90–100
1951–52	40, 50	.004–.008	.0005–.0035	2.125–2.126	.0005–.002	.005–.010	40–45	2.5625 2.5635	.0005–.002	.004–.008	90–100
	70	.004–.008	.0005–.0035	2.248–2.249	.0005–.002	.005–.010	60–65	C	.0005–.002	.004–.008	90–100

A—Thrust taken on number 3 bearing.

B—No. 1, 2.3095 to 2.3115; No. 2, 2.3725 to 2.3745; No. 3, 2.4345 to 2.4365; No. 4, 2.4975 to 2.4995; No. 5, 2.5595 to 2.5615

C—No. 1, 2.5605 to 2.5615; No. 2, 2.6235 to 2.6245; No. 3, 2.6855 to 2.6865; No. 4, 2.7485 to 2.7495; No. 5, 2.8105 to 2.8115

D—No. 1, 2.5595 to 2.5615; No. 2, 2.6225 to 2.6245; No. 3, 2.6845 to 2.6865; No. 4, 2.7475 to 2.7495; No. 5, 2.8095 to 2.8115

E—No. 1, 2.3105 to 2.3115; No. 2, 2.3735 to 2.3745; No. 3, 2.4355 to 2.4365; No. 4, 2.4985 to 2.4995; No. 5, 2.5605 to 2.5615

F—For 1948, 1.997–1.999; for 1949, 1.998–1.999.

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	40	Molded	26	1 3/4	3/16	3/8
	50	A	25	1 3/4	3/16	3/8
	60	A	29	1 3/4	3/16	3/8
	90	A	29	2 1/4	3/16	3/8
1936-37	40	Woven	22 11/16	1 3/4	3/16	3/8
	60, 80	Woven	22 11/16	2	3/16	3/8
	90	Woven	26 13/16	2	1/4	3/8
1938	40	A	22 11/16	1 3/4	3/16	1 1/8
	60	A	22 11/16	2	3/16	1 1/8
	80	A	22 11/16	2	3/16	7/8
	90	A	26 13/16	2	1/4	7/8
1939	40	A	22 11/16	1 3/4	3/16	7/8
	60, 80	A	22 11/16	2	3/16	7/8
	90	A	26 13/16	2	1/4	7/8
1940	40	A	22 11/16	1 3/4	3/16	1 1/16
	50	A	22 11/16	1 3/4	3/16	7/8
	60	A	22 15/16	2 1/4	3/16	1 1/16
	70	A	22 15/16	2 1/4	3/16	7/8
	80, 90	A	26 13/16	2	1/4	7/8
1941-42	40, 50	A	22 11/16	1 3/4	3/16	1
	60, 70	A	22 15/16	2 1/4	3/16	1
	90	A	26 13/16	2	1/4	1
1946-50	40, 50	Molded	22 11/16	1 3/4	3/16	1
	70	Molded	22 15/16	2 1/4	3/16	1
1951	40, 50	Molded	23	1 3/4	3/16	1
	70	Molded	23	2 1/4	3/16	1
1952	40, 50	Molded	23	B	3/16	1
	70	Molded	23	C	3/16	1

A—Primary shoe, woven. Secondary, molded.

B—Front 2 1/4; rear 1 3/4.

C—Front 2 1/2; rear 2 1/4.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	40	+3	+ 7/8	5/32	4
	50	+2	+ 7/8	5/32	5
	60, 90	+1 1/8	+ 7/8	5/32	5
1936	40	+3 1/4	+ 1/4	3/32	4
	60, 80	+2	+ 1/4	3/32	4 3/4
	90	+1	+ 5/8	3/32	4 1/2
1937	40, 60	+ 1/4	+ 3/8	1/32	4
	80	Zero	+ 3/8	1/32	4 3/4
	90	Zero	+ 3/8	1/32	4 1/2
1938-39	40, 60	− 7/8	+ 3/8	1/32	4
	80	− 7/8	+ 3/8	1/32	4 3/4
	90	− 7/8	+ 3/8	1/32	4 1/2
1940	40, 50, 60, 70	+ 3/8	+ 3/8	1/32	4
	80, 90	− 7/8	+ 3/8	1/32	4 1/2
1941	40, 50, 60, 70	+ 3/8	+ 1/2	1/32	3 1/2
	90	+ 3/8	+ 1/4	1/32	4 3/4
1942	40, 50, 60, 70	+ 3/8	+ 3/8	1/32	4 1/4
	90	+ 3/8	+ 3/8	1/32	5 1/4
1946-49	All	+ 3/8	+ 3/8	1/32	4 1/4
1950-52	All	+ 3/4	+ 3/8	3/32	4 1/4

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935	40	.006–.010	Shims	None	.000–.008
	50, 60, 80, 90	.006–.010	Sleeve	None	.000–.008
1936	40, 60, 80	.006–.010	Shims	None	.000–.008
	90	.006–.010	Sleeve	None	.000–.008
1937-47	All	.006–.010	Shims	None	.000–.008
1948-52	All	.008–.012	Shims	None	.000–.008

Year	Model	Cooling System Capacity, Quarts (Without Heater)	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil			Capacity, Pounds or Pints	Grade of Oil		Capacity, Pounds or Pints	Grade of Oil	
					Above +32°F.	Above +10°F.	Above −10°F.		Summer	Winter		Summer	Winter
1935	40	14	16	6	20	20W	10W	1¾	140	90	3	140	90
	50	15½	16	7	20	20W	10W	1¾	140	90	3	140	90
	60	18	19	8	20	20W	10W	4	140	90	4⅝	140	90
	90	23	22	9	20	20W	10W	4	140	90	5½	140	90
1936	40	13¼	16	6	20	20W	10W	1¾	140	90	3	140	90
	60	17	16	8	20	20W	10W	2½	140	90	4	140	90
	80	17	20	8	20	20W	10W	2½	140	90	4	140	90
	90	17	20	8	20	20W	10W	2½	140	90	4½	140	90
1937–38	40	13¼	18	6	20	20W	10W	1¾ (A)	140	90	3	90H	90H
	60	17	18	8	20	20W	10W	2½	140	90	3	90H	90H
	80, 90	17	20	8	20	20W	10W	2½	140	90	4	90H	90H
1939	40	13¼	18	6	20	20W	10W	1¾	90	90	3	90H	90H
	60	17	18	8	20	20W	10W	2½	90	90	3	90H	90H
	80, 90	17	20	8	20	20W	10W	2½	90	90	4	90H	90H
1940	40, 50	13¼	17	6	20	20W	10W	1¾	90	90	3	90H	90H
	60, 70	17	17	8	20	20W	10W	2½	90	90	3	90H	90H
	80, 90	17	19	8	20	20W	10W	2½	90	90	4	90H	90H
1941	40, 50	13	18	6	20	20W	10W	1¾	90	90	3	90H	90H
	60, 70	16¾	18	8	20	20W	10W	2½	90	90	3	90H	90H
	90	18	21	8	20	20W	10W	2½	90	90	4	90H	90H
1942	40, 50	13	19	5½	20	20W	10W	1¾	90	90	3	90H	90H
	60, 70	16¾	19	7	20	20W	10W	2½	90	90	3	90H	90H
	90	18	22	7	20	20W	10W	2½	90	90	4	90H	90H
1946–47	40, 50	13	19	5½	20	20W	10W	1¾	90H	90H	3	90H	90H
	70	16¾	19	7	20	20W	10W	2½	90H	90H	3	90H	90H
1948	40, 50	13	19	5½	20	20W	10W	1¾	90H	90H	4	90H	90H
	70	16¾	19	7	20	20W	10W	C	F	F	4	90H	90H
1949	40, 50	13(D)	19	5½	20	20W	10W	E	F	F	4	90H	90H
	70	16¾	19	7	20	20W	10W	22	B	B	4	90H	90H
1950	40	13(D)	19	5½	20	20W	10W	E	F	F	4	90H	90H
	50	13(D)	19	5½	20	20W	10W	E	F	F	4	90H	90H
	70	17¾	19	7	20	20W	10W	22	B	B	4	90H	90H
1951–52	40, 50	12(D)	19	5½	20	20W	10W	E	F	F	J	90H	90H
	70	18	19	7	20	20W	10W	22	B	B	J	90H	90H

A—For semi-automatic transmission, use 3½ quarts of same oil used in engine.
B—Buick Dynaflow oil.
C—2½ pints for standard transmission; 22 pints for Dynaflow.
D—With Dynaflow, approximately 14 quarts.
E—Standard transmission, 1¾ pints; Dynaflow, approximately 19 pints.
F—90H on standard transmission; Dynaflow oil on Dynaflow transmission.
H—Hypoid gear lubricant.
J—1951 four; 1952 three.

FIRST ENGINE NUMBERS

LOCATION—1935 on right side of crankcase. 1936-52 series 40, 50 on right side of engine near front. 1936-52 series 60, 70, 80, 90 on right side of engine near rear.

Year	Model	
1935	40	4-2937408
	50	5-2922072
	60	6-2922072
	90	9-2922072
1936	40	4-2995239
	60	6-3001000
	80	8-3001000
	90	9-3001000
1937	40	4-3166225
	60	6-3176225
	80	8-3176225
	90	9-3176225
1938	40	4-3396937
	60	6-3396937
	80	8-3396937
	90	9-3396937
1939	40	4-3572652
	60	6-3572652
	80	8-3572652
	90	9-3572652
1940	40	4-3786214
	50	5-3786214
	60	6-3812000
	70	7-3812000
	80	8-3812000
	90	9-3812000
1941	40A	4-4074859
	40B	4-4074859
	50	5-4074859
	60	6-4085000
	70	7-4085000
	90	9-4085000
1942	40A	4-4457941-A
	40B	4-4457941
	50	5-4457941
	60	6-4457941
	70	7-4457941
	90	9-4457941
1946	40	4-4558037
	50	5-4558037
	70	7-4558037
1947	All	Note A
1948	40	4-4999881
	50	5-4999881
	70	7-4999881
1949	40	4-5220972
	50	5-5220972
	70	7-5220972
1950	40	4-5568000
	50 (Std.)	5-5628758
	50 (Dyn.)	5-5624734
	70	7-5635021

Note A: 1947 engine numbers continued from 1946.

FIRST SERIAL NUMBERS

LOCATION—1935-37 on frame under right front fender. 1938-40 on right frame side rail under hood. 1941 on right side of dash under hood. 1942-49 on left front door pillar; also on right side of shroud under hood. 1950-52 plate on left front door pillar and stamped on left side rail near master cylinder.

Year	Model		Year	Model		Year	Model	
1935	All	2777650			3-4263684			5-5050001
1936	All	2830899	1946	All	1-4364445			6-5054001
1937	All	2999497			2-4380001			7-5057001
1938	All	1-3219848			3-4390001	1950	All	1-5360001
		2-3238767	1947	All	1-4524131			2-5370001
		3-3245765			2-4530001			3-5374001
1939	All	1-3388547			3-4542001			4-5380001
		2-3395088			4-4536001			5-5388001
		3-3405088	1948	All	1-4801266			6-5393001
1940	All	1-3596807			2-4820001			7-5397001
		2-3601856			3-4824001	1951	All	1-6031301
		3-3611856			4-4830001			2-6050001
1941	All	1-3880012			6-4830001			3-6055001
		2-3892008	1949	All	1-5020984			4-6061001
		3-3897008			2-5030001			5-6070001
1942	All	1-4257442			3-5036001			6-6075001
		2-4273684			4-5043001			7-6080001

NOTE — Numeral preceding serial number designates assembly plant where car originated.

ENGINE

ENGINE, INSTALL

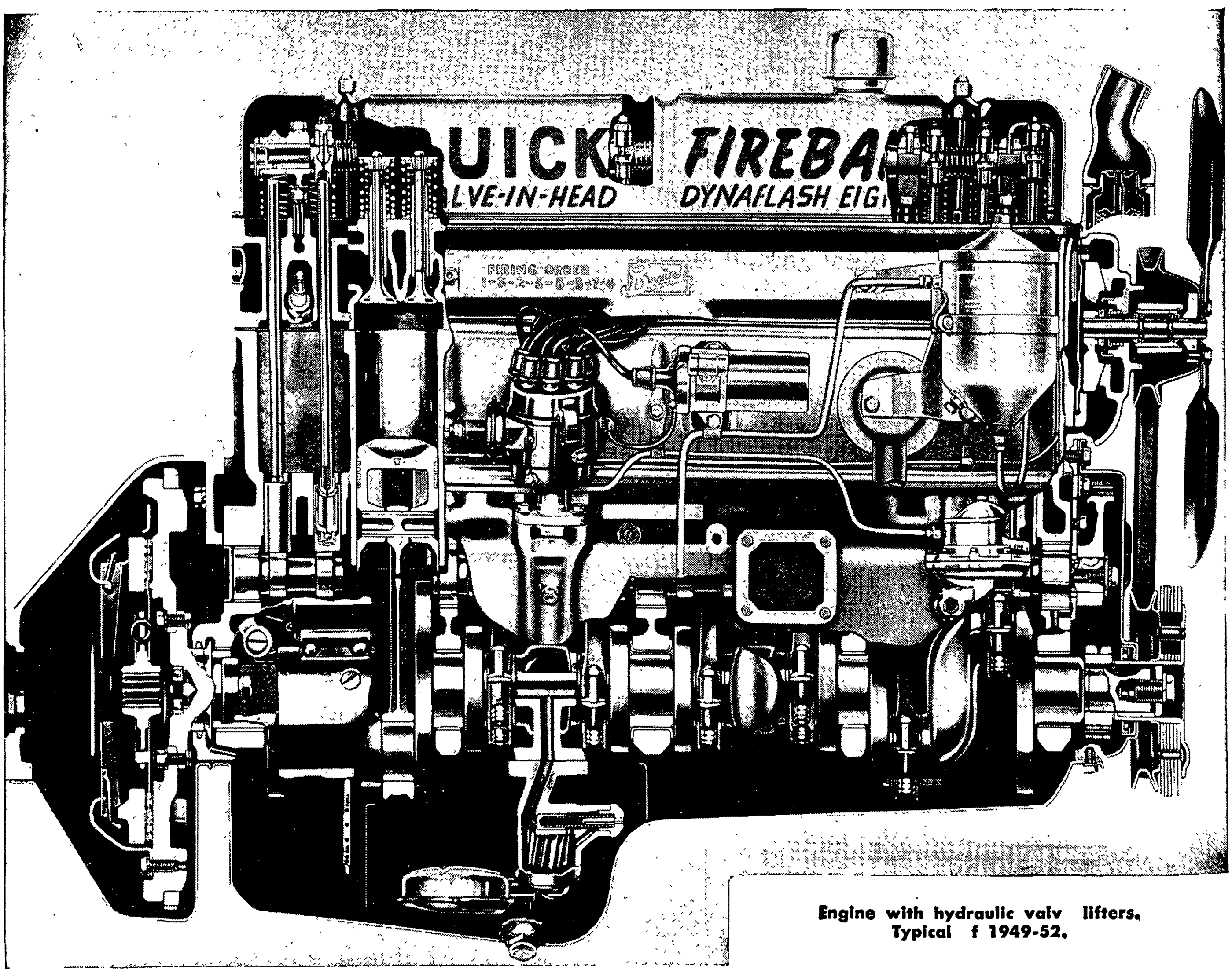
1935-38—When replacing the assembly, center the engine in the frame at the flywheel housing and install the original quantity of shims as were removed.

On series 40, insert shims between engine mountings and flywheel housing; and between engine mountings and frame on series 60, 80 and 90. On these latter cars, if a different engine is being installed, it will be necessary to bolt rear engine mountings to flywheel housing, so that the correct number of shims required to center the engine may be determined.

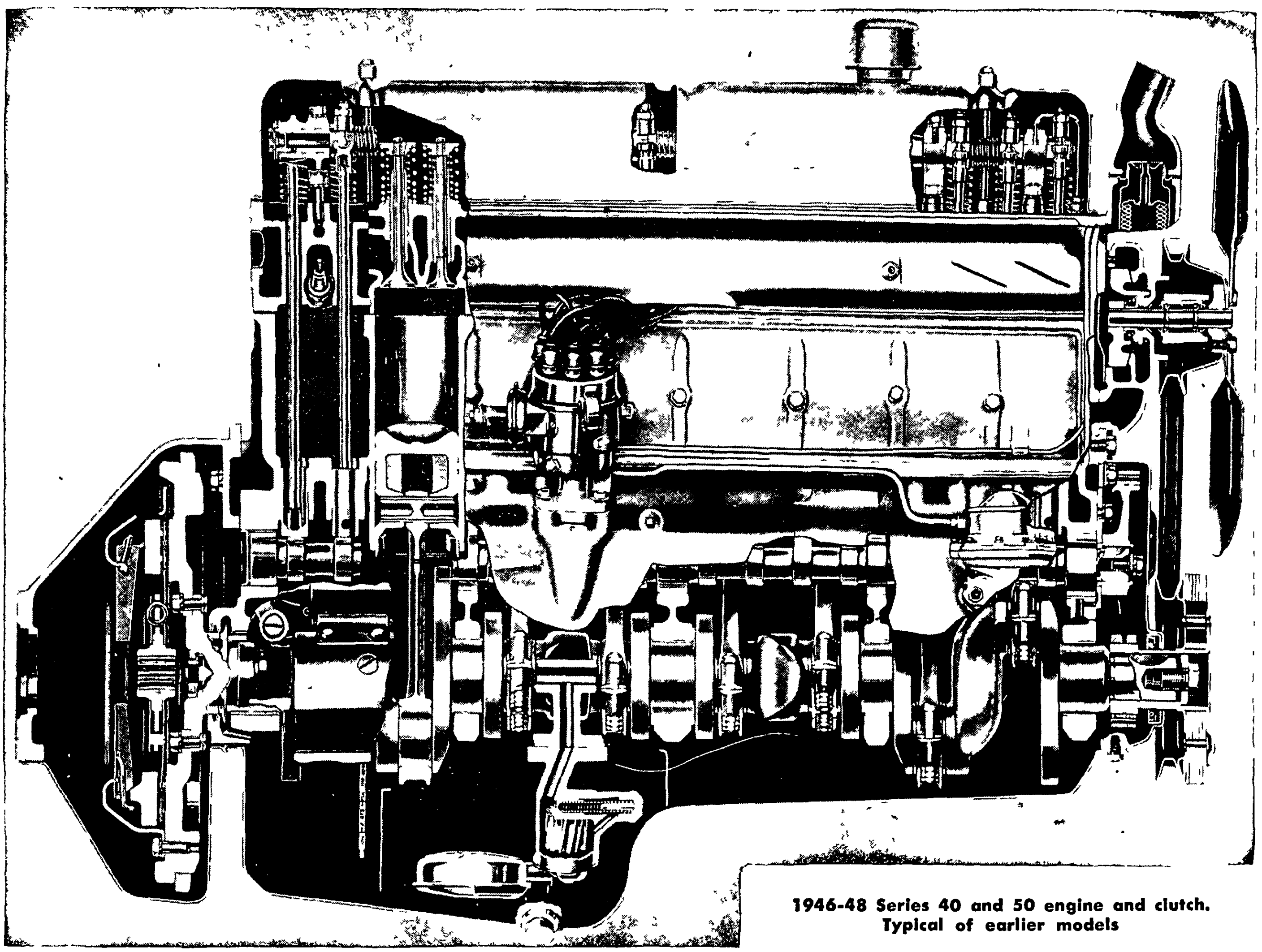
On 1936 cars, engine should be centered in chassis with reference to the center hole in front cross member, and held in this central position while the rear engine mounting bolts are tightened.

On 1935-37 cars, before bolting torque tube to the universal joint flange, loosen rear spring U clips to prevent any undue strain on torque tube when the transmission support is fastened to frame cross member.

On all series, bolt the transmission support to the frame cross member, add-



Engine with hydraulic valv lifters. Typical f 1949-52.



1946-48 Series 40 and 50 engine and clutch. Typical of earlier models

ing shims as required to obtain the central position.

On 1938 cars, assemble the transmission steady rest rod, but do not fasten the rod to the cross member until after the rod is secured to the lower plate at the center of the frame X member. To avoid any strain on the cross member, one of the nuts which fasten the member to the brace rod has a shake-proof washer and should be tightened first.

1939-40 — When removing the power plant, do not loosen the mountings from the frame as complete realignment with the rear axle will then be required. When removing the transmission support and steady rest rod, keep separate the shims at each end of the support so that the original installation is maintained.

On 1940, when connecting the engine to rear engine mountings, install the bolts and place a jack under the transmission to raise the engine until both supports are clear of the mountings. Then lower the engine until one support just rests on its mounting. Now measure the clearance at the opposite support, and insert that amount of shims.

Assemble the transmission steady rest rod, leaving the nuts which attach the rod to the cross member loose while fastening the rod to the lower plate at the center of the frame X member.

1941-47 — When replacing the power plant, tighten front mountings to frame and engine. Bolt center mounting to frame cross member and transmission, using shims as required between the forward web of engine support frame member and lower mounting flange. Tighten transmission support mounting to both the transmission and its support. Shim the support as required where it is attached to frame, using care not to strain the support from its normal position. Then tighten the rod in the transmission support without causing any tension on the rod.

1949-52—When installing the engine in the chassis, first tighten the front mountings and the transmission support to the frame cross member. Then tighten the transmission mounting pad to the transmission support and to the transmission rear bearing retainer.

Measure the distance between the front edge of the vibration damper (at horizontal centerline) and the center of the nearest shock absorber bolt head on each side. If distances on both sides are not equal, shift front of engine sidewise as required to center engine in frame, then tighten the engine mounting pad stud nuts securely. The mounting pad stud holes in the engine mounting brackets are oversize to permit sidewise adjustment of engine.

With engine and transmission resting freely and normally on mounting pads, install sufficient shims between thrust pad and transmission support to fill the existing space snugly. Insert shims from above, with tabs on right side in cars with Syncro-mesh transmission, or left side in Dynaflow Drive cars.

Tighten thrust pad front stud nuts and engine front mounting pad nuts. Finally, connect the torque tube to the torque ball.

ENGINE MARKINGS

1936-52—Engines are marked in production with color codes to indicate exact diameters of cylinder bores and pistons to aid in selective fitting of pistons on the assembly line. Code markings are placed on the crankcase lower flange opposite each cylinder bore and on bosses inside the pistons. These color codes have no value in service since replacement pistons cannot be supplied according to color codes and usually some change has taken place in cylinder bore dimensions after the engine has been in service for some time.

CYLINDER HEAD

1935-52—The general procedure for removing the cylinder head is as follows:

1. Drain cooling system and discon-

nect radiator thermostat housing from cylinder head.

2. Remove spark plug cover and spark plugs.

3. Disconnect temperature gauge tube and rocker arm oil pipe from cylinder head.

4. Remove air cleaner and disconnect gasoline and vacuum pipes from carburetor.

5. Disconnect carburetor linkage.

6. Disconnect exhaust pipe flange from exhaust manifold.

7. Remove rocker arm cover.

8. Remove rocker arm, shaft and bracket assembly.

9. Lift out push rods. On some models it may be necessary to remove No. 16 rod as the cylinder head is removed.

10. Remove cylinder head bolts and lift off head with manifolds attached.

INSTALLATION NOTES — On engines equipped with hydraulic valve lifters, it is extremely important to avoid getting dirt into these units. When removing and installing cylinder head, use every precaution to keep dirt out of the push rod compartment above the lifters.

On 1948 Series 70, the two bolts which attach the air cleaner bracket are ⅛ in. longer than the other bolts and their heads are marked with an "X". If these longer bolts are used elsewhere, the threads may be stripped and the bottoming bolts will distort cylinder bores.

Before the cylinder head is installed, make certain that all dirt and carbon is blown out of the blind tapped bolt holes in the block so that the bolts may be fully tightened without bottoming in the holes.

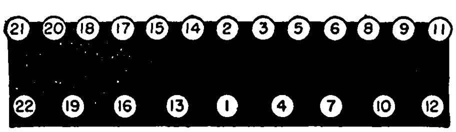


Fig. 1 Cylinder head bolt tightening sequence, 1935-52

Cylinder head bolt holes on the manifold side are open to the water jacket; therefore, bolts installed on this side should have their threads coated with sealing compound to avoid water leaks.

On late model engines equipped with a thin (.015 in.) lacquered steel gasket, use care when handling the gasket to prevent damage to the lacquered surface coat and to prevent kinking at the sealing rings stamped in the gasket. This lacquered gasket should not be coated with any type of sealing material when installed. Always use a new steel gasket because the stamped sealing rings in the used gasket are flattened when once used.

Always use an accurate torque wrench when tightening cylinder head bolts. Uneven or excessively tightened bolts may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder head bolts in the order shown in Fig. 1, tightening them a little at a time in proper sequence about three times around before final tightening to the torque values given in the *Tune Up Chart*. After engine has warmed up to operating temperature, recheck bolts and adjust torque as required.

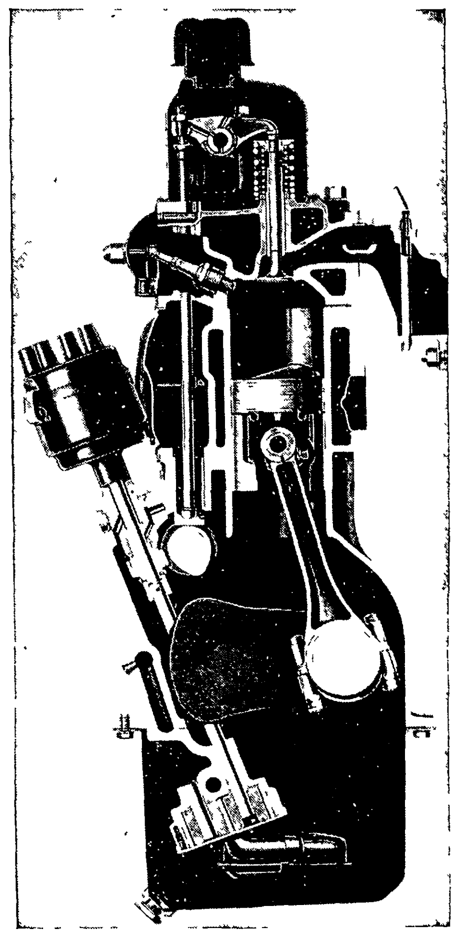
After the head is finally tightened down, adjust valve clearance or make initial adjustment of hydraulic valve lifters.

ROCKER ARMS

1935-52—When it becomes necessary to disassemble the rocker arm assembly, lay all parts on the work bench in proper sequence so that no difficulty will be encountered when reassembling.

To identify each rocker arm and assist in installation, an identification mark is formed on each rocker arm On 1938-42 engines, assemble rocker arms according to the instructions given in Figs 2 and 3, whereas 1946-52 rocker arms should be assembled as shown in Figs. 4 and 5.

Before a new rocker arm cover gasket is installed, scrape all pieces of the old gasket from the cylinder head, wash machined surface with a suitable solvent and wipe it dry. The new gasket should be cemented to the cylinder head instead of the cover. When the gasket is cemented to the cover it is more easily damaged when removing or installing the cover.



Cross section f engine. Typical of all 1939-52

VALVES & SPRINGS

1935-52 — To remove the valves and springs, take off the rocker arm cover and cylinder head. Compress the valve springs, take out the locking keys and

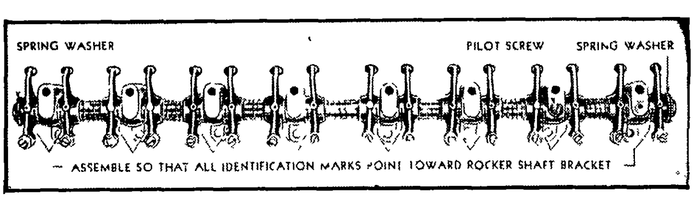


Fig. 2 R cker arm assembly, 1938-42 Series 40, 50

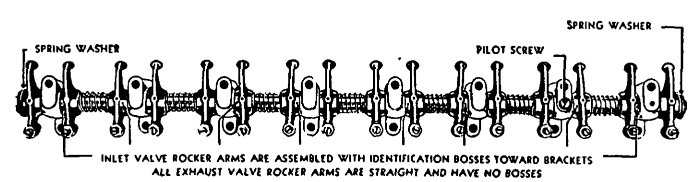


Fig. 3 Rocker arm assembly, 1938-42 Series 60, 70, 80, 90

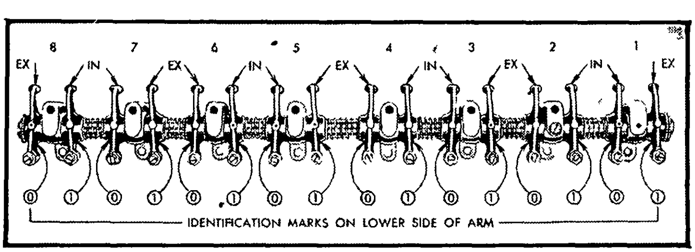


Fig. 4 R cker arm assembly, 1946-52 S ri s 40, 50

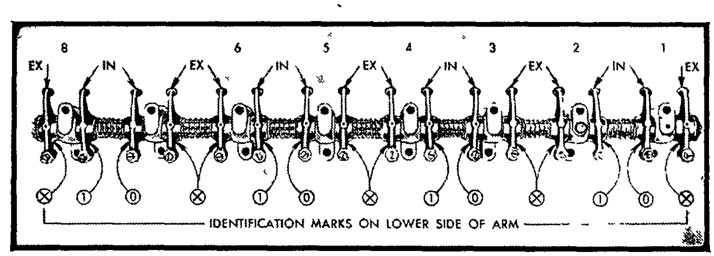


Fig. 5 Rock r arm assembly, 1946-52 Series 70

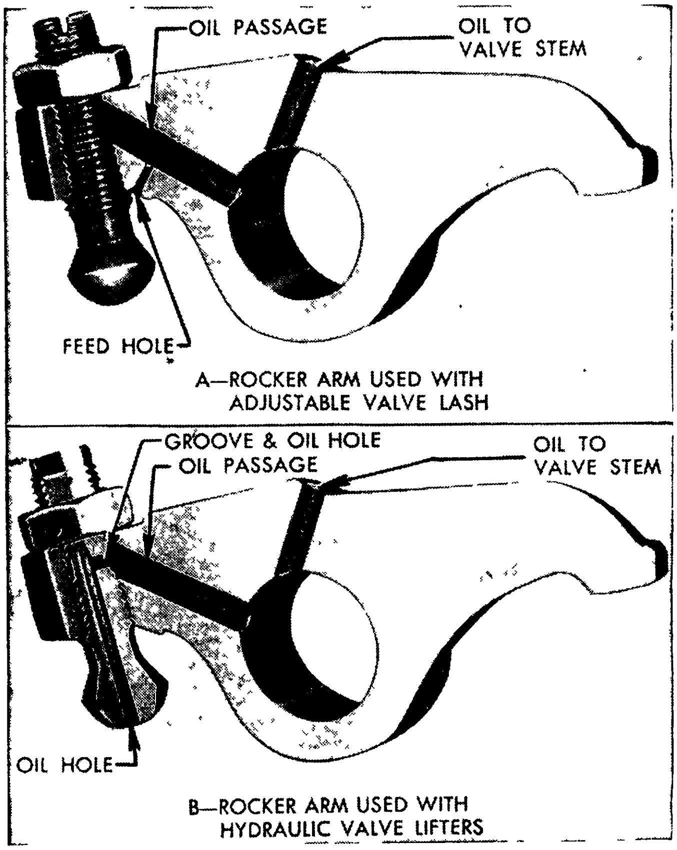


Fig. 9 Sectional view of r cker arms. 1949-52

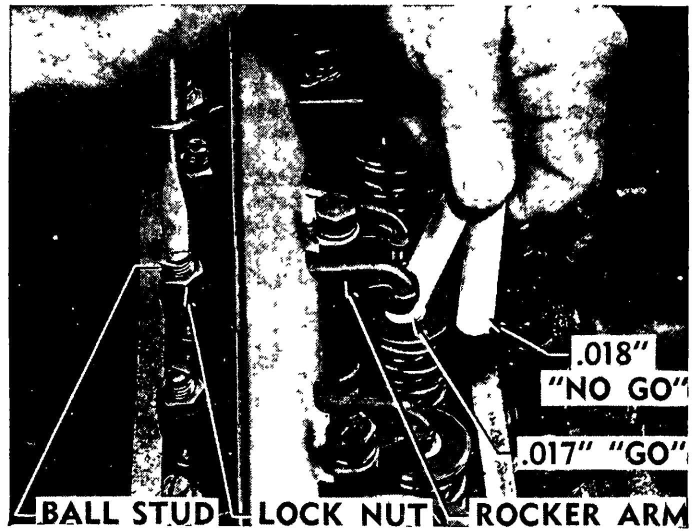


Fig. 7 Adjusting valve lash on 1936-52 engines without hydraulic valve lifters (see text for details)

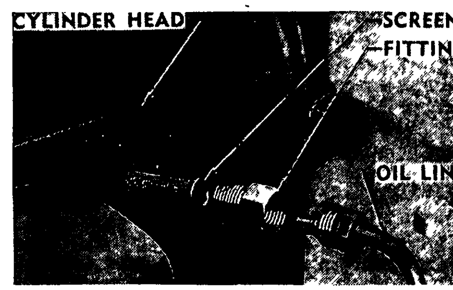


Fig. 8 Rocker arm oil lin scr n should always be cleaned when servicing valve system and tune up work. 1938-47

Fig. 10 Install chain s ther are 10 links r 11 teeth, indicat d by c pper-plated washers, betw n sprocket marks. 1936-52

lift out the valves and springs.

When using valve seating equipment, the seats and faces should be cut only just enough to tune up the surfaces. Cutting away the seat lowers the valve spring pressure, causing valve noise, valve sticking and less cooling at the seats.

Before replacing valve springs, be sure they conform to the specifications given in the *Valve Table,* replacing any that do not.

VALVE CLEARANCE, ADJUST

1935-52—On engines with non-hydraulic valve lifters, valve lash should always be adjusted whenever the cylinder head has been removed or tightened. To adjust valves in the shop to obtain a .015" *road operating clearance* (.008" on 1935) loosen the radiator cap (under some conditions, this will prevent an excessive water temperature build-up) and run the engine at a fast idle (700 RPM minimum) for about 30 minutes in order to stabilize the water and oil temperatures.

If the car has recently been operated on the road, and the engine oil is warm when starting the engine for a valve adjustment warm-up, use a .017" feeler gauge and check with an .018" gauge; the .017" feeler should pass while the .018" should not (see Fig. 7).

If the engine, particularly the oil, was cold, or at normal room temperature when the warm-up was started, use an .018" feeler and check with a .019" feeler; the .018" feeler should pass while the .019" should not.

If the car has been standing outdoors for some time during cold weather, it should be warmed up for at least 30 minutes and be adjusted with an .018" feeler and checked with a .019" feeler.

Cars coming in from a hard run should be allowed to stand with the engine not running for about an hour before warming the engine for an adjustment. This is because the oil is at operating temperature and will not cool sufficiently while the engine is idled to use the above procedure.

HYDRAULIC LIFTER ADJUSTMENT

1949-52—An initial adjustment of hydraulic valve lifters is required after the valves have been refaced, whenever the setting of the adjusting ball stud has been disturbed for any reason, or whenever valve lifters are removed and installed. To make the initial adjustment, proceed as follows:

Crank engine over slowly until distributor rotor indicates that affected cylinder is in firing position, which places both lifters in this cylinder on the camshaft base circle (off the cam).

Turn adjusting ball stud as required until all play of push rod between lifter and ball stud is *just removed,* and there is no lash clearance in the valve train.

Turn adjusting ball stud down exactly two turns more. Check to make sure that oil groove on ball stud, Fig. 9, is at least halfway down in the rocker arm so that it connects with the drilled oil passage in the rocker arm, then tighten the lock nut.

If the oil groove on the ball stud is not at least halfway down in the rocker arm, turn the ball stud down an additional turn (total 3 turns) and tighten lock nut. If oil groove is still too high,

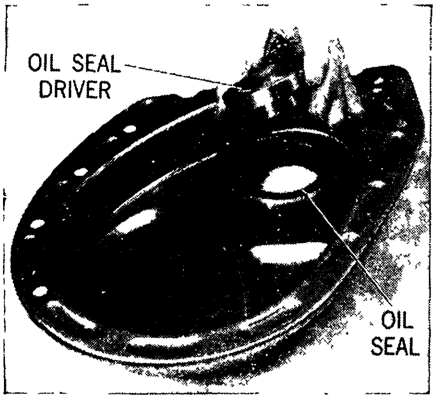


Fig. 11 Us of special oil seal driver n 1942-52 timing chain covers

it will be necessary to install another push rod or lifter.

VALVE STEM GUIDES

1935-52—See the *Valve Table* for valve stem clearance specifications. Before removing the old guides, measure the distance between the cylinder head to the top of the guide and install the new guides accordingly.

VALVE LIFTERS & GUIDES

1935-52—To remove the valve lifters, take off the rocker arm, spark plug and push rod covers. Unfasten the rocker arm shafts, support bolts and oil fittings. After lifting out the push rods, the lifters may be removed. Lifters are carried in guide holes reamed in the crankcase.

NOTE—For complete data on servicing hydraulic valve lifters, consult the special chapter devoted to this subject.

VALVE TIMING

1935-52—The position of the pistons and valves is correctly timed when the marks on the camshaft and crankshaft sprockets are in line with the copper-plated washers on the timing chain, Fig. 10. This applies to all models except 1935-50, 60 and 90. On these engines, the relationship is correct when the marks on the camshaft and crankshaft gears are in mesh.

If the chain has no copper-plated washers, it should be installed so there are 11 chain teeth or 10 links between the marks on the sprockets.

TIMING GEARS

1935 Series 50, 60, 90 — Normal gear backlash is from .0005" to .001". Excessive backlash may be reduced .001" by using replacement camshaft gears designated as plus 1S, which have teeth .001" thicker at the pitch circle than standard gears. If this gear does not reduce the backlash to normal, the complete set of gears should be replaced.

NOTE—When installing timing gear, be sure the timing marks are meshed.

TIMING CHAIN & COVER

1936-52—The general procedure for replacing the timing chain is as follows:

1. Drain cooling system and remove radiator core.

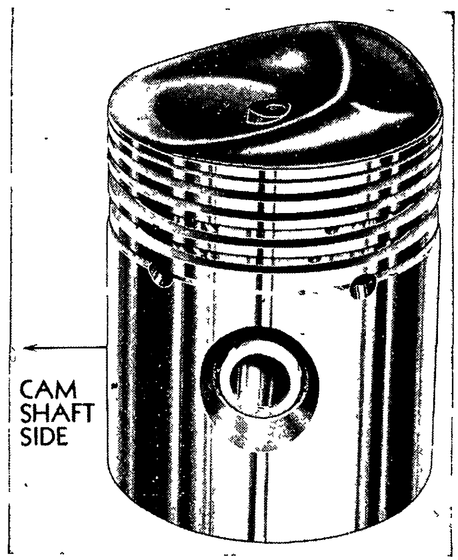


Fig. 12 On 1939-52 models, assemble rod and piston so that oil hole in rod and hollowed side of piston head faces camshaft when installed

2. Remove fan belt and vibration damper.
3. Remove timing chain cover after loosening two oil pan bolts on each side to avoid damage to gasket.
4. Check slack in timing chain. If slack exceeds one inch when chain is pulled outward, a new chain should be installed.
5. To install a chain, turn crankshaft to align timing marks on sprockets with timing marks on chain, Fig. 10.
6. Remove camshaft sprocket which is attached to camshaft by a bolt, lockwasher and plain washer. The sprocket drives the camshaft through a key pressed into the camshaft. Remove chain and sprocket together.
7. Clean all sludge from timing cover and chain compartment. Make sure that oil drain hole to oil pan is clear.
8. Install new chain with camshaft sprocket, being sure timing marks are in line as shown in Fig. 10.
9. If oil seal in cover is worn or otherwise doubtful, install a new one as follows: Drive out the old seal with a punch, using care not to distort the cover. Remove old gasket and wipe all dirt out of recess. Place new gasket in recess, and place new seal in position with spring side outward. Drive seal into recess and tight against the gasket, using Seal Driver J-1870, Fig. 11.
10. Examine hub of vibration damper for burrs which would damage oil seal and for grooving from contact with oil seal. A slightly grooved hub may be refinished; however, if deeply grooved, the vibration damper should be replaced to insure proper contact of hub with oil seal.

CAMSHAFT & BEARINGS

1935-52—The camshaft is supported in five steel-backed babbitt-lined bearings which are pressed into the block. The bearings must be line-reamed to size after being pressed into place. Since this operation requires special reaming

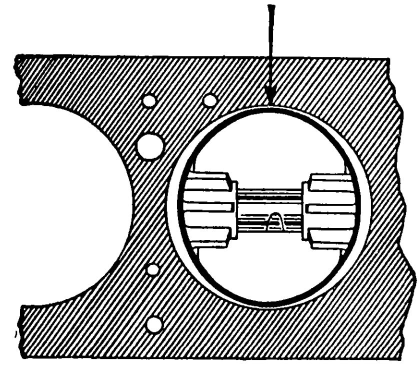


Fig. 13 Arrow indicat s wher f eler should be used when ch cking piston clearance. 1935-52

equipment the original bearings should be retained unless severely damaged.

Slightly scored camshaft bearings will be satisfactory if the surface of the camshaft journals are polished and bearings are cleaned up to remove burrs, and the fit of the bearings is free and within the clearance limits given in the *Engine Bearing Data* chart.

Camshaft end play is controlled by a spacing ring located between the camshaft front bearing journal and a thrust plate attached to the block behind the camshaft sprocket. The spacing ring provides the necesary clearance or end play when the sprocket is tightened against it by the sprocket bolt. End play specifications are listed in the *Engine Bearing Data* chart.

IMPORTANT—When a new camshaft is installed, make certain that it is the correct part for the type of valve mechanism in the engine. Use of a camshaft designed for an engine with hydraulic valve lifters, or vice-versa, will result in extremely rough and noisy engine operation.

PISTONS & RODS, REMOVE

1935-52 — After removing the cylinder head, examine the cylinder bores above the ring travel area. If bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove connecting rod caps and push pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so that they can be reinstalled in original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1935-38 Flat Head Pistons—When assembled, the oil spray hole in the big end of the rod should face the camshaft side of the engine with the slotted side of the piston facing away from the camshaft.

1938-52 Dome Head Pistons — Fig. 12. When assembled, the oil spray hole in the big end of the rod should be toward the hollowed side of the piston head.

And when installed in the cylinder, the hollowed side of the piston head should face the camshaft side of the engine.

PISTONS

1935-52 — Standard size Buick service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileage. Service pistons are also furnished in .005, .010, .020 and .030 in. oversizes. All service pistons are diamond bored and selectively fitted with piston pins; pistons are not furnished by Buick without pins.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin (thrust side of piston). Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is very important that refinished cylinder bores are trued up to have not over .0005 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fiber brush. If all traces of abrasive are not removed, rapid wear of new pistons and rings will result.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore; therefore the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees F. between parts is sufficient to produce a variation of .0005 in.

The high and low limits on clearance of pistons in cylinders at 70 degrees F. are given in the *Piston & Ring Data* chart. The clearance should be measured with two feeler gauges of "Go" and "No Go" thicknesses specified in the chart.

Feeler gauges should be approximately 12 in. long and ½ in. wide, except that the "Go" gauge should be ¼ in.. wide (if obtainable), since this width gives a more sensitive test of clearance. Feeler gauges must be free of dents, burrs and rough edges.

Wipe pistons and cylinder walls clean and dry. Then wet pistons and cylinders with penetrating oil, which will materially aid in determining fits with feeler gauges.

Suspend the specified "Go" gauge its full length in the cylinder bore at the point shown in Fig. 13. Then insert the piston into the bore with head downward and piston pin parallel to engine. The piston should move downward the length of the cylinder by its own weight when tested with the "Go" feeler gauge. Repeat the test using the

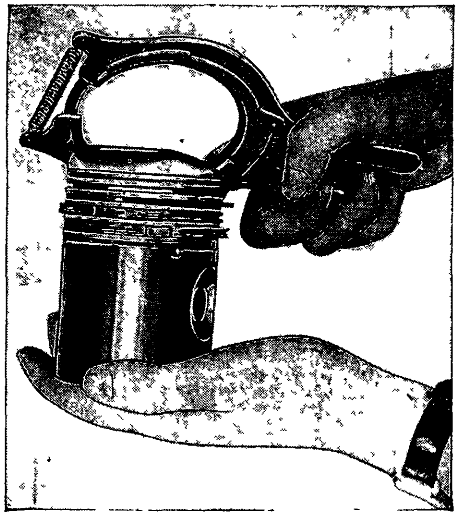


Fig. 14 Piston ring removing and replacing tool. 1935-52

specified "NoGo" feeler gauge, in which case the piston should fit closely enough so that it will not move downward of its own weight.

PISTON RINGS

1935-52—When new piston rings are installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter. This is done with a "Glaze-buster" or with a hone equipped with the finest grade of stones.

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. However, Flex-Fit rings used on late model cars need no fitting or checking for gap. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston and Ring Data* chart for ring groove clearances and end gap clearances.

To check the end gaps of rings other than Flex-Fit, place the ring in the cylinder in which it will be used. Square it in the bore by tapping with the lower end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends of rings carefully with a smooth file.

PISTON PINS

1935-52—Piston pins are fitted with a clearance of from .0003" to .0004" at approximately 70 degrees F., which is equivalent to an easy finger push at that temperature.

All service pistons are diamond bored at the pin holes and are fitted with pins. When piston fits are found to be too tight or too loose, new piston and pin assemblies will have to be installed. Slight tightness on new pistons will correct itself as mileage builds up.

NOTE—Sometimes pins will be found tight due to varnish or other accumulation from lubricants. Removing this accumulation will usually correct the fit. Pistons which have been scored, even though the score is slight, may have tight pins due to the two piston pin bosses being pulled out of alignment with each other.

CAUTION—To prevent the possibility of wristpin distortion, with a consequent binding in the piston, do not tighten the wristpin clamp bolt with extreme force. A standard 5½" wrench should be used.

CONNECTING RODS

1935-48—The lower end bearing of the connecting rods are babbitt-lined, bonded directly to the rod and cap. Shims are provided to allow adjustment without filing. If bearings require adjustment, remove the same thickness of shims from each side until a metal-to-metal contact is established with the crankpin. Then replace an equal thickness of shims on each side to provide the proper oil clearance.

When assembling connecting rods, care must be taken to insure that the sides of the cap and rod line up to prevent scoring of the thrust faces on the crankshaft cheeks. The marker on the rod and cap should point toward the rear of the engine.

Special diameter ground bolts are used to assure an accurate line-up of the cap and rod. Under no circumstances should common bolts be used as it will not be possible to obtain proper fits.

1949-52 — Connecting rod bearings in these engines consist of two half shells which are alike and interchangeable in rod and cap. When the shells are placed in the rod and cap the ends extend slightly beyond the parting surfaces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the shells must never be filed flush with the parting surface of the rod and cap.*

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the connecting rod or cap be filed to adjust the bearing clearance.

Service bearings are furnished in standard size and several undersizes, including undersizes for reground crankshafts.

The clearance of connecting rod (and main) bearings may be checked with Plastigage, Type PG-1 (green), which has a range of .001 to .003 in. Plastigage is available from Buick dealers and

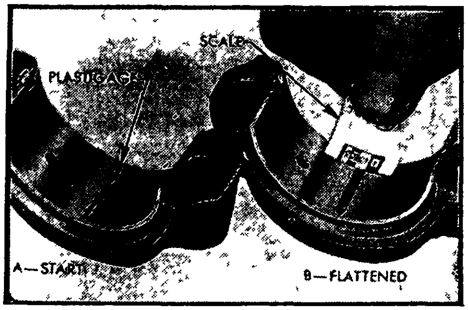


Fig. 14A Checking bearing clearanc with Plastigage

auto parts jobbers. To check clearance, proceed as follows:

1. Remove connecting rod cap and wipe the oil from the bearing and crankshaft journal. Also blow the oil out of the oil hole in the crankshaft. *Plastigage is soluble in oil.*
2. Turn crankshaft so that crankpin being checked is approximately 30 degrees before bottom dead center. In this position the clearance will be checked at the point of least clearance if crankpin is worn out of round, and the Plastigage will not be at the oil hole in the crankshaft.
3. Place a piece of Plastigage lengthwise along the bottom center of the lower bearing shell, Fig. 14A. Install the cap and torque tighten the cap bolts to the tension given in the *Engine Bearing Data* chart.
4. Do not turn crankshaft with Plastigage in bearing.
5. Remove bearing cap. The flattened Plastigage will be found adhering to either the bearing shell or crankshaft. *Do not remove it.*
6. Using the scale printed on the Plastigage envelope, measure the width of the flattened Plastigage at its widest point, Fig 14A. The number within the graduation which most closely corresponds to the width of the Plastigage indicates the bearing clearance in thousandths of an inch.
7. The desired clearance with a new bearing is .0008 to .0015 in. If bearing has been in service it is advisable to install a new bearing if the clearance exceeds .0022 in. However, if the bearing is in good condition and is not being tested for bearing noise, it is not necesary to replace the bearing.
8. If a new bearing is being selected, try a standard size, then each undersize bearing in turn until one is found that is within the specified limits when checked for clearance with Plastigage. Each undersize bearing shell has a number on outer surface on or near the tang to indicate amount of undersize.
9. After the proper size has been selected, clean off the Plastigage, oil the bearing thoroughly, install the cap and tighten bolts to the recommended tension.
10. With selected bearing installed and bolts tightened, it should be possible to move the connecting rod freely back and forth on crankpin as allowed by end clearance. If rod cannot be moved, either the bearing is too much undersize or a misaligned rod is indicated.

MAIN BEARINGS & CRANKSHAFT

1935-36—In these engines, main bearings are dowelled to the crankcase, making it necessary to remove the engine and crankshaft to install new bearings. When bearings require adjustment, remove an equal thickness of shims from each side until the desired clearance is obtained.

1937-47—These bearings are assembled with from .000" to .002" projection above the bearing cap and face on the crankcase to insure positive contact. Shims are provided to allow adjustment for wear. Main bearing caps should not be filed.

Main bearings are supplied in service in reamed sets. These must only be used in complete sets as they are produced by line reaming a set of bearings in a crankcase. Therefore, when mixing with another line reamed set, misalignment of the crankshaft is very likely to occur.

Main bearings are also supplied in service which are not reamed to size. When fitting these bearings, special line reaming equipment is required.

1948-52—Main bearings in these engines are the precision insert type which do not require reaming to size or other fitting. Shims are not provided for adjustment since worn bearings are readily replaced with new bearings of proper size. Bearings for service replacement are furnished in standard size and several undersizes. Under no circumstances should main bearing caps be filed to adjust for wear in old bearings. And the end of the bearing shells must never be filed flush with the parting surface of the crankcase or bearing cap for then the proper "crush" fit of the bearing will not be obtained.

CRANKSHAFT END THRUST

1935-52—Crankshaft end thrust is taken by the flanges on the center main bearing. Through normal wear, the end play will seldom become excessive but whenever new bearings are fitted, check the end play by forcing the crankshaft forward to the limits of its end play, using a pry bar or other suitable tool, then slip the feeler between the bearing flange and the crankshaft fillet. If the end play is not within the limits given in the *Engine Bearing Table,* the bearing flanges may be dressed down to provide the desired clearance.

NOTE—If excessive end play develops, it will be necessary to replace the bearing.

REAR BEARING OIL SEALS

On 1935-38 Series 40, a groove in the bearing ahead of the oil collecting groove allows surplus oil to drain to the oil pan.

On 1935-37 Series 50, 60, 80, 90, a cork ring gasket is provided in the machined groove in the cap and crankcase to prevent oil leaks at the rear main bearing. When a new seal is installed, plug the oil return hole in the bearing cap with cup grease so that the cork will have enough initial lubrication when the engine is first started. By plugging this drain hole, the oil can only return to the oil pan through the cork seal.

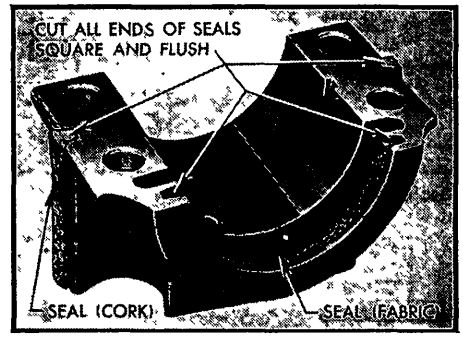


Fig. 14B Rear main bearing oil seals, 1939-52

1938 SERIES 60, 80, 90; All 1939-52—In these engines, the rear main bearing is sealed against external leakage in the following manner.

1. An oil slinger machined on the crankshaft rotates in a groove formed in the crankcase and bearing cap just to the rear of the bearing. This oil collecting groove drains back into the oil pan.
2. Braided fabric seals are pressed into the grooves formed in the crankcase and bearing cap to the rear of the oil collecting groove, Fig. 14B.
3. Cork seals are located at the vertical joints between the bearing cap and crankcase.

The braided fabric seal can be installed in the crankcase only when the crankshaft is removed. However, the seal can be replaced in the bearing cap whenever the cap is removed. Remove the old seal and place the new seal in the groove with both ends projecting above the parting surface of the cap. Force the seal into the groove by rubbing down with a hammer handle or smooth wood stick until the seal projects above the groove not more than $\frac{1}{16}$ in. Cut the ends off flush with the surface of the cap, using a sharp knife or razor blade, Fig. 14B.

The engine must be operated at a slow speed when first started after a new braided seal is installed.

The cork seals are slightly longer than the grooves in the bearing cap. Coat the grooves with gasket cement and when this is tacky, carefully work the seals into the grooves with a putty knife. Lightly compress the seals into the grooves by placing the cap in a vice for a few minutes. Cut ends of seals square and flush with machined surfaces of bearing cap and coat outer surfaces with vaseline before installing cap in crankcase.

ENGINE OILING

OIL PAN

1935-52—Before the oil pan can be lowered on 1936-38 engines, it is necessary to disconnect the stabilizer bar from the frame brackets. On 1941-52 models, remove the engine side pans and disconnect the pitman arm from the tie rod.

NOTE—On all models, turn the engine over to bring No. 1 and 2 pistons as near to the center of their cylinders as possible so that the crankshaft throws will not interfere with the pan as it is being lowered.

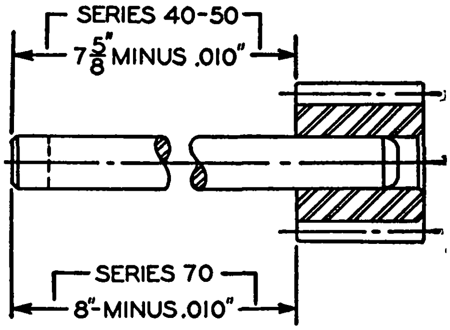


Fig. 15 P sition of oil pump gear n shaft, 1940-52

OIL PUMP

1935-52—When an oil pump is removed for repairs the following procedure must be used to inspect parts and assemble pump in order to insure adequate oil pressure when work is completed.

1. Remove screen and float assembly from pump cover by removing retaining cotter pin. Wash screen thoroughly in kerosene or other solvent and apply light air pressure through the inlet tube to dislodge dirt from outer surface of screen.
2. Check oil pressure valve to see if it is free in pump body. Also, check hole in body to see that it is not oversize and that the valve fits the hole throughout its length. Check the spring to see that it is not collapsed, worn on its side, or broken. Replace with a new spring if in doubt.
3. On 1940-52 models, check position of gear on shaft. Measurement should be as shown in Fig. 15.
4. Install gear and shaft in pump body and install idler gear with rounded end of teeth placed inward or away from pump cover.
5. Check for clearance between gears and cover by using a steel straight edge as shown in Fig. 15A. Use feeler gauge between straight edge and gears.
6. Install pump cover and tighten all cover screws. Then turn pump shaft to check for bind. Shaft and gears must turn freely and a very slight amount of end play should exist.
7. Attach screen and float to pump cover and make sure it is securely retained by the cotter pin, that it swings freely, and that the stops permit full range of vertical movement.
8. Attach pump to crankcase, using the proper gasket. Tighten the two attaching screws evenly.
9. Test pump alignment by twisting the pump shaft with fingers. Shaft should turn freely within limits of gear backlash. Make this test every 180 degrees through two complete revolutions of crankshaft. If pump shaft is not free in all positions, loosen attaching screws and shift pump to a position which will relieve all binding.
10. If tightness still exists, it may be due to the limits to which the pump body was machined, or to a rebuilt distributor assembly, or both. In this case, it will be necessary to remove the pump and the distributor and grind a slight amount from ends of pump and distributor shafts to provide a slight clearance. The distributor gear must be removed, and when reinstalled, both ends of retaining pin must be securely riveted.
11. If low oil pressure persists after checking through oil pump, look for loose crankshaft and camshaft bearings.

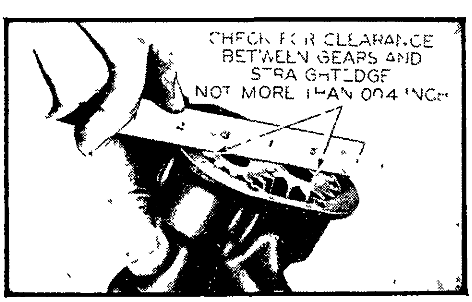


Fig. 15A Checking clearance of il pump gears at c ver, 1935-52

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-52—On 1935-36 cars, the core is removed with the shell and grille as a unit. On 1937-52, the core is disconnected from its attaching points and lifted out over the top of the engine after removing the water pump. On 1941 models, detach the upper radiator arched stamping.

WATER PUMP, REMOVE

1935 Series 40, All 1936-52—Remove the water hose, fan blades and lift off the pump assembly. On 1938-39 cars, disconnect the right hood side panel.

1935 Series 50, 60. 90—Loosen the hose clamps and remove the pump mounting bolts to lift off the assembly, moving it back to disengage the water pump drive and hose couplings.

WATER PUMP, OVERHAUL

1935-36—On 1935 Series 40 and all 1936 models, remove the fan blades and pull hub from shaft. On 35-50, 60, 90, drive the pin out of coupling and shaft. On all models, remove housing cover. Loosen packing nut and press impeller and shaft out through rear of housing. Remove packing nut and packing, cleaning out housing thoroughly. Drive out front and rear bushings (front ball bearing on 36-60, 80, 90).

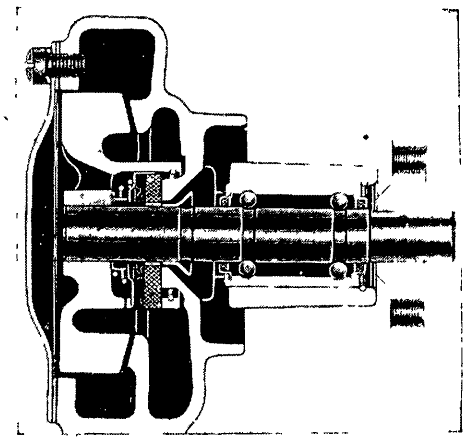


Fig. 16 Water pump. 1938-47

NOTE—When installing a new impeller, apply pressure evenly to prevent the impeller from cracking. Always use a new pin.

To assemble, insert the shaft through rear of housing, pushing it forward through rear bushing, packing rings, packing nut, and front bushing or bearing.

1938-47 BALL BEARING PUMP—Fig. 16. Overhaul as follows: Take off fan blades and pulley. With a puller, remove hub from shaft.

NOTE—Do not apply extreme force to the shaft in such a manner that the load is taken by the bearing, as damage to the bearing will result in noise

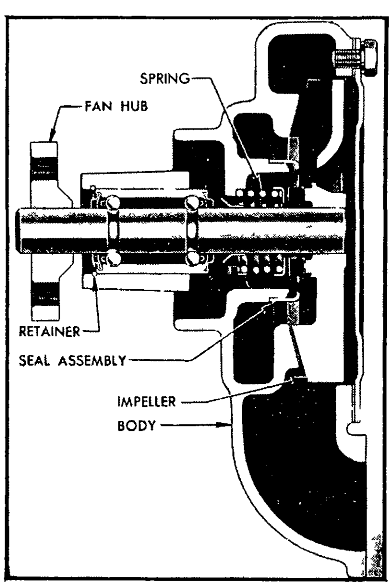


Fig. 17 First type wat r pump. 1948 engines

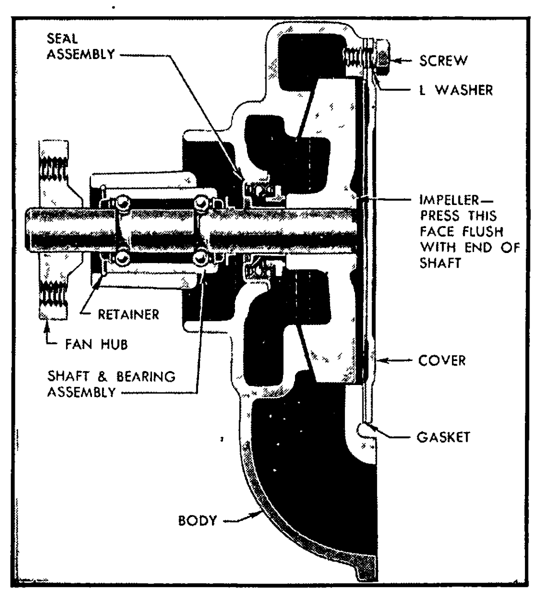


Fig. 18 S c nd type 1948 and all 1949-52 wat r pump

and eventual failure. Remove pump cover. Release snap ring from front of housing. Support pump on the circular flange just to rear of bearing assembly and press shaft through impeller, taking out shaft and bearing assembly from forward end of pump.

NOTE—The seal and impeller are serviced as an assembly, therefore do not remove the seal. The shaft and bearing are also serviced as a unit, pre-packed with lubricant.

To assemble, press in the shaft and bearing, applying the pressure to the forward end of the outer bearing race while supporting the pump housing on its rear cover face. Replace the front bearing snap ring. Support the impeller end of the shaft, press on the fan hub until the shaft protrudes through the hub for 3/8″ on 1938-1940 series 40 and 50; 3/16″ for 1938-1940 series 60, 70, 80 and 90, and 13/64″ for all 1941-47 models. These measurements are taken from the forward face of the fan hub.

Apply a little cup grease to the impeller end of the shaft; to the carbon disc of the seal, and to the surface in the pump body against which the disc rotates. Support the pump assembly on the forward end of the shaft and press on the impeller and seal assembly until the rear face of the impeller hub is flush with the end of the shaft. Replace the impeller cover and install the pump.

1948-52—In the first type 1948 water pump, Fig. 17, the seal assembly is composed of a brass shell, a carbon ring and rubber washer bonded together. The brass shell is pressed on the hub of the pump body and a helical spring presses the carbon ring against the hub of the impeller to seal against passage of water.

In the second type 1948 water pump (also used in 1949-52), Fig. 18, the seal assembly is composed of a brass sleeve, a helical spring, a rubber bellows, and a carbon washer. The brass sleeve is pressed into the hub of the pump body. The spring presses the flanged end of the rubber bellows against the sleeve and carbon washer, and also presses the carbon washer against the hub of the impeller to seal against passage of water. Two ridges pressed in the brass sleeve engage notches in the carbon washer to prevent the washer from turning with the impeller.

NOTE—Since the first type pump can be replaced by the second type pump at very little increase in cost over repairs, and thus gain the advantage of the improved seal design of the second type pump, replacement parts are not furnished for the first type pump. These pumps can be identified by the number on the body casting. The body casting number for the first type pump is 1330139, and the casting number for the second type pump is 1336756.

ELECTRIC SYSTEM

IGNITION TIMING

1935-52—Fig. 19. On 1935-38 models, set the octane selector pointer at its central position (no scale is used on 1939-52). With the breaker gap set to the clearance given in the *Tune Up Chart,* crank engine until No. 3 exhaust valve starts to open. Continue cranking slowly until the ADV mark on flywheel lines up with indicator on flywheel housing; at this position, No. 1 cylinder should fire.

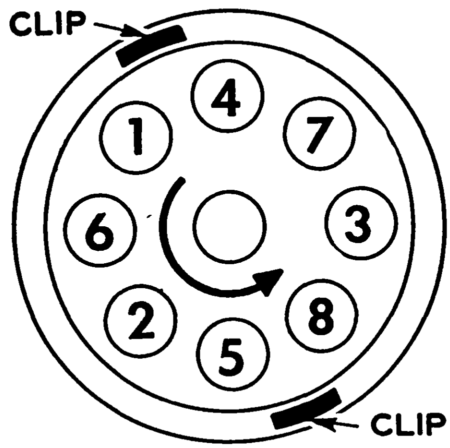


Fig. 19 Drawing of 1935-52 distributor cap showing firing order, direction of rotation and location of cap clips

The correct ignition timing for highest performance and maximum mileage is best indicated when there is a slight "ping" at wide open throttle at a speed between 10 and 20 mph. The standard timing given above may have to be altered slightly to obtain maximum performance due to variations in different fuels. On series 40 and 50 engines, the standard timing is designed for regular fuels, while on 60, 70, 80 and 90 engines, it is based on the use of high test fuel.

NOTE—The flywheels used on 1941-42 series 40 and 50 are marked for both single and compound carburetors. The space between these marks is serrated and painted. If equipped with compound carburetors, use the 6 degree mark (4 degree on 1941); if a single carburetor is used, set to the 4 degree mark (2 degree on 1941).

CLUTCH

CLUTCH PEDAL, ADJUST

1935-52—Before adjusting the pedal lash on 1935-40 cars, see that the pedal clears the underside of the floor board by 3/8″ to 5/8″. This clearance is obtained by adjusting the clutch pedal stop screw at the lower end of the pedal.

On 1941-52 cars, a rubber bumper is mounted on the underside of the toe board and holds the pedal away from the floor pan and besides, locates the air seal properly.

Free play of the clutch pedal is adjusted by turning the pedal adjusting screw or clevis, thereby changing the length of the pedal rod (see Figs. 20, 21, 22, 23A. On all models, free pedal play should be from 3/4 to 1 inch.

CLUTCH, REMOVE & INSTALL

1935-52—The general procedure for removing the clutch is as follows:

1. Remove rear axle assembly and

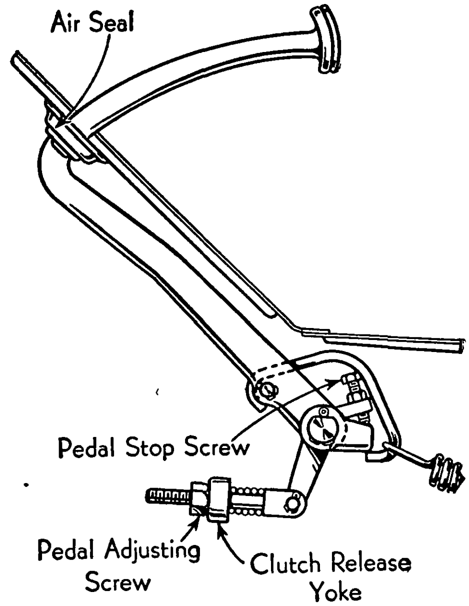


Fig. 20 Clutch pedal adjustment. 1935-38 Series 60, 80, 90

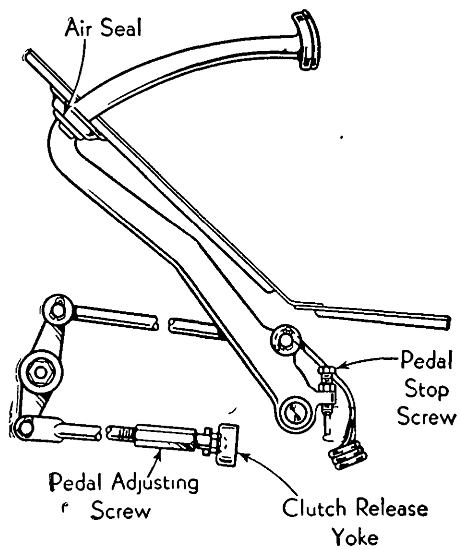


Fig. 21 Clutch pedal adjustment. 1936-38 Series 40

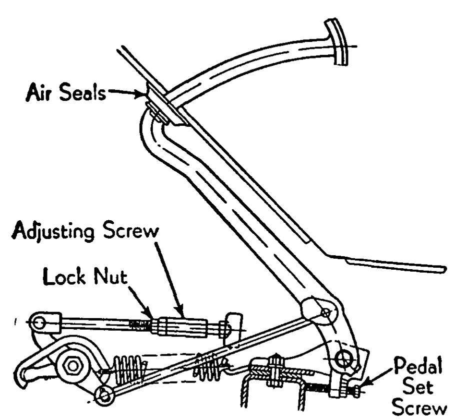


Fig. 22 Clutch pedal adjustment. 1939, 1940

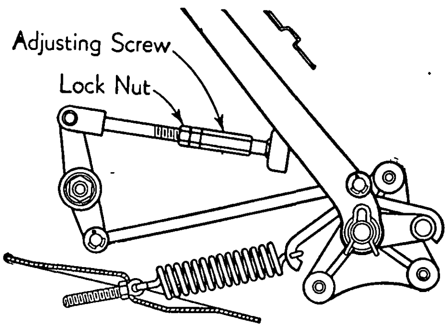


Fig. 23 Clutch pedal adjustment, 1941 thru 1949

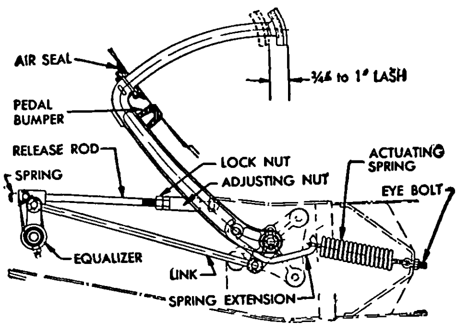


Fig. 23A Clutch pedal adjustment, 1950-52

transmission as outlined under their respective headings.

2. Remove flywheel lower housing.

3. Disconnect release rod from release yoke and remove yoke boot and release rod nut lock which are bolted to the yoke, Fig. 23B.

4. Remove spring washer which retains release bearing support in flywheel housing and remove support and gasket.

5. Pull outward on release yoke to free it from the ball stud in flywheel housing and remove yoke and release bearing through bottom of housing. Separate yoke from bearing.

6. Mark clutch cover and flywheel with center punch so that cover can be reinstalled in the same position on flywheel in order to preserve engine balance.

7. Loosen each clutch cover bolt a little at a time in order to relieve clutch spring pressure evenly and avoid distortion of cover. Support pressure plate and cover assembly while removing the last cover bolts, then remove assembly and driven plate.

INSTALLATION OF CLUTCH—

1. Very sparingly apply front wheel bearing lubricant to main drive gear pilot bearing in crankshaft. If too much lubricant is used it will run out on face of flywheel when hot and ruin driven plate facings. Make sure that surface of flywheel is clean and dry.

2. Make sure that splines in driven plate hub are clean and apply a light coating of Lubriplate. Driven plate facings must be clean and dry.

3. Place driven plate on pressure plate with oil slinger toward pressure plate. Then place clutch assembly in position against flywheel, being sure to align

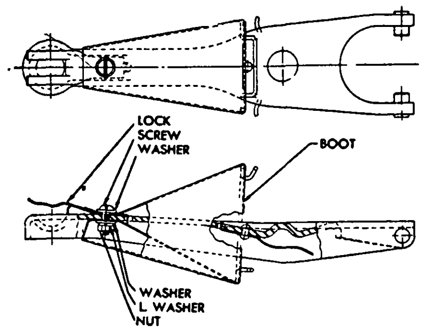


Fig. 23B Clutch release yoke and boot, 1940-52

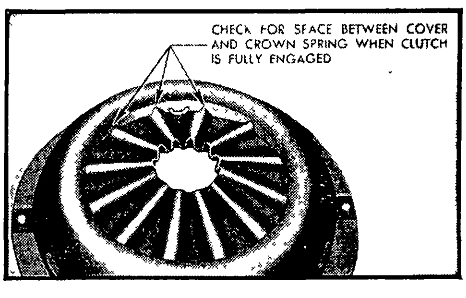


Fig. 23C Points to check contact of clutch spring with cover, 1939-52 Series 40, 50

marks made on flywheel and cover before removal. Install cover bolts with lockwashers but do not tighten bolts.

4. Insert a spare main drive gear through hub of driven plate and into pilot bearing. Tighten each clutch cover bolt several turns at a time to draw cover evenly into pilot of flywheel and avoid distortion of cover. While tightening cover bolts, move main drive gear from side to side to center driven plate with pilot bearing. If plate is not properly centered, it will be difficult to slide transmission into place. Make sure all cover bolts are uniformly tightened.

5. Fill groove in release bearing sleeve with wheel bearing lubricant. Coat release yoke ball stud and ball recess in release yoke with Lubriplate or Delco Brake Lubricant (not brake fluid). Attach release bearing to release yoke and attach yoke to ball stud in flywheel housing.

6. Install release bearing support with a new gasket, placing support in flywheel housing with the tab on support aligned with molded recess in housing to permit positive drain back of oil to transmission. Install spring washer with outer edge against bearing support.

7. Install transmission, being sure to use guide pins, Fig. 24; to avoid damage to clutch driven plate which would result if weight of transmission is allowed to rest on main drive gear in driven plate hub.

8. Install boot and release rod nut lock on yoke, Fig. 23B. Attach release rod to yoke, then adjust clutch pedal lash of ¾ in.

9. Have a helper hold clutch fully disengaged, then check with a feeler gauge for space between cover and clutch spring at points of contact, Fig. 23C (diaphragm spring clutches). The clutch will not fully disengage if any one of the clutch spring contact points fails to contact the cover solidly. This condition must be corrected by removing clutch and properly setting the spring retainer ears on cover.

10. Install flywheel lower housing, making sure that it is in condition to insure a tight seal. Install rear axle assembly.

11. Road test car for clutch performance. Under no circumstances should the clutch be harshly used immediately after installation of a new driven plate, flywheel or pressure plate. Sudden engagement of clutch with engine running at abnormal speed, or continual slipping of clutch, may prematurely injure driven plate facings and may cause scoring of flywheel and pressure plate. When these parts are new they must be given moderate use for several days until nicely burnished.

SYNCROMESH TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1935-38—Remove the transmission as follows:

1. Remove floor boards, disconnect speedometer cable, and take off cover.

2. Remove rear axle assembly as described under *Rear Axle.*

3. Detach brake controls from transmission (1935).

4. Remove transmission support.

5. Disconnect transmission steady rest rod (38-60, 80, 90).

6. Remove two top transmission mounting bolts and insert guide studs in their place, Fig. 24.

7. After removing other mounting bolts, slide transmission back along guide studs and lift out assembly.

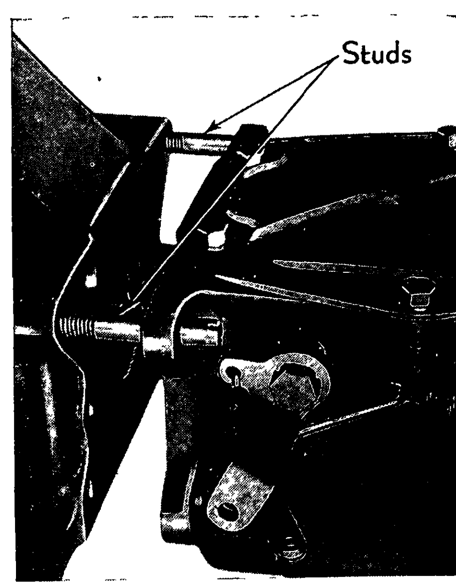


Fig. 24 Use of guide studs in transmission mounting holes when removing and installing syncromesh transmission. 1939-52

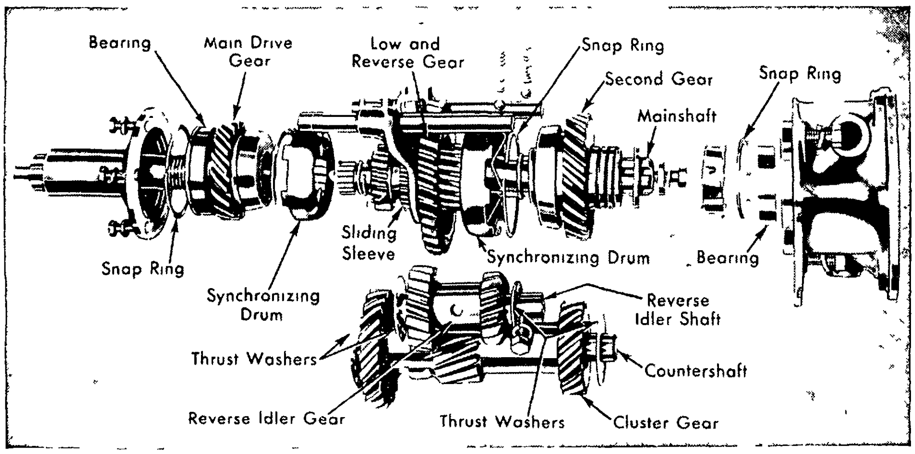


Fig. 25 Transmission. Typical of all 1935-38 Series 40, 50

Reverse the order of above procedure to replace the unit, being sure to use the guide studs to guide the transmission into position without damaging the clutch.

1939-52—On these models, it is not necessary to remove floor boards.

1. Disconnect speedometer cable.
2. Disconnect shift rods from transmission levers.
3. Remove shift levers from transmission (1941-52 series 40, 50).
4. Remove rear axle assembly as described under *Rear Axle.*
5. Remove transmission steady rest rod (1939-40 except 39-40, 50).
6. Remove transmission support.
7. Support rear of engine firmly without placing any strain on rear engine mounting bolts (1941-52).
8. Remove two top transmission mounting studs and insert guide studs in their place, Fig. 24.
9. Remove remaining mounting bolts and slide transmission back along guide studs and lift out assembly.

Replace the transmission in the reverse order of removal, being sure to use the guide studs to guide the transmission into position without damaging the clutch. After installation, connect and adjust the shifter mechanism as described under *Gearshift.*

NOTE—Since the transmission support is part of the engine mounting arrangement on 1941-52 models, make sure that the support is adjusted so that no upward or sidewise tension is placed on the transmission.

TRANSMISSION, OVERHAUL

35-50; 1935-38 Series 40—Fig. 25.

1. Take out shift rails and forks.
2. Unfasten mainshaft rear bearing retainer and on 1935-37 twist retainer to unlock countershaft.
3. Drive countershaft out rearward, allowing cluster gear to lie in case.
4. Withdraw mainshaft assembly through rear.
5. Unfasten main drive gear bearing retainer, release snap ring and push main drive gear into case and lift out.
6. Lift out cluster gear and thrust washers.
7. Remove reverse idler lock screw, push out shaft and lift out gear and thrust washers.
8. To disassemble mainshaft, slip off sliding sleeve and flat springs. Remove snap ring or wire retainer and take off second speed synchronizing drum. Detach universal ball and retainers, remove universal joint and press mainshaft out of yoke and bearing. Take off second speed gear.
9. To disassemble main drive gear, release snap ring or wire retainer and slip off high speed synchronizing drum. On 1935-36 units, unscrew drive gear thrust nut (left-hand thread) and bump shaft on wood block to remove bearing. On 1937-38 units, release snap ring and bump bearing off in same manner.

ASSEMBLY NOTES — Install reverse idler gear, placing the larger thrust washer at the front. Assemble cluster gear and thrust washers in bottom of case. Before installing countershaft, replace main drive gear, placing *shielded side of bearing toward inside of case.* When replacing shift rails, be sure to install the shorter one to accommodate second and high gear shifting.

TRANSMISSION, OVERHAUL

1936-38 Series 60, 80, 90—Fig. 26

1. Remove universal ball and retainers.
2. Remove universal joint from mainshaft.
3. Remove mainshaft rear bearing retainer, release snap ring and tap out bearing.
4. Lift mainshaft out through top.
5. Remove drive gear bearing retainer, expand snap ring and tap gear into case and lift out.
6. Drive countershaft out rearward, using arbor of correct length to hold needle bearings and thrust washers in position.
7. Drive reverse idler shaft out rearward and lift out gear.
8. To disassemble mainshaft, slip off sliding gear and synchronizer. Expand second gear snap ring and remove gear. (On 1936 units, second gear has needle bearings and can be disassembled by removing snap ring from rear of gear, after which withdraw needle bearings and sleeve.)

ASSEMBLY NOTES—Assemble reverse idler gear and thrust washers and insert shaft, being sure lock screw hole is toward front. Assemble needle bearings and thrust washers in cluster gear, using grease to hold the parts in place. Insert the arbor through the assembly, line it up in the case and drive out the arbor with the regular countershaft.

Assemble mainshaft in reverse order of removal, being sure the flat detent springs are not bent or broken. Be sure the synchronizing cones are not scored and that their oil grooves are clean.

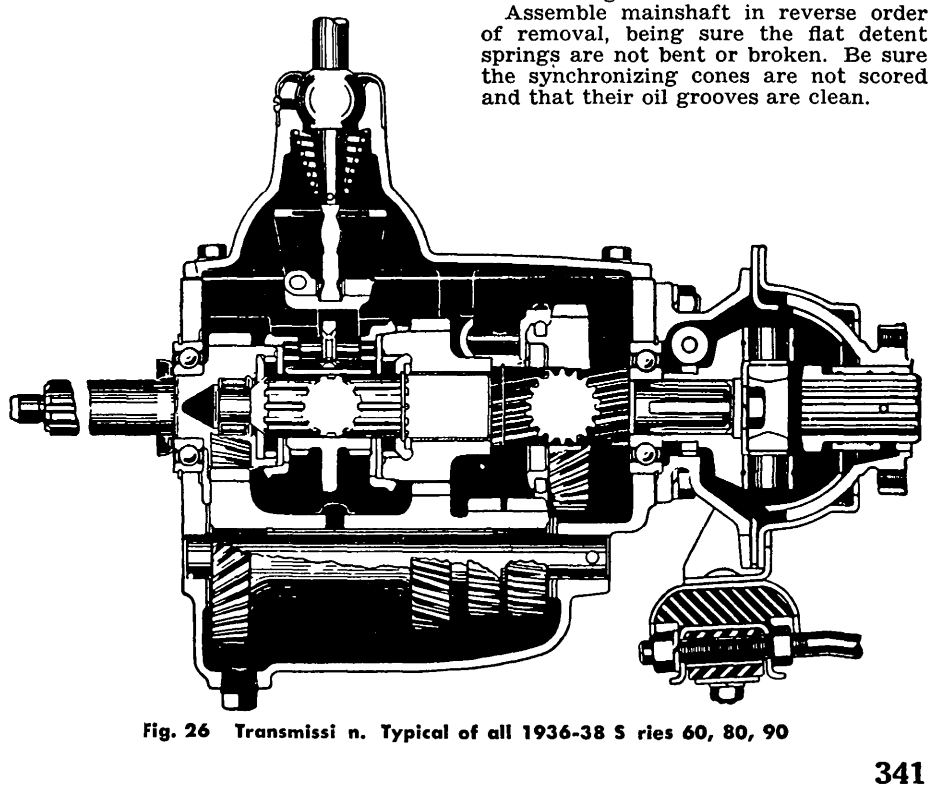


Fig. 26 Transmissi n. Typical of all 1936-38 S ries 60, 80, 90

TRANSMISSION, OVERHAUL

1939-52 Series 40, 50—Figs. 27, 28.

1 Disconnect shift shaft lever from selector lever

2 Take off transmission cover

3 Lock transmission in high gear to prevent sliding sleeve and low gear from dropping into case

4 Remove universal ball and retainers and take universal joint from mainshaft

5 Unfasten rear bearing retainer and take mainshaft and second gear out through rear

6 Remove set screws from selector cams and shift forks (If low gear and sliding sleeve are not to be removed, it is not necessary to take out selector shift and shift rails)

7 Tap selector shaft out through right side of case

8 Slide shift rails out rearward, being careful to collect balls and springs

9 Slip sliding sleeve from main drive gear and lift out sleeve and low gear

10 Drive countershaft out rearward, using an arbor of right length to hold needle bearings and thrust washers in position

11 Expand snap ring and push main drive gear into case and lift out

12 Lift out cluster gear

13 Drive reverse idler lock pin into shaft, tap out shaft and lift out gear

14 To disassemble mainshaft, pry synchronizer drum retainer over shoulder on second gear and remove drum Remove second gear snap ring and take off gear and thrust washer Release mainshaft rear bearing snap ring and bump mainshaft on wood block to release it from rear bearing retainer Remove snap ring from rear of bearing and take off bearing, thrust washer, speedometer drive gear and spacer

15 To disassemble main drive gear, proceed as directed in Fig 29 Then remove snap ring and washer which retains bearing and bump shaft on wood block to remove bearing

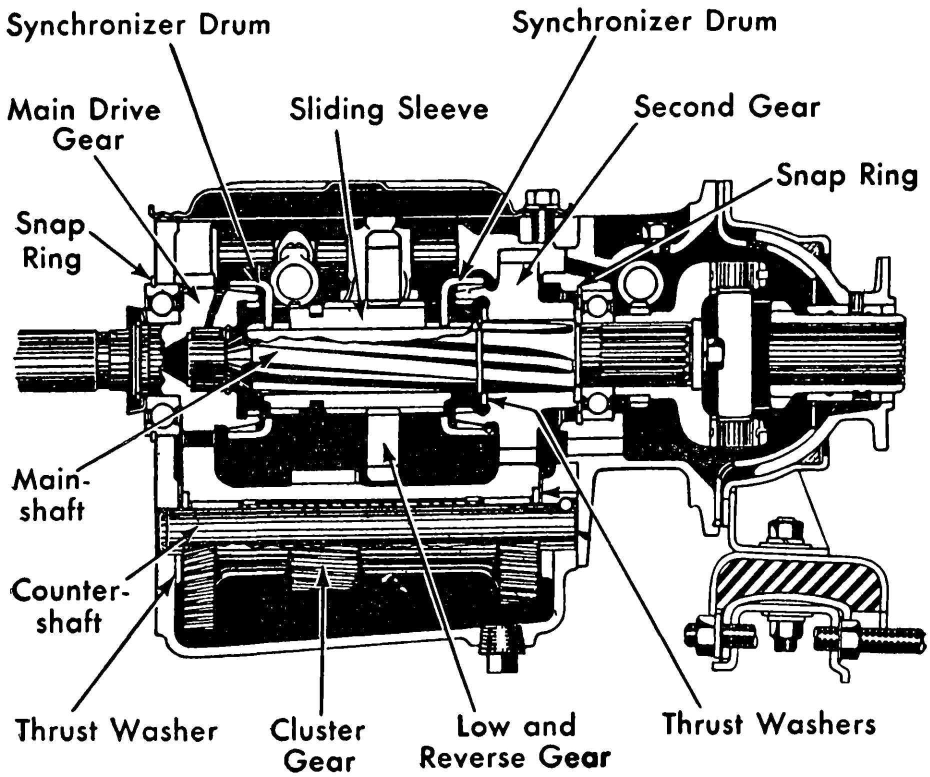


Fig. 27 Transmission. Typical of all 1939-48 Series 40, 50 (see Fig. 133 for mounting on 1939 Series 40, 50)

ASSEMBLY NOTES — Install reverse idler gear with a thrust washer at each end And when installed, the outer end of the idler shaft lock pin should be ¾ inch inside the case

Assemble cluster gear needle bearings and thrust washers, using grease and the arbor to hold the parts in place Then place the cluster gear in the bottom of the case but do not install the countershaft until after the main drive gear is replaced

After assembling the mainshaft parts, slip the low gear on the sliding sleeve and mesh the sleeve into the high speed cone Then install the mainshaft through

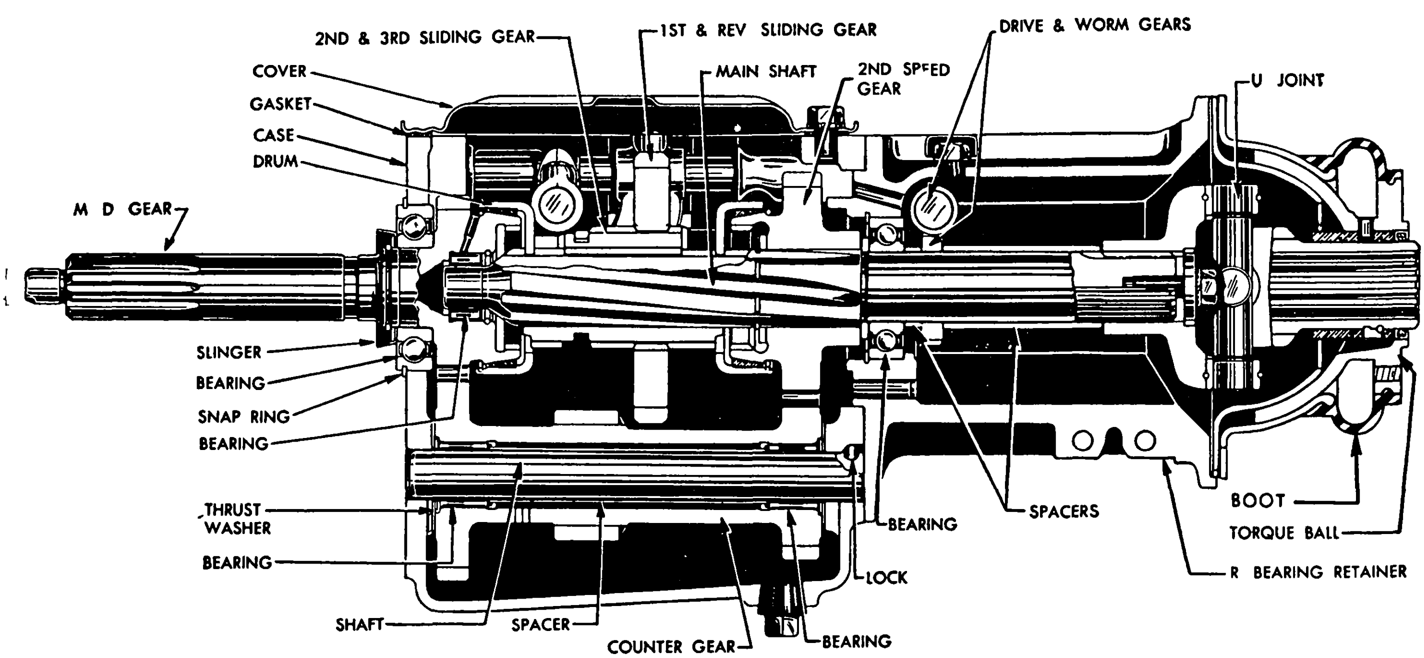


Fig. 28 1949-52 Series 40, 50 syncr m sh transmission

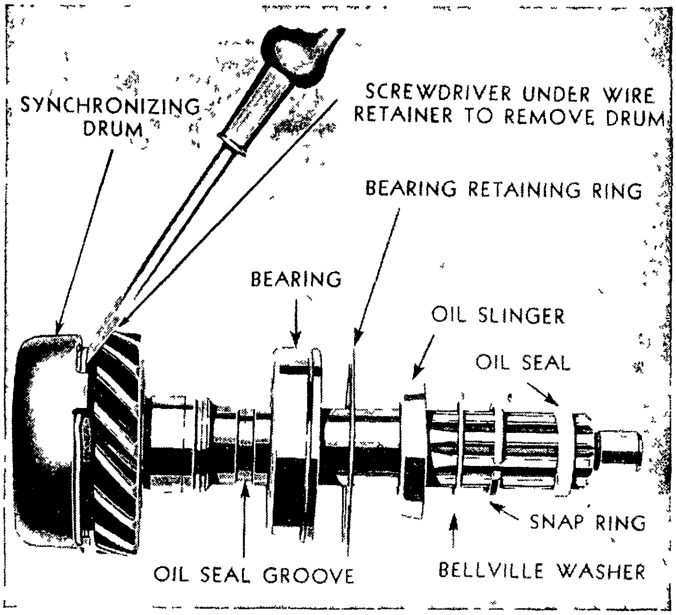


Fig. 29 Main drive g ar parts. 1939-52 Seri s 40, 50 syncro-mesh transmission

the rear, sliding it through the sleeve and into the pilot bearing in the drive gear recess.

After installing the shift mechanism, install a new welch plug in the selector shaft opening.

TRANSMISSION, OVERHAUL

1939-48 Series 60, 70, 80, 90—Figs 30, 31.

1. Remove shift shafts, rails, forks, springs and balls.
2. Disconnect universal ball and retainers, unfasten joint and pull it off main-shaft.
3. Detach rear bearing retainer, remove snap ring and tap bearing out rearward.
4. Lift mainshaft out by its front end.
5. Drive countershaft out rearward, using an arbor of the right length to hold needle bearings and thrust washers in place. (Allow cluster gear to lie in case until main drive gear is removed.)
6. Remove drive gear bearing retainer and its snap ring and push gear into case and lift out.
7. Lift out cluster gear.
8. Drive reverse idler lock pin into shaft, withdraw shaft and lift out gear.
9. To disassemble mainshaft, remove synchronizer and expand second speed snap ring and slide gear off shaft.

SERVICE NOTE—The mainshaft may be disassembled inside the case without removing the shift forks as follows: Take out the shift fork lock screws. Shift the synchronizer into its high speed position and pull the mainshaft back until clear of the pilot bearing. Move the mainshaft up and to the left until the high speed fork is free of the synchronizer collar, then move the fork to the rear. Work the mainshaft to the right until the low speed fork is free from the collar and shift this fork to the front. Slip off the synchronizer and, after removing the second gear snap ring as shown in Fig. 32, strip the shaft.

ASSEMBLY NOTES — When installing the reverse idler, use a new lock pin and drive it in so that its outer end is from ⅝ to ¾" past the flush surface of the case boss.

After assembling the cluster gear parts, set the assembly in the bottom of the case but do not install the countershaft until after the main drive gear has been replaced. (See Fig. 33 for layout of cluster and reverse idler gear parts.)

Before assembling the mainshaft, be sure the steel synchronizing cones are free from score marks or cuts, as this condition will result in a too severe synchronizing action. The steel cones may be polished with fine emery cloth and finished with a polishing cloth, using care not to change the angle of the cones. Never polish the bronze cones.

DYNAFLOW TRANSMISSION

1948-52—The complete Dynaflow transmission, Fig. 34, consists essentially of a hydraulic torque converter placed in front of a hydraulically-operated two-speed-and-reverse planetary gear transmission. In the latter, both reverse and low have positive gear ratios of 1.82:1. Direct drive is used almost exclusively for forward driving.

How Torque Converter Works — Briefly stated, a torque converter automatically balances torque against speed to meet load conditions.

At first glance the torque converter looks something like a fluid coupling. The important distinction is that while a fluid coupling operates by virtue of centrifugal force alone, the torque converter, in addition to centrifugal force, also utilizes the principle that *each force produces an equal and positive reaction force.*

A fluid coupling merely transmits the torque delivered to it by the engine. By mounting a set of reaction blades between the two members of a fluid coupling for the fluid to push against, a reacting force is provided which will multiply torque.

The Dynaflow torque converter, therefore, consists essentially of a driving member (pump), a driven member (turbine), and the stator (reaction) member.

The pump blades are divided into two sections connected by a one-way clutch element so the smaller set of blades can free-wheel under certain conditions.

The stator also is divided into two sections. Both are connected with the transmission through free-wheeling elements so they can turn forward freely, entirely independent of each other, when hydraulic reaction forces are no longer

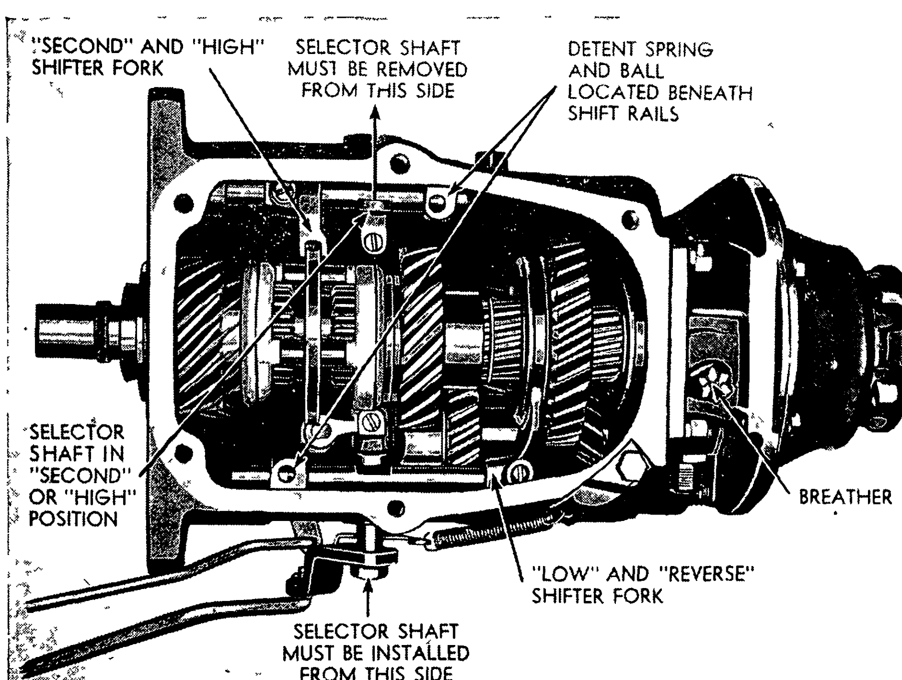


Fig. 30 Transmissi n. Typical f all 1939-48 Series 60, 70, 80, 90

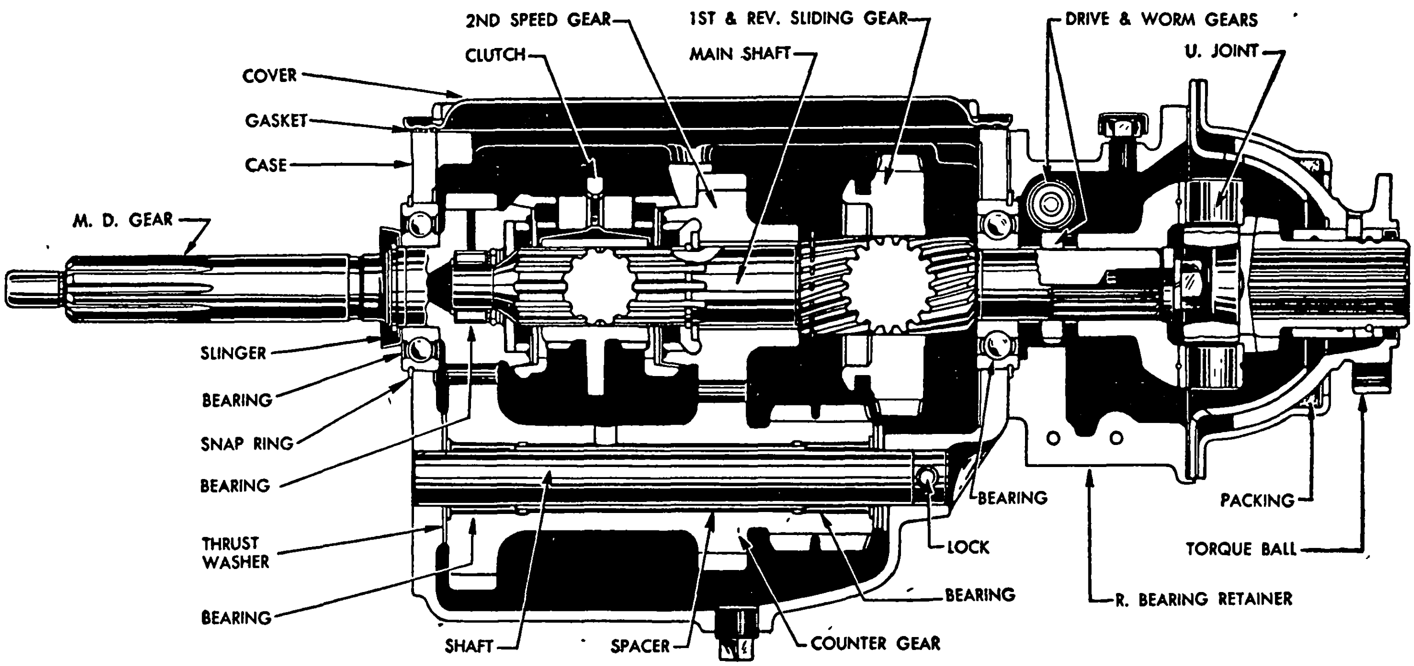


Fig. 31 Syncromesh transmission. 1948 Series 70

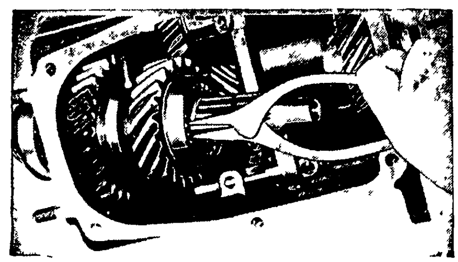


Fig. 32 Removing sec nd sp d gear. 1939-48 Series 60, 70, 80, 90

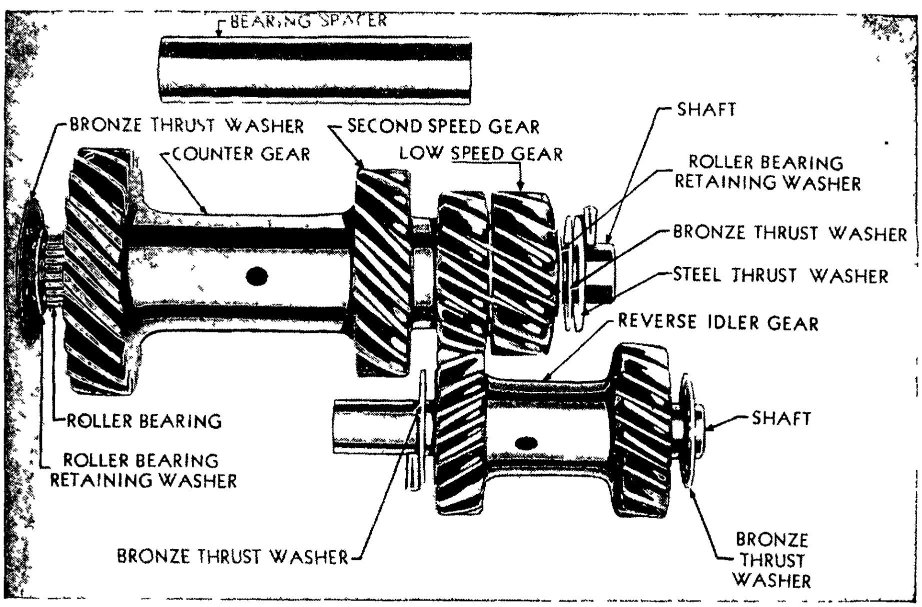


Fig. 33 Arrangement of cluster gear and reverse idler gear parts. 1939-48 Series 60, 70, 80, 90

present. These free-wheeling elements permit the torque converter to become, in effect, a fluid coupling as soon as torque increase is no longer needed.

DYNAFLOW TROUBLE SHOOTING

ROAD TEST—When improper operation of a Dynaflow transmission is experienced, time and expense will usually be saved by first making a thorough road test to observe operation in all ranges under appropriate driving conditions. The road test will also serve to thoroughly warm up the transmission, which is required for any subsequent tests made in the shop.

The person making the road test should be familiar with the operation and performance of Dynaflow Drive in all ranges so that he will be able to detect any sub-standard condition. The required "feel" of a Dynaflow car can best be acquired by driving through a test routine on one or more cars whose performance is known to be satisfactory.

The road test should include operation in Direct Drive, Low and Reverse; also operation when shifting between Low and Direct Drive under load. The test should include steep grade as well as level road operation when possible. Operation in forward ranges after extended operation in Reverse should be tested. Slip or over-run of engine should be checked. The degree of creep in all ranges with car stopped on a level road and engine idling should be observed.

NOTE—The importance of this overall test can be illustrated with the complaint of "excessive slip". The owner may report excessive slip in Direct Drive, which would lead to the assumption that the direct drive clutch is at fault. The road test may reveal that slip also occurs in Low and Reverse, at which time the clutch is disengaged. Slip in all three ranges indicates low oil pressure, improper control linkage adjustment or improper pump pressure. These possible causes may be corrected in considerably less time than any work on the direct drive clutch. Moreover, work on the clutch would not correct the trouble in this case.

SHOP TEST & INSPECTION — After road testing the car, a number of shop tests and inspections should be made while the transmission is thoroughly warmed up to operating temperature.

1. In every case of transmission complaint, first check the oil level as outlined under "Maintenance" further on. If oil level is low and the car's history indicates oil loss of one pint or more per 1000 miles,

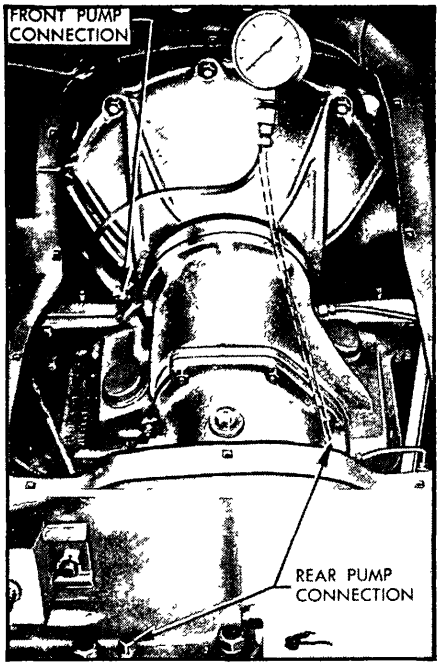


Fig. 34A Gaug connections for oil pump pr ssur t sts. 1951-52 models have no rem vable floor pan

or transmission exterior is oily, a thorough inspection for oil leakage should be made.

2. In cases of improper operation in one or more ranges it is always advisable to check the adjustment of the transmission manual control linkage as described under "Service Adjustments" further on.
3. When diagnosing almost all cases of improper operation it is necessary to have accurate knowledge of oil pressures in the hydraulic control system. The following oil pressure tests should be made before performing any mechanical work.

TESTING OIL PRESSURES

Before making pressure tests, oil level must be correct and the transmission must be warmed up to operating temperature. Place rear end of car solidly on car stands or on a free wheel type hoist so that the transmission can be operated with rear wheels free to turn.

On models prior to 1951, the transmission opening pan must be removed from the body floor pan to provide access to the connection points for the pressure gauge. On 1951 and later models, the connections must be made from below the car since no removable opening pan is provided.

To test front oil pump pressure, remove pipe plug from left side of transmission case and connect pressure gauge, Fig. 34A.

To test rear oil pump pressure, remove pipe plug in lower flange on front end of rear bearing retainer and connect pressure gauge, Fig. 34A.

To test pressure in high or low accumulator, remove pipe plug from front side of accumulator body and connect pressure gauge, Fig. 34B.

Run engine at 500 rpm and test pump and accumulator pressures in Low, Drive and Reverse. Test front oil pump in all ranges and rear oil pump in all but Reverse. Test high accumulator only in Drive and test low accumulator only in Low. Repeat tests at 1000 rpm in Low and Drive only. The pressures that should obtain are shown in Fig. 34C.

Low or erratic oil pressure indicates an air leak into the pump suction line, faulty pressure regulator valve operation, or excessive clearance in pump.

Low rear pump pressure also may be caused by a leak in the valve and servo body passages which connect the rear pump with the pressure regulator valve.

If pressure of one pump is low but pressure in other pump is satisfactory, air leaks into suction line and faulty pressure regulator valve are eliminated as possible causes since both pumps use a common suction line and the same valve regulates pressure of both pumps.

Very low accumulator pressure may be caused by external or internal leakage past the accumulator body gasket. A difference of more than 10 pounds pressure between front pump and an accumulator indicates an excessive leak between the accumulator and the clutch (if high accumulator pressure is low). The metering orifice in the accumulator may be restricted or plugged.

With the results of the road test and the pressure tests in mind, the cause of improper operation in most cases can be ascertained by consulting Fig. 35.

DYNAFLOW TRANSMISSION NOISES

A hum or whine in Neutral or Parking is normal since all planetary gears are free to rotate without the steadying effect of a load. Some hum may also be expected in Low and Reverse.

When diagnosing abnormal noises in the transmission, consideration should be given to the parts that are in motion when the noise occurs. The presence or absence of noise in each range should be noted so that the parts which cause the noise can be determined by the process of elimination.

A buzzing noise can be caused by low oil level, or by the front pump delivery check valve seating on the edge of the gasket between valve and servo bodies. A buzzing noise, noticeable in Neutral and Parking, may be caused by excessive

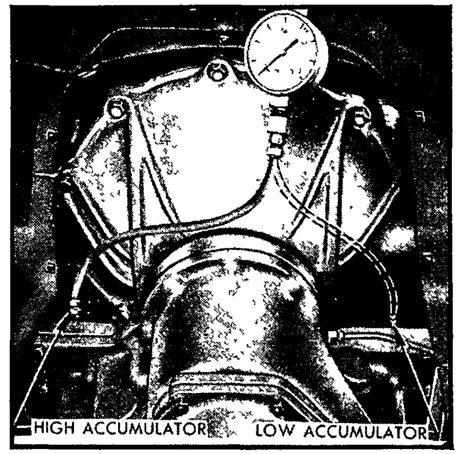


Fig. 34B Gauge connections f r accumulat r pressure tests. 1951-52 m d ls hav no removable flo r pan

clearance of pressure regulator valve in valve body or an oversize orifice in the valve land; correction calls for replacement of valve and body.

A clicking noise in all ranges may be caused by a foreign object going through the converter. A clicking noise only when car is in motion may be caused by the parking lock pawl contacting the ratchet wheel due to improper manual control linkage adjustment.

Abnormal hum or whine which occurs in all ranges may be attributed to worn parts or excessive clearances in the front oil pump. Noise caused by the front pump will increase in Low and will diminish at car speeds above 45 mph in Direct Drive. It increases and decreases with engine speed in all ranges. When excessive clearances exist in the front oil pump, a pressure test will usually indicate low front pump pressure.

Squeeling or screetching immediately following installation of front oil pump parts indicates that the driving gear has been installed backwards. This condition should be corrected without further operation of transmission as severe damage will result.

Abnormal hum or whine in all ranges

ALWAYS MAKE THE FOLLOWING CHECKS AND INSPECTION BEFORE DOING ANY WORK

TRANSMISSION MUST BE WARMED TO NORMAL OPERATING TEMPERATURE AND FILLED TO CORRECT OIL LEVEL

PUMP AND ACCUMULATOR PRESSURES—WHEELS FREE TO TURN

ENGINE R.P.M.		PRESSURES SHOULD CHECK			PRESSURES ACTUALLY CHECK			
		FRONT PUMP	REAR PUMP	ACCUMULATOR	FRONT PUMP	REAR PUMP	ACCUMULATOR	
500	LOW	100	75	90				ACCUMULATOR PRESSURE IN DRIVE RANGE MUST NOT BE MORE THAN 10 LBS. UNDER FRONT PUMP PRESSURE
	DRIVE	90	90	80				
	REVERSE	100						
1000	LOW	160	125	150				ACCUMULATOR PRESSURE IN LOW RANGE MUST NOT BE MORE THAN 10 LBS. UNDER FRONT PUMP PRESSURE
	DRIVE	90	90	85				
1800	LOW	180	175	170				
	DRIVE	90	90	85				

FRONT PUMP SHOULD CUT OUT UNDER 2500 R.P.M. ACTUALLY CUTS OUT______R.P.M.
(FRONT PUMP PRESSURE DROPS TO APPROXIMATELY 20 LBS. WHEN REAR PUMP TAKES OVER)

Fig. 34C Dynafl w oil pr ssure guide

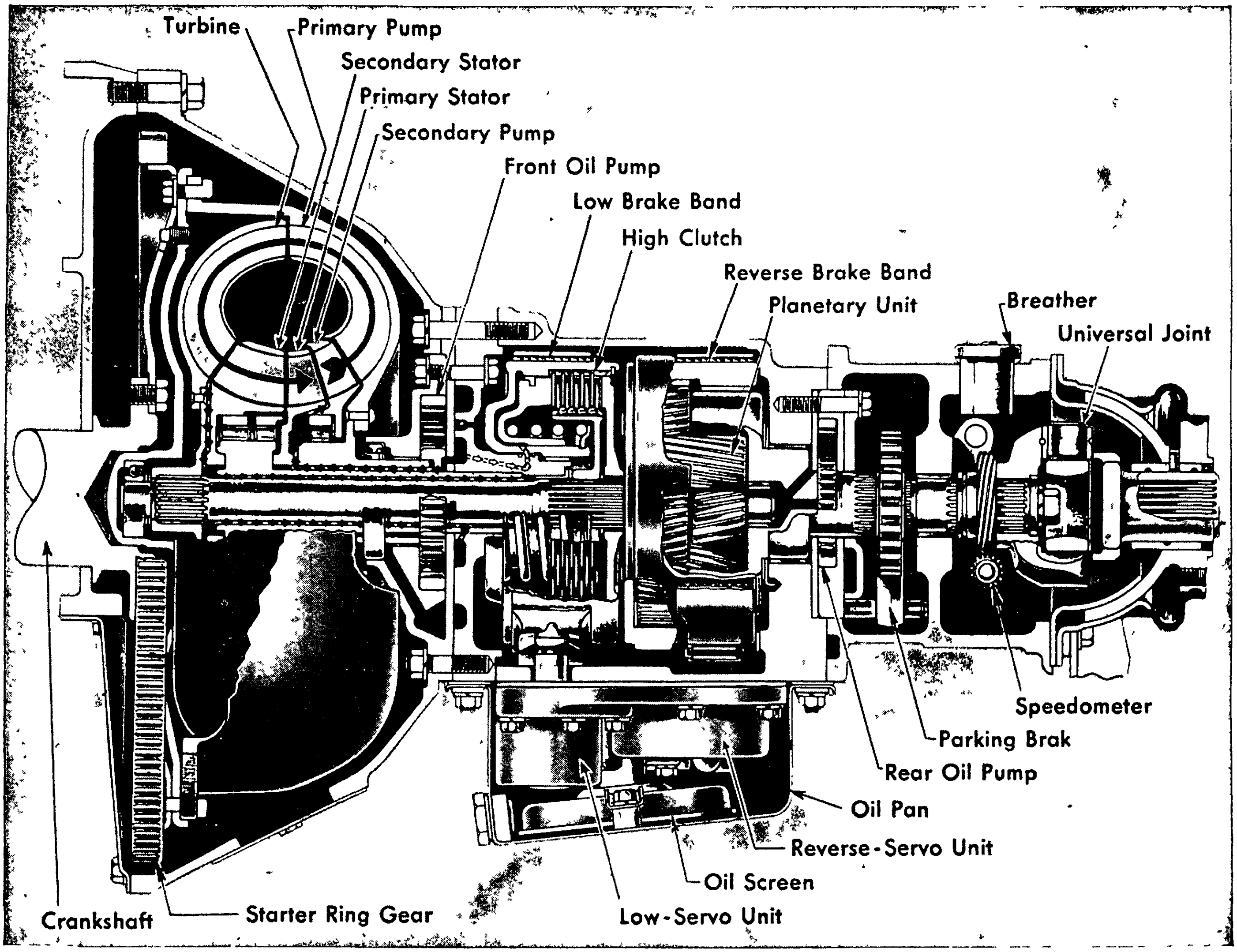


Fig. 35 Dynaflow transmission. Typical of 1948-52

but Direct Drive may be attributed to conditions in the planetary gear train since these gears are locked in Direct Drive but either idling or transmitting power in all other ranges.

DYNAFLOW OIL LEAKS

If the transmission is found consistently low on oil, indicating loss of one pint or more per 1000 miles, a thorough inspection should be made to locate and correct all external leaks. An inspection for external leaks also should be made if the oil pump and accumulator tests already described show low oil pressure, since leaks at some gaskets which affect pressure will show externally.

If the exterior of the transmission is not wet with oil or if the following inspection procedure does not reveal any external oil leaks, check the lubricant level in the rear axle housing. An overfilled rear axle housing indicates leakage past the propeller shaft spline seal. The rear axle should be disconnected at the torque ball flange for inspection of this seal. Rear axle lubricant that has been diluted by Dynaflow oil should be discarded.

In some cases, oil leaks that show externally can be corrected without removal of transmission, but in other cases removal is necessary. For this reason it is very important to locate the source of an external oil leak before removal of transmission in order that the cause can be definitely identified during disassembly operations.

INSPECTION FOR EXTERNAL LEAKS

If exterior of transmission is oily, first make certain that the oil is not coming from the engine, since engine oil caught in the air stream will be thrown back over the transmission. If the engine block and oil pan are wet with oil, thoroughly wash and dry, then run engine until cause of engine oil leakage is found and corrected.

To check for transmission oil leakage, place car on high car stands or a free wheel type hoist so that engine and transmission can be operated with rear wheels free and transmission can be inspected.

Remove the bell housing cover and hand hole cover. Clean the inside of the bell housing and surface of flywheel and primary pump as far as possible. Use carbon tetrachloride or other non-inflammable quick drying cleaner. It is impossible to locate the source of an oil leak unless all visible surfaces are clean and dry.

Start engine and operate transmission in Direct Drive until an oil leak becomes evident. Thoroughly inspect for evidences of fresh oil at points shown in Fig. 36.

Even though oil does not show in interior of bell housing, check for oil leaks at primary pump cover and at front oil pump.

To check primary pump cover, hold a piece of white paper or cardboard between flywheel and bell housing. To check front oil pump, insert a long roll of paper through hand hole toward the pump. If oil is leaking at either place, oil spray will be visible on the paper.

After inspecting transmission while operating in Direct Drive, shift to Low. Then run engine at 1000 rpm and repeat the inspections. The higher pump pressure existent in Low may cause a leak to show that would not be evident at the lower pressure existent in Direct Drive.

INTERNAL OIL LEAKS

Internal oil leaks which affect Dynaflow operation are indicated by the oil

It is assum d that wh n ch cking f r th f ll wing conditi ns, the transmissi n linkag is pr perly adjust d, unit is warm d t n rmal temp rature, il is at pr p r l vel and idl sp d is pr perly s t.

CONDITIONS	CODE TO POSSIBLE CAUSES
Car won't move in any range for 1 to 8 minutes after standing all night	1-8
Car will not mov in any range after backing up	1-2-8
Car won't move in direct drive, front pump pressure is satisfactory, high accumulator pressure is l w	3-4-5
Car won't move in "DRIVE," front pump and accumulator pressure O.K.	4
Car moves forward in "N" range, engine speed below 1500 R.P.M.	4
Car creeps forward in "N" range when accelerated to approximately 2500 R.P.M.	6
Noise in converter which sounds like something striking a spinning fan	7
Transmission makes a whining noise in all ranges which increases and decreases with engine speed	1-8
Transmission oil f ams	2-9
Car won't m v in reverse	10
Too much "clunk" or chatter in reverse or low range	11
Transmission squeals or screeches after overhaul	12

POSSIBLE CAUSES AND SUGGESTED INSPECTION FOR CORRECTION

1. Insp ct front pump and front pump cover.
2. Inspect rear pump and gasket for cause of air leak.
3. Inspect rear pump check valve to see that it is seating properly, not binding in its recess and installed properly.
4. Inspect clutch sealing rings and grooves. Inspect clutch assembly.
5. Check for leaks in valve and servo bodies or between them.
6. Inspect ball checks in clutch piston and reaction flange.
7. Foreign object going through the converter.
8. Check alignment of bell housing and primary pump hub.
9. Wrong oil in transmission.
10. See that reverse bank strut is in place and anchor not broken.
11. Adjust bands. Check all motor mountings for being tight and see that rubber hasn't pulled loose from rear thrust mount.
12. Probably caused by front oil pump driving gear installed backwards.

Fig. 35 Dynaflow trouble diagnosis guide

pressure and accumulator pressure tests described previously.

Since low pump and accumulator pressure can be caused by faulty pressure regulator valve operation or leaks at joints between valve body, servo body and transmission case, it is advisable first to remove the valve and servo body assembly for inspection. This can be done without removal of the transmission. It is also advisable to check the condition of the accumulator body gasket.

If the cause of the internal oil leak is not disclosed by this work, it will be necessary to remove the transmission for inspection of pumps and direct drive clutch.

DYNAFLOW MAINTENANCE

OIL RECOMMENDATIONS—The following oils are approved for Dynaflow Drive and no other fluid should be used (1) "Special Buick Oil for Dynaflow Drive". (2) "Automatic Transmission Fluid, Type A", which is available through petroleum suppliers. This fluid must have an AQ-ATF number embossed in lid of can for identification.

PERIODIC LUBRICATION—Every 1000 miles check transmission oil level with

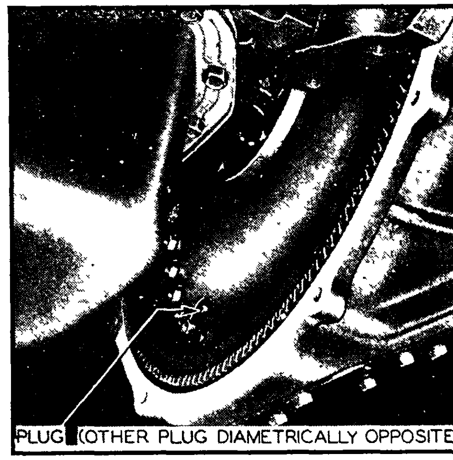


Fig. 37 Converter drain plug

oil warm, transmission in Parking and engine idling.

On 1948 and early 1949 cars, the oil gauge rod is located under the floor pan. It may be reached by turning back the right side of the front floor mat and removing the cover which is attached to the floor pan. On late 1949 and all 1950 and later cars, the oil gauge rod is located under the right side of the hood.

To check the oil level, remove the rod, wipe it dry and reinstall to its full depth. Remove rod and note the level.

If oil level is more than one inch below the "FULL" mark on gauge rod, add sufficient oil to bring it up to but not over the "FULL" mark. The distance between the "FULL" and "ADD OIL" marks is one inch and represents approximately one pint. (First type rods were marked "LOW" instead of "ADD OIL".)

If oil level is consistently low when checked, indicating loss of a pint or more per 1000 miles, the transmission should be inspected for oil leaks as outlined previously.

DRAINING & REFILLING—Every 25,000 miles the oil pan and torque converter should be drained and refilled with fresh oil. Transmission must *not be flushed* when oil is changed. The procedure is as follows:

1. Warm up transmission, then remove bell housing cover.
2. Loosen one converter drain plug (through opening in flywheel) then turn flywheel until opposite drain plug is straight down, Fig. 37. Remove this plug and allow converter to drain completely.
3. Remove drain plug from oil pan and

	O.K.	LEAKS		O.K.	LEAKS
OIL PAN			FILLER PIPE		
REACTION FLANGE			PRIMARY PUMP COVER		
FRONT PUMP COVER			FRONT OIL PUMP		
REVERSE BAND ADJ. COVER			HIGH ACCUMULATOR		
LOW BAND ADJ. COVER			LOW ACCUMULATOR		
REAR BEARING RETAINER			ACCUMULATOR CAPS		

Fig. 36 Dynafl w il l ak check p ints

Fig. 38 Oil pan and bell housing cover

allow transmission to drain completely, Fig. 38.

4. Install and tighten all drain plugs and install bell housing cover.
5. Pour in 3 qts. of specified oil in transmission. Then, with engine idling and transmission in Parking position, complete the refilling to bring oil level to 1¾" below the "FULL" mark on gauge rod. When transmission oil is warmed up, the oil level should then be at the "FULL" mark.

DYNAFLOW SERVICE ADJUSTMENTS

MANUAL CONTROL LINKAGE — Before making any checks or adjustments on the manual control linkage, make certain that the transmission is thoroughly warmed up and that the oil is at the proper level. To warm up the transmission, drive the car approximately 20 miles with frequent stops and starts as might be encountered in heavy traffic. Then proceed as follows:

1. Place shift control lever in Neutral position so that the detent plunger is centered in the detent notch. Then move the control lever until stop pin is against stop in dial housing and note the movement of the dial pointer.
2. Repeat this operation in Low position. The movement of the dial pointer should be approximately equal in Neutral and Low. If it is not, loosen the control detent mounting bolts, Fig. 39, and shift the detent until movement of the dial pointer is equal in both ranges. Then tighten mounting bolts securely.
3. Place shift control lever in Low position and carefully bend dial pointer, if necessary, to center the pointer behind the letter "L" on dial.
4. Park car on ramp or steep grade with control lever in Parking position to determine whether parking lock holds securely. Then let car roll with control lever in Neutral position and listen for a clicking or ratchet noise which would indicate that parking lock pawl is contacting the parking lock ratchet wheel.
5. If parking lock fails to hold or ratchet noise exists in neutral, adjust shift rod as described in Steps 6, 7, 8; otherwise proceed to Step 9.

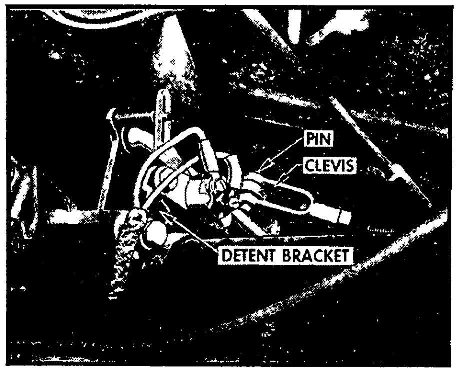


Fig. 39 Shift rod adjustment

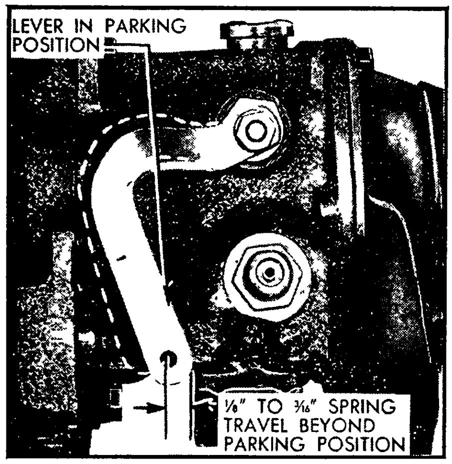


Fig. 40 Spring travel at shift lever

6. Place control lever in Parking position and disconnect shift rod from shift idler lever by removing clevis pin and washers, Fig. 39 Pull forward on shift rod and move car slightly to make sure that locking pawl is fully engaged in ratchet wheel. Do not jerk on rod as this may spring linkage in rear bearing retainer.
7. Check movement at lower end of transmission shift lever by pushing forward against spring pressure until a definite stop is felt. The spring travel or movement of lower end of lever should be ⅛" to 3⁄16" beyond the Parking position, Fig. 40. If spring travel is not within these limits, the control valve operating rod in the transmission is incorrectly adjusted and it will be necessary to remove the torque ball and adjust the operating rod.
8. When spring travel is correct, pull shift rod forward until stop is felt. Then adjust shift rod clevis until clevis pin will just enter hole in shift idler lever, with control detent firmly engaged in Parking position. Lengthen shift rod by unscrewing clevis three complete turns. Then temporarily connect rod to idler lever with clevis pin.
9. Place shift control lever in Neutral position, making sure that detent is firmly engaged. Then install the adjustment gauge shown in Fig. 41 on dial housing with the line under "N" centered on the dial pointer.

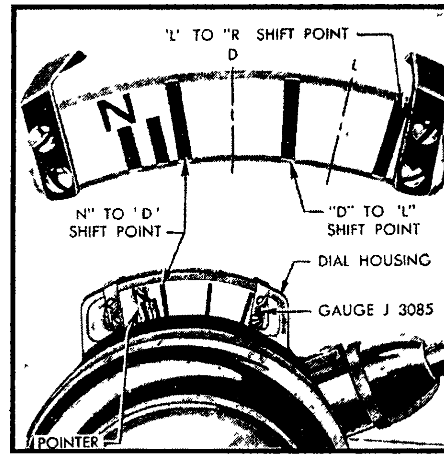


Fig. 41 Linkage adjustment gauge J-3085 set for checking shift p int

Fig. 42 Throttle linkage and dashpot adjustments. 1948-49

10. With transmission warmed up and engine idling at approximately 600 rpm, slowly move control lever from "N" to "D" position. The clutch should engage, as indicated by an immediate *decrease* in engine speed, when the tip of the dial pointer is behind the *long* gauge mark located midway between "N" and "D" on speed ratio dial, Fig. 41. The width of this mark provides for the allowable variations in shift point.
11. Slowly move control lever from "D" to "N". Clutch should disengage, as indicated by an immediate *increase* in engine speed, when tip of speed ratio pointer is behind the midway mark on gauge, as in Step 10.
12. If points of clutch engagement and disengagement are not as specified, adjust shift rod clevis (Steps 6, 7, 8) to obtain required setting. Be careful not to change the clevis so much that the parking lock fails to hold or parking lock pawl contacts ratchet wheel in Neutral.

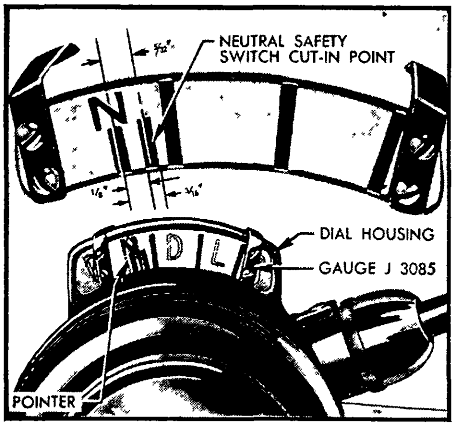


Fig. 43 Linkag adjustment gauge J-3085 set for n utral safety switch timing

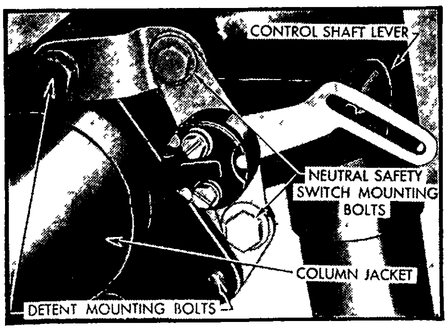


Fig. 44 C ntrol detent and neutral safety switch mounting bolts

13. Check operation in Low and Reverse. Low and Reverse should be obtained when detents are engaged and the shift points should occur when tip of dial pointer is behind the corresponding shift point marks on gauge. If these conditions are not correct, the transmission shift lever may be bent, the valve operating upper lever may be bent, or the lever may be loose or improperly seated on the shaft.
14. After adjustments have been completed, tighten clevis lock nut securely and permanently install clevis pin with plain washer and spring washer on each side of clevis pin.
15. After any change in control detent and shift rod, check adjustments of neutral safety switch and back-up lamp switch before removal of gauge.

THROTTLE LINKAGE ADJUSTMENTS

On 1948-49 Dynaflow equipped cars, a dashpot is included in the throttle control linkage to cushion the closing of throttle valves when the accelerator pedal is suddenly released while driving. This prevents sudden shut off which might cause stalling of the engine. The dashpot action is controlled by a spring and vacuum operated diaphragm, ball check valve and a calibrated by-pass bleed.

The dashpot operating lever and adjusting screw are mounted on the lower end of the accelerator equalizer shaft so that the adjusting screw contacts the plunger at the dashpot, which is mounted

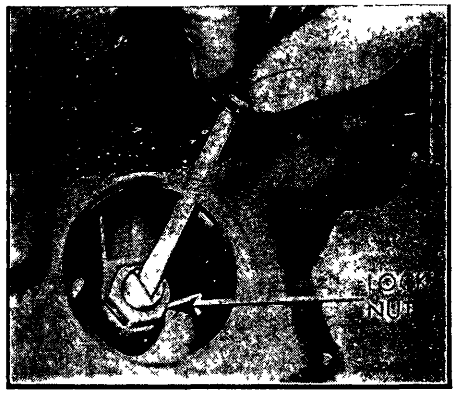


Fig. 45 Band adjustment

on the equalizer shaft lower bracket. A pipe connects the dashpot to the intake manifold, Fig. 42.

Improper adjustment of the throttle linkage and dashpot may cause engine racing or stalling. Adjustments should be checked and corrected as follows:

1. Warm up engine and adjust carburetor to give smooth engine idle at 450 rpm, with fast idle cam in *hot* position.
2. Check clearance between equalizer shaft lower bracket and the stop on the lever at the lower end of the equalizer shaft, Fig. 42.
3. Clearance should be $\frac{1}{32}''$ to $\frac{1}{16}''$. Adjust to these limits by adjusting the throttle operating rod at the ball joint.
4. With engine shut off, check for full opening of throttle valve when accelerator pedal hits the floor mat, which must be in place. Adjust accelerator pedal rod at ball joint, if necessary, to obtain full opening of throttle valve.
5. Hold choke valve closed and insert a .030″ feeler gauge between the adjustment or stop screw and the fast idle cam. Then turn adjusting screw on dashpot operating lever until it just contacts the dashpot plunger button. This gives a starting setting which may require slight alteration to obtain proper dashpot control.
6. With transmission in Direct Drive and brakes firmly applied, snap throttle open to approximately 1400 rpm and immediately release accelerator pedal. If engine returns to idle too slowly, back out dashpot adjusting screw a little at a time until proper dashpot control is obtained. If engine returns to idle too fast, causing it to stall or roll, turn adjusting screw in.
7. If proper control cannot be obtained by adjustment, replace dashpot.

NEUTRAL SAFETY SWITCH

Dynaflow cars are provided with a neutral safety switch which prevents operation of the starting motor except when the transmission is in Neutral (N) or Parking (P) positions. This switch is a safety feature installed for the purpose of preventing car motion when starting the engine.

The switch is connected in series with the starter control circuit, in the line between the ignition switch and the accelerator vacuum switch on the carburetor. It is mounted at the lower end of the steering gear column jacket and is operated by the lever at the lower end of the transmission control shaft.

When properly adjusted, the neutral safety switch remains closed, to permit cranking the engine, until the center of the speed ratio dial pointer is moved approximately $\frac{5}{32}''$ out of "N" toward "D" position.

If the switch opens when the center of the pointer is less than $\frac{1}{8}''$ from "N", the starter control circuit may not be completed when the transmission control lever is in neutral.

If the switch remains closed when the center of the pointer is more than $\frac{3}{16}''$ out of neutral, the starter might be operated before the transmission is completely out of the driving (D) range.

NEUTRAL SWITCH TIMING WITH GAUGE

1. Check manual control linkage and adjust if necessary.
2. Ground primary terminal of distributor with a jumper wire so that engine can be cranked without firing.
3. Firmly engage "step-on" parking brake and place transmission control lever in "N" position, making sure that detent is firmly engaged.
4. Insert the gauge shown in Fig. 43 on the speed ratio dial housing so that the *short* line under "N" is centered on the dial pointer.
5. Move control lever to "D" position, turn on ignition and depress accelerator pedal to close accelerator vacuum switch.
6. Slowly move dial pointer from "D" toward "N" and note position of *center* of pointer at the instant the starter just starts to operate. Release accelerator pedal.
7. The *center* of the dial pointer should be within the limits of the *short* line just to the right of the "N" mark on the gauge, Fig. 43. This line provides the required limits of $\frac{1}{8}''$ to $\frac{3}{16}''$ out of neutral.
8. If the neutral safety switch does not cut in within the required limits, adjust switch timing as follows:
9. Loosen safety switch mounting bolts at lower end of steering gear column jacket, Fig. 44, and raise switch up as far as it will go.
10. Have a helper hold control lever so that dial pointer is centered behind the short cut-in mark on gauge, Fig. 43. Then turn on ignition and depress accelerator pedal.
11. Gently tap switch downward until starter just starts to operate and tighten switch mounting bolts without moving switch. Helper should release accelerator pedal when starter starts to operate.
12. Recheck switch timing as directed in Steps 5 and 6. Remove jumper wire from distributor and gauge from dial housing when switch timing is correctly adjusted.

NEUTRAL SWITCH TIMING WITHOUT GAUGE

If the gauge shown in Fig. 43 is not available, the switch may be adjusted in the following manner:

1. Place a narrow strip of masking tape on the speed ratio dial so that the upper end of the dial pointer is visible.
2. Make two marks on the masking tape at $\frac{1}{8}$" and $\frac{3}{16}$" from *center* of pointer. These marks give the same cut-in limits as provided by the gauge.
3. Check and adjust switch timing in the same manner as with the gauge.

LOW & REVERSE BAND ADJUSTMENT

On Dynaflow cars prior to 1951 the bands may be adjusted while the transmission is in the vehicle after the floor opening pan is removed. On 1951 and later models this is not possible because no removable floor pan is provided. Adjustment is made in the following manner:

1. Loosen lock nut, Fig. 45, and turn adjusting screw clockwise until considerable resistance is felt, indicating that band is in full contact with drum (low) or ring gear (reverse).
2. Back off adjusting screw until just a trace of play can be felt by prying up on lock nut with a screw driver. From that point, back off screw six complete turns and snug up lock nut.
3. After noting position of adjusting screw slot, tighten lock nut to 20-25 lbs. ft. torque. Remove torque wrench and check to make sure that the adjusting screw did not move during the tightening process.
4. Install band adjusting covers with new gaskets.

BACK-UP LAMP SWITCH ADJUSTMENT

The back-up lamp switch adjustment should always be checked after adjustment of transmission control detent, or when back-up lamp fails to light in Reverse.

On 1948 models, clearance between upper end of switch operating arm and nearest edge of switch bracket should be $\frac{15}{32}$" when shift control lever is in Reverse position, Fig. 46.

On 1949-52 models, clearance between switch operating arm and lower edge of control shaft lower lever should be 0 to $\frac{1}{16}$" when shift control lever is in Low position, Fig. 47.

If the specified clearance does not exist, loosen two switch mounting screws and move switch up or down on mounting bracket as required to obtain clearance, then tighten screws securely.

TOWING DISABLED DYNAFLOW CAR

A disabled Dynaflow Drive car must not be towed on rear wheels with transmission in any of the driving ranges because unecessary damage to the transmission may result. It may be safely towed in Neutral only at speeds under 30 MPH. Long distance towing (over approximately 300 miles) is not recommended.

The Neutral locking strap should be employed to lock transmission in neutral position for towing in cases where car damage makes it impossible to obtain or maintain neutral position by means of the regular transmission control mechanism. Install the locking strap on the transmission in the following manner:

1. While holding shift lever forward to avoid straining internal linkage, remove lever retaining nut and lockwasher, then remove lever from cross shaft.

2. Install neutral locking strap over cross shaft, with U slot of strap straddling speedometer cable sleeve nut, Fig. 48. Hold strap in place by reinstalling shift lever.

REMOVING TRANSMISSION

1. Raise right side of hood and remove bell housing dowel bolt, located to rear of starting motor solenoid, using a suitable offset brass drift. This bolt cannot be removed from under car.

2. Connect one wire of "Remote Control Starter Switch J-2679" to positive terminal of battery and connect other wire to terminal of starter solenoid relay to which a white wire with black parallel tracers is connected. Place starter switch so that engine can be cranked from under car.

3. Hoist front and rear of car and rest it solidly on stands placed under frame. Frame side rails should be at least 20" above floor.

4. Disconnect torque tube from torque ball and move rear axle back to disengage propeller shaft from universal joint.

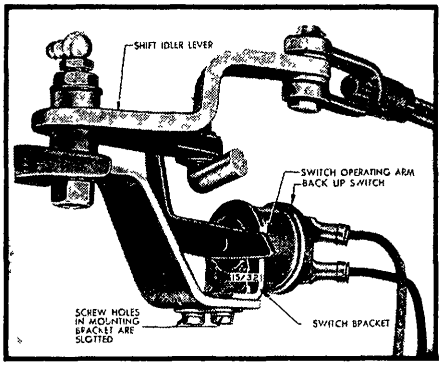


Fig. 46 Adjustment of back-up lamp switch. 1948 models

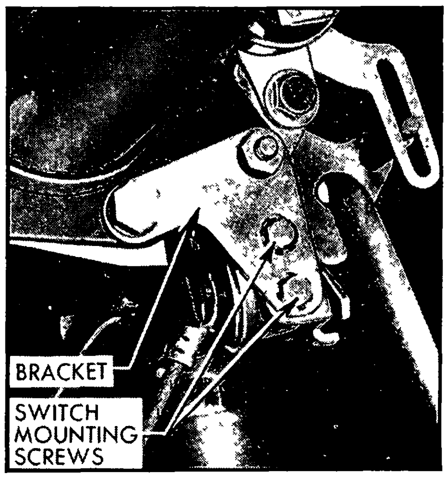


Fig. 47 Adjustment of back-up lamp switch. 1949-50 models

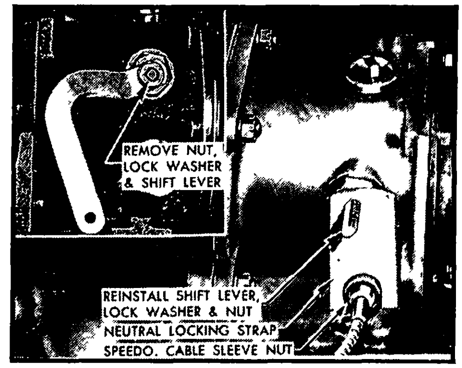


Fig. 48 Installati n f neutral locking strap

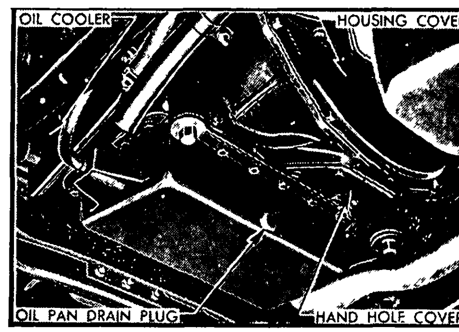


Fig. 49 Right sid f transmission installati n

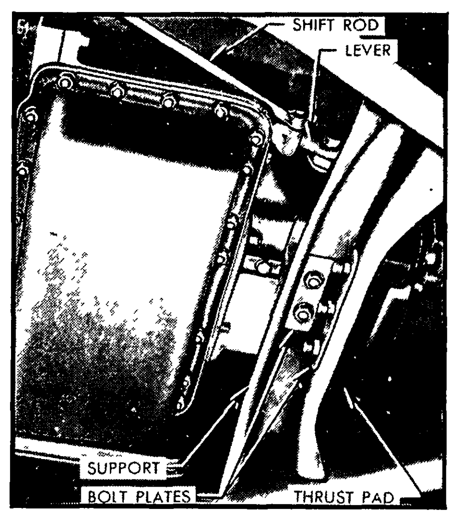


Fig. 50 Left side f transmission installati n

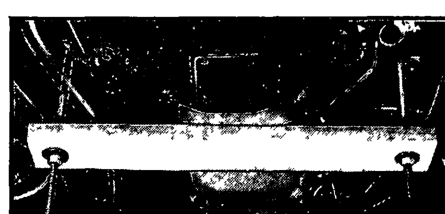


Fig. 51 Engin supp rt bar and ho ks in plac

5. Remove bell housing cover and bell housing hand hole cover, Fig. 49.

6. Crank engine with remote control starter J-2679 until one converter drain plug is down. Then loosen but do not remove this plug. Crank engine until opposite plug is down, remove plug and drain oil from converter.

7. Remove plug from oil pan to drain oil from transmission.

8. Disconnect oil cooler pipes and oil cooler bracket from transmission case. Tie oil cooler to frame so that it will be supported clear of transmission.

NOTE—On some models it may be necessary to disconnect hoses from cooler and remove cooler after transmission is removed from car.

9. If oil filler pipe is located under hood, disconnect pipe at rubber hose, which is identified by a red stripe.

10. Disconnect transmission shift rod at both ends and remove. Disconnect speedometer cable.

11. Disconnect rubber thrust pad from transmission support by removing three nuts and plate, then lift out shims located between support and thrust pad. Remove two bolts and plate which attach transmission mounting pad to support, Fig. 50.

12. Install engine support bar under rear end of lower crankcase, Fig. 51. Place left side hook over frame to rear of brake master cylinder. Snug nuts up evenly on both hooks.

13. Place transmission jack or hoist in position and adjust it according to the instructions for the equipment being used. An overhead hoist requires removal of transmission opening floor pan; an underneath jack does not require removal of pan.

14. Raise engine and transmission just enough to relieve load on transmission support by tightening nuts on engine support bar hooks, Fig. 51, following up with transmission lift or jack.

15. Remove transmission support from frame X member and remove thrust pad from thrust plate.

16. Mark flywheel, converter primary pump and cover with daubs of paint so that pump can be reinstalled in same position on flywheel. Then disconnect converter from flywheel.

17. If underneath jack is used, lower engine and transmission just enough so that top bell housing bolts can be reached with a suitable extension wrench. If floor pan is removed this is not necessary. Disconnect bell housing from engine.

NOTE—On models where exhaust pipe hanger is attached by bell housing bolts, loosen clamp and move hanger forward on pipe to clear bolts.

18. Move transmission rearward to disengage converter pump cover from crankshaft, lower transmission and remove it from under car.

INSTALLING TRANSMISSION

1. Turn flywheel so that one hole for converter drain plug is straight down and turn converter so that one drain plug is straight down. Paint marks placed on flywheel, converter primary pump and cover during removal must align when transmission is installed.

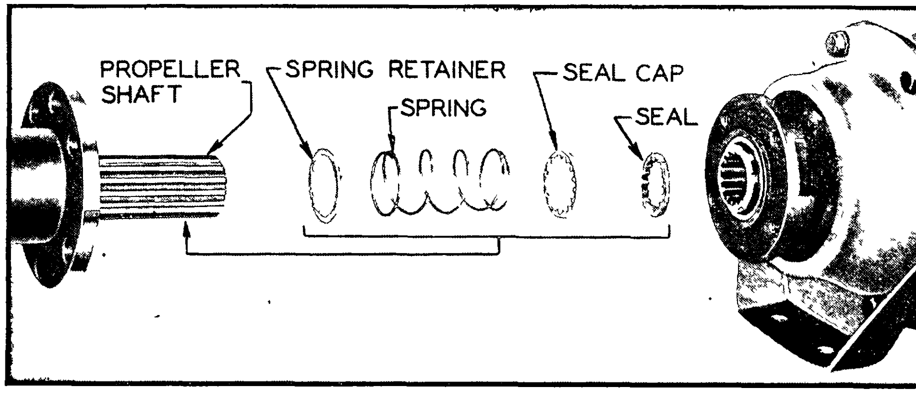


Fig. 52 Propeller shaft spline oil seal on 1948-52 Dynaflow cars

2. Raise transmission into place with same equipment used for removal. Align converter drain plug and cover bolts with corresponding holes in flywheel before moving transmission forward against flywheel housing.

3. Adjust lifting equipment so that bell housing meets flywheel housing squarely. Install two bell housing dowel bolts first, then install remaining bolts and torque tighten to 40-45 lbs. ft. The crankcase ventilator outlet pipe support is attached by the lower right bell housing bolt.

NOTE—On models where exhaust pipe hanger is attached by lower left bell housing bolts, install nuts on bolts and tighten, then place hanger over bolts and secure with additional nuts. Tighten hanger clamp around exhaust pipe.

4. Attach thrust pad to thrust plate. Raise transmission far enough to install transmission support. Then lower transmission until weight is carried by mounting pad and support. Attach mounting pad to support with bolt plate and self-locking nuts.

5. Remove lifting equipment and engine support bar.

6. With engine and transmission resting freely and normally on mountings install sufficient shims between thrust pad and transmission support to fill existing space. Insert shims from above with tabs on left side. Then install bolt plate and three nuts which attach thrust pad to support.

7. Connect converter to flywheel with paint marks on flywheel and primary pump aligned, and torque tighten bolts evenly to 25-30 lbs. ft.

8. Check converter drain plugs for tightness. Then install bell housing and hand hole covers.

9. Mount oil cooler on transmission case and connect oil pipes. If oil cooler was mounted before transmission was installed, connect hoses as originally installed.

10. Connect speedometer cable. Attach transmission shift rod to shift lever on transmission but leave front end disconnected for later adjustment.

11. Cement a new gasket in recess in front end of torque tube and make sure that propeller shaft spline oil seal parts are installed in the order shown in Fig. 52.

12. Connect torque tube to torque ball with bolts and lock washers.

13. If transmission oil filler pipe is located under hood, place spring bracket over filler pipe and connect pipe to oil pan pipe with both pipes contacting inside rubber hose. Place spring bracket over front end of bell housing dowel bolt. Nut and lock washer will be installed later.

14. Wipe all oil from outside of transmission and lower car to floor.

15. Install lock washer and nut to right hand bell housing dowel bolt, making sure that oil filler pipe spring bracket is in place, that filler pipe is in line with oil pan pipe, and that clearance exists between filler pipe and floor pan.

16. Fill transmission to proper level as instructed under "Lubrication." Fill radiator to proper level.

17. Check adjustment of shift control detent. Then adjust shift rod and connect it to shift idler lever as previously described.

18. Check adjustment of neutral safety switch and back-up lamp switch as previously outlined.

19. Road test car for approximately 20 miles with frequent stops and starts as might be encountered in heavy traffic.

20. Place car on hoist and carefully examine transmission and all connections for leaks. Recheck oil level.

DISASSEMBLING TRANSMISSION

IMPORTANT — Absolute cleanliness is essential when servicing the transmission. Only a clean bench should be used for laying out parts and all parts should be carefully cleaned before reassembling.

The tools which were designed specifically for working on the transmission are illustrated throughout the text and the part number of the tool is also given. These tools are available through the Kent-Moore Organization, Detroit, Michigan.

Torque tightening specifications are given for almost all nuts and capscrews in the unit. Unless these specifications are carefully followed, successful repair of the unit may not be obtained. In this same category are several procedures outlining sequences in which tightening is to be performed. This is equally as important as obtaining the correct torque.

When ordering parts, be sure to specify the transmission serial number. This number is stamped into the bottom sur-

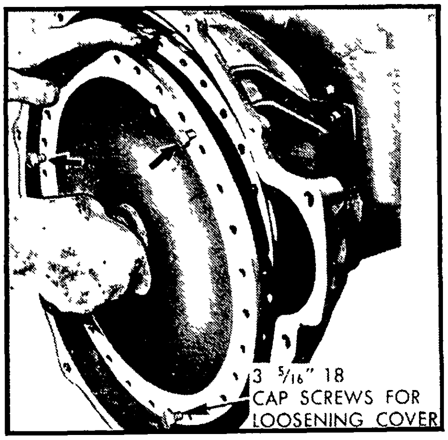


Fig. 53 Rem ving converter pump cover

face of the transmission case directly to the rear of the high (left) accumulator.

REMOVAL OF EXTERIOR PARTS—

1. Remove transmission shift lever to avoid damage to valve operating linkage while working on transmission. Hold lever forward while removing retaining nut so that linkage will not be strained. Then remove lever from cross shaft.
2. Remove oil cooler and oil pipes if these were not removed during removal of transmission from car.
3. If valve and servo body is to be removed, remove both band adjustment covers and gaskets. Remove oil gauge rod if it has not already been removed.
4. Remove both pipe plugs from primary pump cover to drain any oil remaining in converter.
5. Turn transmission over, with oil pan up and bell housing resting on bench.

REMOVAL OF CONVERTER & BELL HOUSING—This operation is not required for removal of valve and servo body, universal joint or rear bearing retainer.

1. When converter has drained, remove all nuts, flat washers and bolts which attach cover to primary pump. Hold cover to prevent turning by inserting a punch in drive bolt holes through bell housing hand hole.
2. Screw $\frac{5}{16}$" capscrews into three tapped holes in pump cover to loosen and remove cover, Fig. 53.
3. Remove torque converter spacer and shim washers which may either be on input shaft or in bearing recess in pump cover. Push against end of input shaft to avoid withdrawing this shaft with converter turbine as it is removed, Fig. 54.
4. Check each stator for free wheel clutch slippage. Stators should rotate freely in clockwise direction but lock tight in opposite direction.
5. Use a narrow pointed tool to remove retaining ring from reaction shaft. Remove both stators as one unit, Fig. 55 (if separated clutch parts will fly out).
6. Check secondary pump for free wheel clutch slippage. Pumps should turn freely in clockwise direction but lock tight in opposite direction, Fig. 56.
7. Pull primary and secondary pump forward from reaction shaft and immediately check for evidence of oil leakage. Radial streaks of fresh oil on back of primary pump and fresh oil running down face of front oil pump body indicate leakage past oil pump seal.
8. Before removing bell housing, check to see whether all attaching bolts are tight. Loose bolts may be the cause of oil leakage at this point.
9. Put bell housing over edge of bench and remove it. Examine rubber seal located around front pump to see whether it has been uniformly compressed by the bell housing. If not, check for any obstacle that may be around the oil pump or opening in bell housing that would prevent uniform compression of the seal.

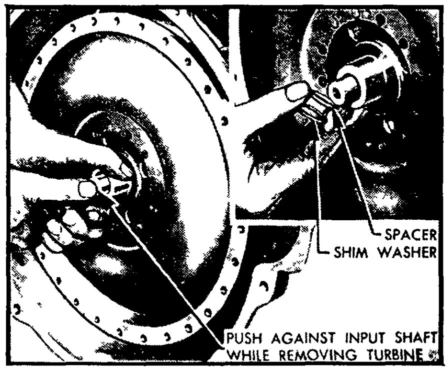


Fig. 54 Removing shim washers, spacer and turbine

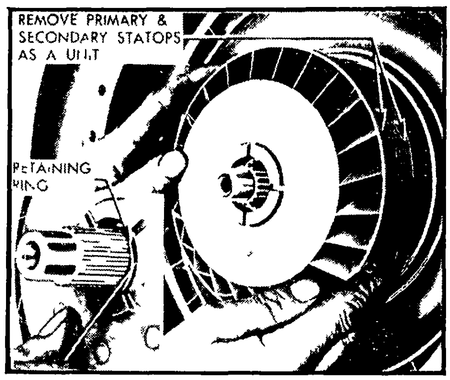


Fig. 55 Removing reaction shaft retaining ring and stators

REMOVING OIL PAN, VALVE & SERVO BODY—For removal of valve and servo body only, converter and bell housing need not be removed. The following procedure may also be used with transmission in car.

1. Remove oil pan and gasket.
2. If oil screen is first type (mounted in oil pan) immediately examine impression made by oil screen suction pipe in neoprene sealing ring located in recess in servo body, Fig. 57. A full impression of end of suction pipe in sealing ring indicates that no air leak existed at this point. Remove sealing ring.
3. Disconnect valve operating rod from valve operating lever (upper) by placing screw driver on rod close to lever and exerting slight pressure, Fig. 58. A

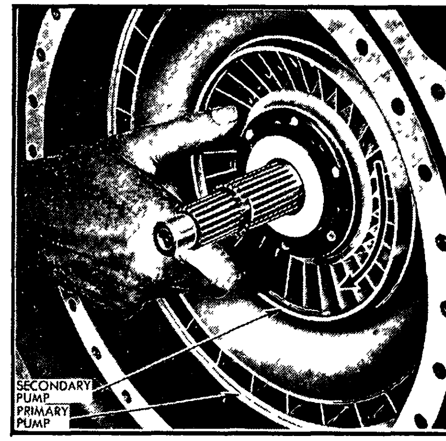


Fig. 56 Checking sec ndary pump free wheeling clutch

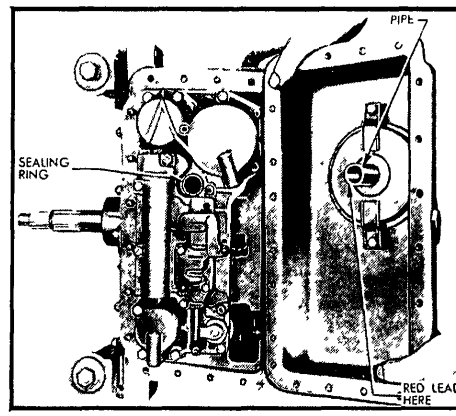


Fig. 57 First type il scr n and sealing ring

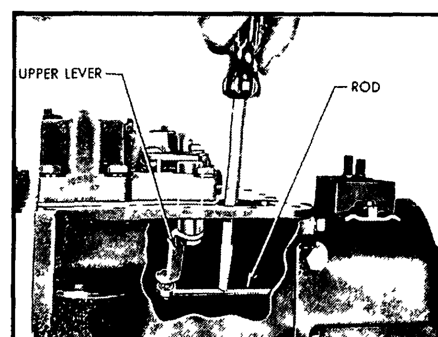


Fig. 58 Disconnecting valve operating rod from upper l v r

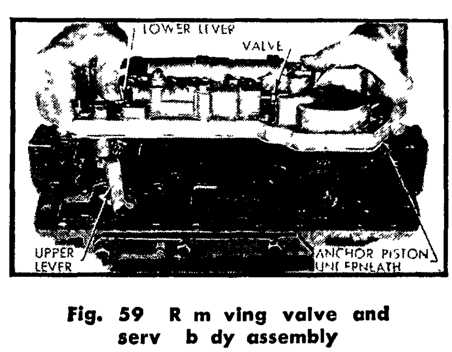


Fig. 59 R m ving valve and serv b dy assembly

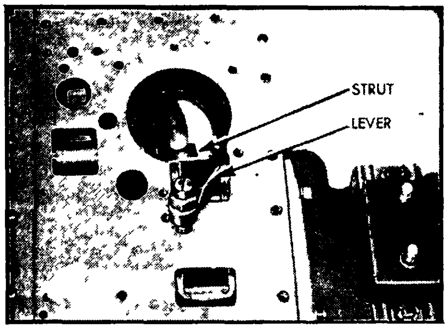


Fig. 60 Removing reverse band perating strut

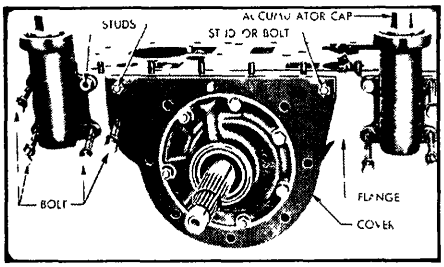


Fig. 61 Accumulator body and reaction shaft flange attaching screws

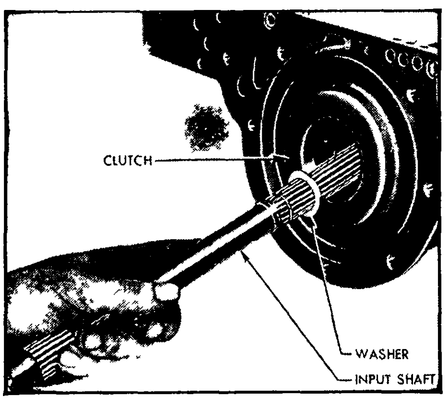


Fig. 62 Removing input shaft and clutch hub thrust washer

spring-loaded socket on rod engages a ball stud on lever.

4. If oil screen is of second type mounted on valve body, lift screen away from suction pipe to which it is held by a rubber grommet snapped into hole in screen body. Remove suction pipe spring support, retaining spring, suction pipe, and cork gasket which seats in recess in servo body.

5. Slightly loosen all valve and servo body attaching screws but do not loosen the slotted safety nuts on valve-to-servo body studs. Remove all screws, turning each a little at a time in succession until pressure of anchor piston spring is relieved.

6. Lightly pry upward on assembly to free gasket between servo body and transmission case. Push shift control valve and lower operating lever inward to align lower lever with opening in transmission case. As assembly is lifted from case reach under to hold anchor piston to prevent it from falling out and getting damaged, Fig. 59.

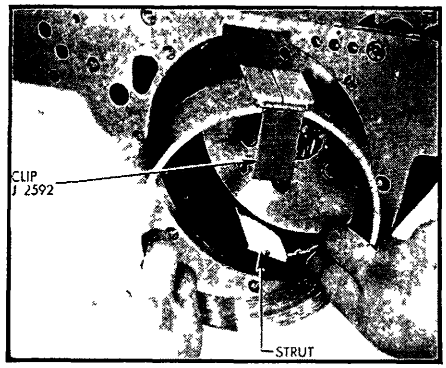


Fig. 63 Removing band with installing clip J-2592

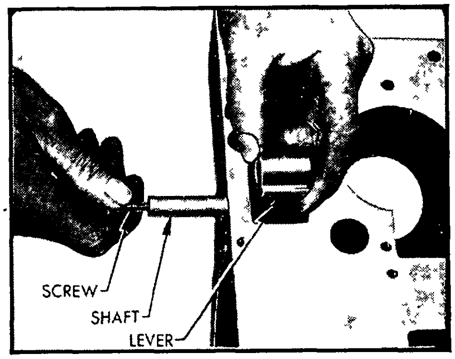


Fig. 64 Removing low band lever and shaft

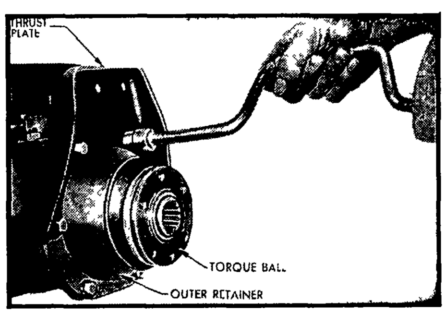


Fig. 65 Removing torque ball

CAUTION—Do not grasp slotted end of shift control valve because sharp edges may cut hand. Remove gasket and check for indication of oil leakage.

7. Remove reverse band operating strut by extending a finger through adjustment hole to prevent strut from falling into transmission case. Then release strut by raising operating lever, Fig. 60.

REMOVING REACTION SHAFT FLANGE, FRONT OIL PUMP & ACCUMULATORS — The converter, bell housing and oil pan must be removed. Valve and servo body need not be removed.

1. Loosen, but do not remove servo body caps.

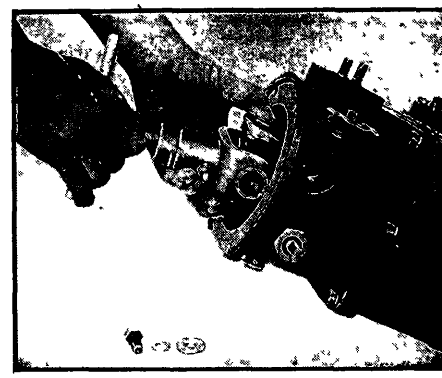


Fig. 66 Removing universal j int with puller

2. Remove three bolts which attach each accumulator body but do not remove the stud nut, Fig. 61.

3. Remove bolts extending through front oil pump cover but do not remove any stud nuts. First type transmissions had one screw and two stud nuts; later jobs have two screws and one stud nut.

4. Tap very lightly on rear of accumulator bodies with fiber mallet to loosen reaction shaft flange, then remove assembly and gasket. Leave input shaft in place in transmission.

5. Check reaction flange gasket for good imprint and freedom from damage which would cause an oil leak at this point.

REMOVING INPUT SHAFT, CLUTCH & LOW BAND — The converter, bell housing, valve and servo body and reaction shaft flange must be removed.

1. Pull input shaft and clutch hub front thrust washer from clutch. Then remove clutch, Fig. 62.

2. Block low band anchor lever down with screw driver and compress low band with operating lever while applying Band Installing Clip J-2595 across strut flanges of band, Fig. 63. Release levers and remove low band. Then remove struts which will drop into case.

3. Remove low band anchor and operating levers by threading ¼" capscrew into each lever shaft and pulling shaft out of case, Fig. 64.

REMOVING TORQUE BALL & UNIVERSAL JOINT—None of the preceding operations are required for removal of torque ball and universal joint.

1. Remove torque ball rubber boot.

2. Remove attaching bolts, Fig. 65. Then take off mounting thrust plate and gasket, torque ball, inner and outer retainers and all paper shims. These shims govern the adjustment of the torque ball.

3. Remove speedometer driven gear and sleeve.

4. Place transmission shift lever on cross shaft and push lever forward while turning universal joint until locking pawl engages parking lock ratchet wheel.

5. Unfasten and pull universal joint from output shaft, using Universal Joint Puller J-682-A on Series 40, 50, or J-859-A on Series 70 if joint cannot be removed by hand, Fig. 66.

6. Remove transmission shift lever.

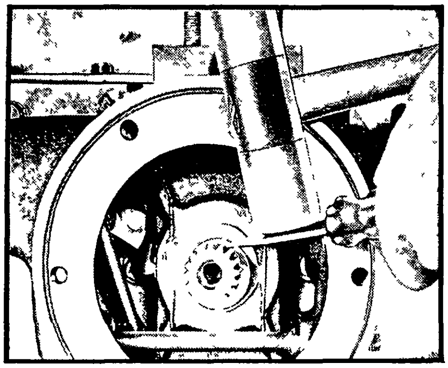


Fig. 67 Removing universal joint r taining ring

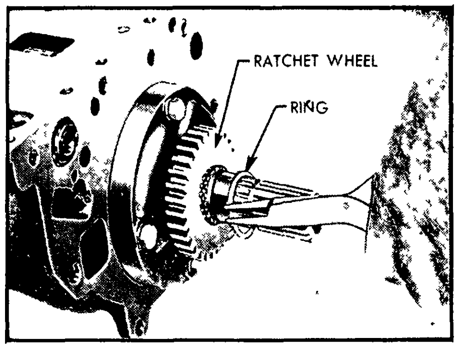


Fig. 68 Removing ratchet wheel retaining ring

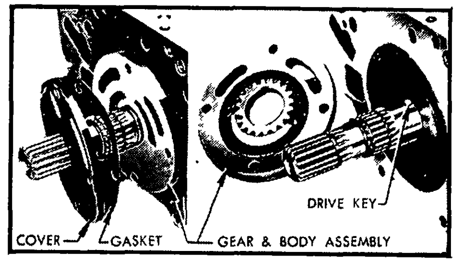


Fig. 69 Removing first type rear il pump

REMOVING REAR BEARING RETAINER & PARKING LOCK RATCHET WHEEL—Only the torque ball, universal joint and oil pan need be removed to perform this operation.

1. Disconnect valve operating rod from upper operating lever if not previously done (see Fig. 58).
2. Remove universal joint retaining ring from output shaft, Fig. 67. Use care to avoid nicking output shaft as nicks will damage rear bearing retainer bushing during removal of retainer.
3. Remove retaining bolts and take off rear bearing retainer and gasket. Check gasket for evidences of oil leakage.
4. Using snap ring pliers, remove ratchet wheel outer retaining ring, slide wheel from output shaft and remove inner retaining ring, Fig. 68.

REMOVING REAR OIL PUMP & REGULATOR VALVE—

1. Remove retaining bolts and take off pump body, which contains pump gears. In transmissions below A-36,000 the pump assembly consisted of a separate cover, gasket, and body and gear assembly, Fig. 69. Check gaskets for indication of oil leakage.
2. Remove drive key and use pointed tool to remove rubber cushion which is located under drive key in output shaft.
3. Remove rear pump plate and gasket if they can be removed from case without prying. If plate is stuck, it can be tapped out after removal of planetary gear set. Check gasket for indication of oil leakage.
4. Remove oil pressure regulator valve seat, using a suitable drag link socket, Fig. 70.

REMOVING PLANETARY GEARS, REVERSE RING GEAR AND BAND—

All the preceding operations must be performed before the planetary gear set can be removed.

1. Remove planetary gear set through front of case, Fig. 71.
2. Remove reverse ring gear and two planet carrier thrust washers if they did not come out with the planetary gear set.
3. If rear pump plates and gasket were not previously removed, tap them out with a hammer handle from front side of case, Fig. 72.
4. Thread a ¼" bolt into the reverse band anchor shaft and pull it from transmission case; then remove operating lever, Fig. 73.
5. Rotate reverse band toward adjusting hole until anchor can be disengaged, then remove this part.
6. Compress ends of reverse band and apply Band Installing Clip J-2595 across strut flanges and remove band.
7. Remove reverse ring gear rear thrust washer from case.

CONVERTER STATORS & PUMPS, OVERHAUL

DISASSEMBLY OF STATORS—

1. Rotate primary and secondary stators as shown in Feg. 74 while slowly drawing stators apart. Separate stators carefully otherwise free wheeling rollers and springs may fly out.
2. Remove free wheel race, which may be found in either stator, and remove the roller spacer from secondary stator, Fig. 75.
3. Remove free wheel rollers, springs and spring cups from both stators. Take roller assembling washer from primary stator, Fig. 75.

DISASSEMBLY OF CONVERTER PUMPS—

1. Remove secondary pump retaining ring and free wheel roller spacer, then rotate secondary pump in clockwise direction while withdrawing it from primary pump, Fig. 76.
2. Remove rollers, springs and spring cups from secondary pump and remove secondary pump thrust washer which may be either in primary pump or attached by oil to secondary pump.

INSPECTION OF PARTS—

1. Wash all parts in clean solvent and dry thoroughly.
2. Inspect input shaft pilot bearing in primary pump cover and replace if worn or rough.
3. Carefully examine all other parts for excessive wear, scoring or other damage. Check free wheel roller springs for permanent set, distortion or breakage.
4. Small nicks on free wheel rollers and race should be removed with an Arkansas stone and polished with crocus cloth. Nicks on pump or stator vanes should be removed with a fine file.

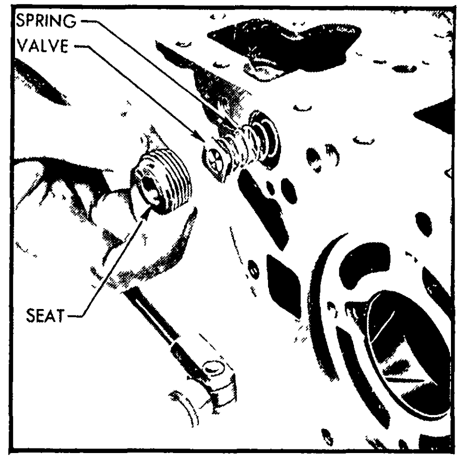


Fig. 70 Removing lubricati n il pressure regulat r valve

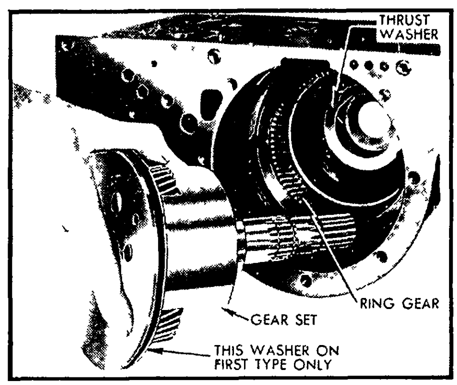


Fig. 71 Removing planetary gear set

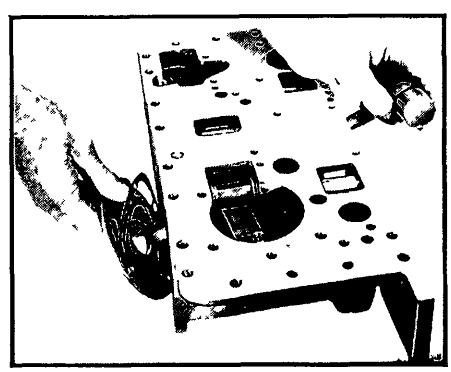


Fig. 72 Rem ving r ar il pump plate and gask t

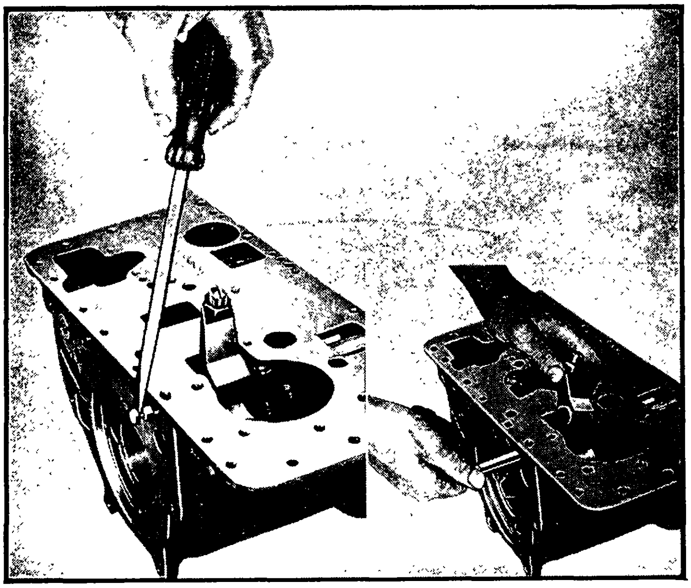


Fig. 73 R m ving rev rs band perating lev r and shaft

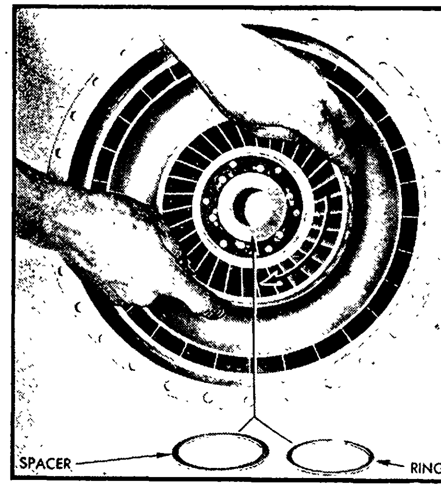


Fig. 76 Removing s c ndary pump

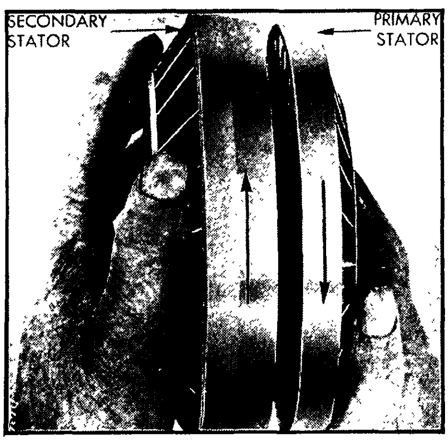


Fig. 74 Separating primary and secondary stators

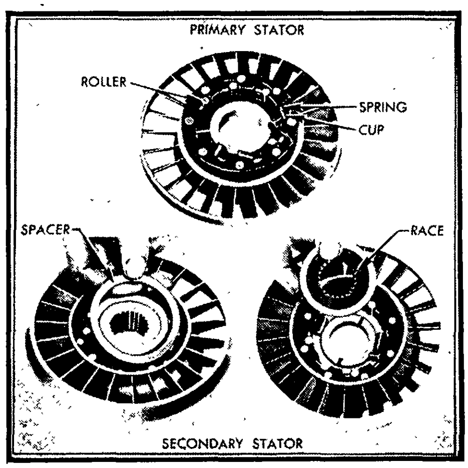


Fig. 75 Free wheeling parts of stators

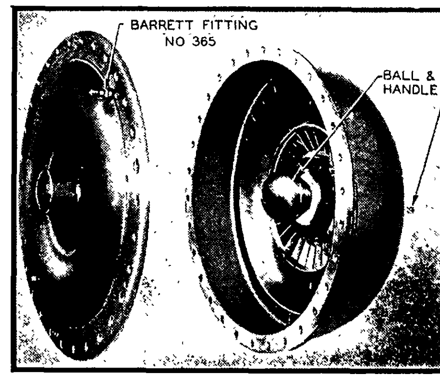


Fig. 77 Ball and fitting installed for pump test

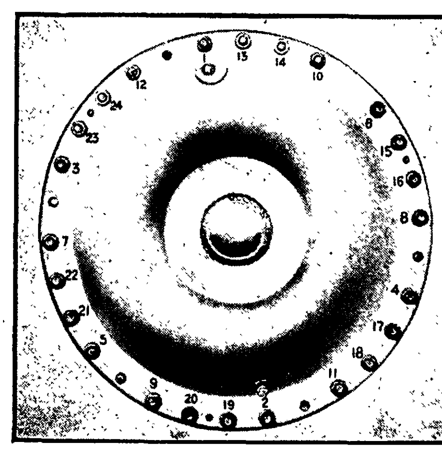


Fig. 78 Primary pump c ver bolt tightening sequenc

TESTING PRIMARY PUMP FOR OIL LEAKAGE—If primary pump is suspected of leaking oil it may be tested by means of a standard 2½" rubber tank ball with wire handle and a Barrett fitting No. 365 having a standard tire valve core.

1. Insert tank ball in primary pump hub as shown in Fig. 77, and hold it in position with wire handle.
2. Install primary pump cover and gasket and tighten all bolts to proper sequence, Fig. 78.
3. Install one drain plug in cover and install Barrett fitting in other drain hole, Fig. 77, and attach air hose.
4. Fill pump with compressed air at 80-100 pounds and submerge pump in water tank. Air bubbles will appear at any point where oil leakage exists.

CAUTION: After primary pump cover gasket is used in this test it should not be used when rebuilding transmission.

ASSEMBLY OF CONVERTER PUMPS—

1. Install secondary pump thrust washer over primary pump hub.

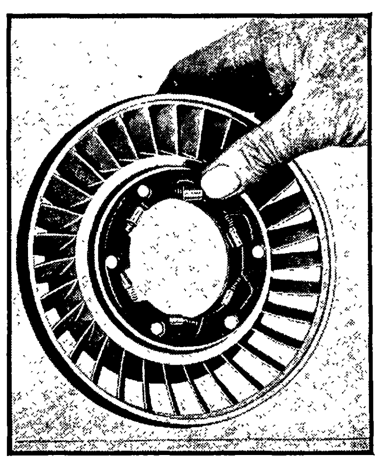


Fig. 79 Installing free wheel springs and cups in secondary pump

2. Insert free wheel springs and spring cups in secondary pump.
3. Install secondary pump over hub of primary pump with springs outward. Slowly rotate pump clockwise during installation.
4. Compress springs with a thin narrow tool and insert free wheel rollers.
5. Install free wheel roller spacer and secondary pump retaining ring over hub of primary pump to hold rollers and secondary pump in place.
6. Check free wheel clutch action by making certain that secondary pump will turn freely in clockwise direction and lock tight in opposite direction.

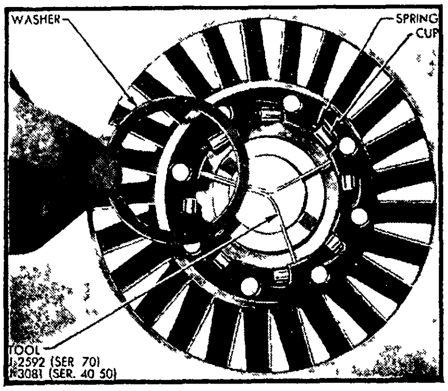


Fig. 80 First position of primary stat r assembly tool

ASSEMBLY OF STATORS—

1. Install free wheel springs and cups in secondary stator and install free wheel race, Fig. 79. Install race in same position as before removal, as indicated by wear pattern. A new race may be installed either end first.
2. Depress springs and cups with a thin narrow tool and install *long* free wheel rollers. Place roller spacer around race and over rollers.
3. Install free wheel springs and cups in primary stator.
4. Install Primary Stator Assembly Tool J-2592 (Series 70) or J-3081 (Series 40, 50) in primary stator, Fig. 80, so that the three points of tool are between the roller recesses. Then place roller washer flat on tool.
5. Depress springs and cups with a thin narrow tool and install the *short* free wheel rollers. Install first roller adjacent to one leg of tool and the next roller diametrically opposite first roller. Then install alternate rollers until all are in place. Use care to keep flat washer against tool and depress springs so that rollers slide into place without being forced.
6. When all rollers are in place, turn tool counter-clockwise until one end can be pushed into a roller recess. This will free other ends so that tool can be removed without disturbing washer.
7. Place secondary stator on bench with rollers facing upward. Place primary stator squarely in position over secondary stator, with rollers facing downward. Then twist primary stator counter-clockwise while pushing it down against other stator. *Keep primary stator level.*

VALVE & SERVO BODIES, OVERHAUL

NOTE — If transmission identification number is A-2999 or lower and valve and servo body assembly is first type, replace assembly with second type. Also replace anchor piston with second type.

DISASSEMBLE VALVE BODY—The valves and anchor piston have sharp edges which can cut fingers if improperly handled. As these parts are removed wrap them separately in clean cloth to avoid damage through contact with other parts.

1. Remove low band anchor piston, spring and shims from servo body to avoid damage in handling.
2. Remove safety nuts and washers from studs, then lift valve body and gasket from servo body. Remove shift control from valve body. Check gasket for evidence of oil leakage.
3. Remove rear pump delivery check valve and spring from servo body to avoid losing these parts.
4. Remove large pressure regulator valve plug from body, using care because of the heavy spring pressure behind the plug. Remove two springs and spring seat, Fig. 81.
5. Remove small valve plug and pressure regulator valve from body.
6. Remove valve body plate and gasket, front pump delivery check valve and spring. Check gasket for evidence of oil leakage.

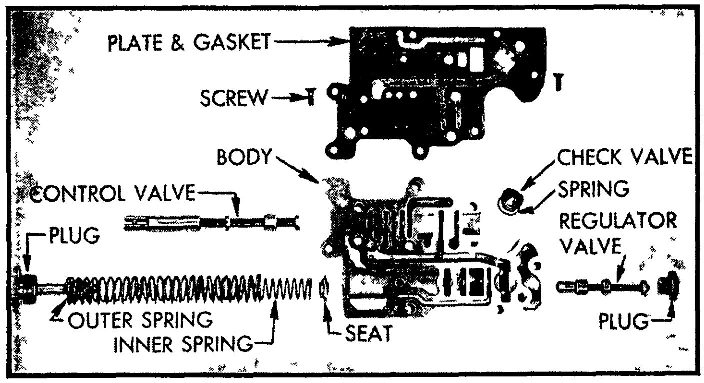


Fig. 81 Valve b dy disass mbled

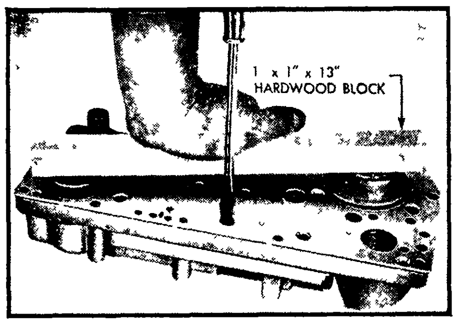


Fig. 82 Removing servo body spacer plate

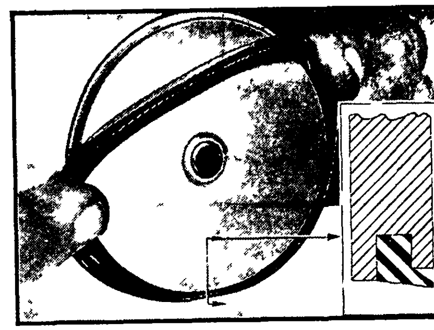


Fig. 84 Installation of serv piston seal

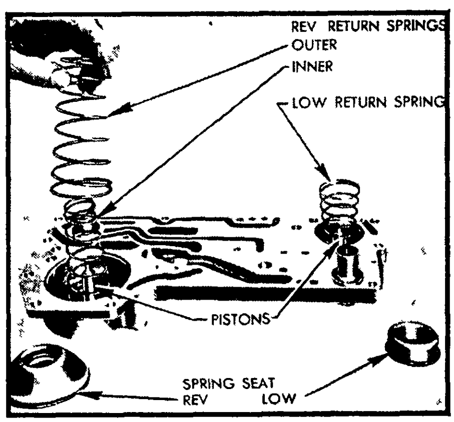


Fig. 83 Low and reverse servo parts

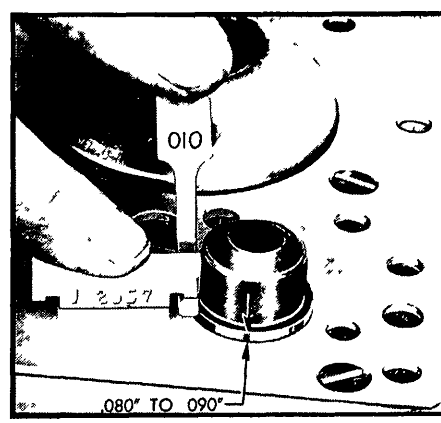


Fig. 85 Checking h ight f anchor piston land

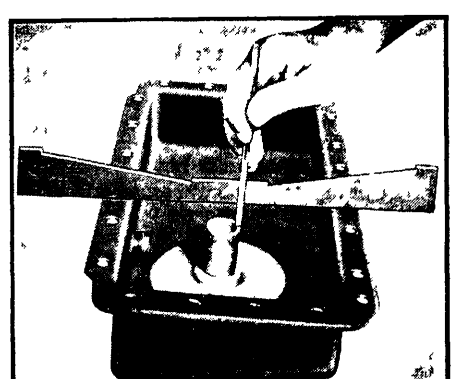


Fig. 86 Checking p siti n of first type il screen sucti n pip

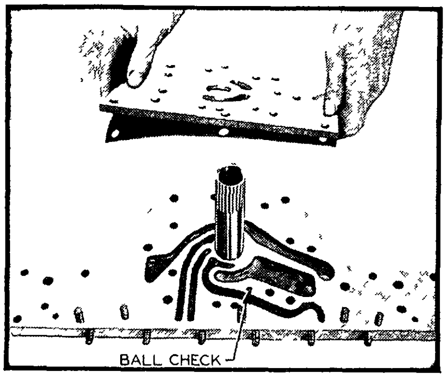


Fig. 87 Front oil pump cover and reacti n shaft flange

DISASSEMBLE SERVO BODY—

1. Remove nut and lockwasher which attaches upper valve operating lever to lower lever shaft and remove both levers.
2. Remove servo body spacer plate attaching screw at reverse servo which is in line with low servo. Then place 1" x 1" x 13" wooden block across low and reverse servo spring seats, Fig. 82.
3. Hold block down firmly while removing remaining spacer plate attaching screws. Then carefully release pressure on block to allow servo springs to expand. This operation must be done carefully to avoid springing spacer plate or letting springs fly out. Remove spacer plate and gasket. Check gasket for indication of oil leakage.
4. Remove servo parts, Fig. 83.
5. If low band anchor piston was retained by spacer plate (early jobs) remove piston, spring and shims.

INSPECT VALVE & SERVO PARTS—

1. Wash valve and servo bodies with clean solvent, dry and blow out all passages with air. Wash other parts and dry thoroughly.
2. Carefully inspect bodies for cracks, damage to gasket surfaces, scores in piston and valve cylinders, or other damage which would render these parts unfit for use.
3. Inspect surfaces and shoulders of shift control valve, pressure regulator valve, and anchor piston. Surfaces must be free of nicks, scores or deep scratches. A valve or piston must be replaced if sharp edges of shoulders are marred or rounded because such conditions will permit fine particles of foreign matter to work in between part and body and cause sticking. Check valves on surface plate and replace if bent.
4. Worn or damaged piston seals should be replaced. When a new seal is installed on a piston, make sure that lip fits over smaller diameter land, Fig. 84.

ASSEMBLE SERVO BODY—

1. Oil and install low and reverse servo pistons in body. Start each piston at an angle and then straighten, being careful not to curl or damage edge of seal. Check pistons for freedom of movement in servo body.
2. Install anchor piston, spring and original shims in servo body.
3. Install smallest piston return spring with small end in groove in low servo piston. Install the two large return springs with large ends in grooves in reverse servo piston. Install spring seats on upper ends of springs, Fig. 83.
4. Install new spacer plate gasket and place spacer plate in position over spring seats. Install spacer plate screws with the aid of wooden block shown in Fig. 82. Tighten screws uniformly to avoid distorting spacer plate.
5. Check anchor piston to make sure that no interference exists between piston and spacer plate or gasket. If interference exists, slightly loosen all spacer plate screws and tap plate in required direction to provide clearance all around piston. Tighten spacer plate screws uniformly.
6. Using the "go" and "no go" ends of Anchor Piston Gauge J-2657, Fig. 85, and a narrow .010" feeler gauge, check distance from face of spacer plate and anchor piston as shown. Height of piston land is adjusted by installing or removing shims between spring and piston. If piston land is too high with all shims removed, grind off end of spring.
7. Insert valve operating lower lever shaft through bearing in servo body. With lower lever pointing to low servo body, install upper lever on shaft so that it points to reverse servo piston spring seat. Install lockwasher and nut and torque tighten 5-7 lbs. ft.

ASSEMBLE VALVE BODY—Fig. 81.

1. Place front pump delivery check valve spring in body with large end down and place check valve in spring with ridged side up.
2. Install valve body plate and a *new* gasket, making sure check valve is seated against plate and is not caught under gasket.
3. Place pressure regulator spring seat on inner spring, then install spring seat, inner and outer springs, and large plug in valve body. Torque tighten plug 20-25 lbs. ft.
4. See that oil orifice in pressure regulator valve end land is clear, then install valve with this land outward. Install plug and torque tighten 25-25 lbs. ft.
5. Install shift control valve with slotted end on same end of valve body as large pressure regulator plug.
6. Install rear pump delivery check valve in its seat in servo body, ridged face inward, and place valve spring on valve with large end up.
7. Install a *new* gasket and valve body on servo body, using care to keep pump delivery check valve spring below the gasket. Then install plain washers and safety nuts on all studs. Torque tighten stud nuts 11-15 lbs. ft.

OIL SCREEN ADJUSTMENT

1. If oil screen is the second type (mounted on servo body) thoroughly clean the screen and check for any cracks or holes which would allow dirt to pass through.
2. If oil screen is of the first type (mounted in oil pan) mark screen and pan so screen can be reinstalled in the same position, then remove screen, clean it and the pan, removing old gasket from pan.

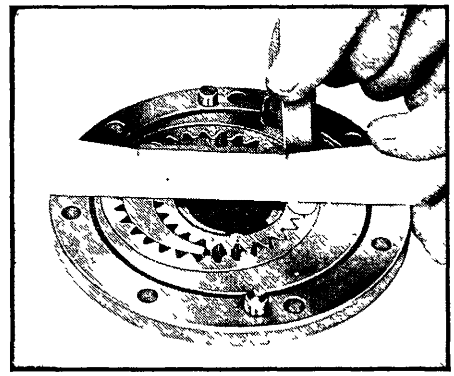


Fig. 88 Checking side clearanc of gears in pump b dy

3. Check flanges of pan with straight edge and carefully straighten flanges if distorted.
4. Reinstall screen in pan according to marks and attach with flat washers, lockwashers and bolts.
5. Place Converter Clearance Gauge J-2596 or a similar straight edge across oil pan and measure distance that oil suction pipe is below flange of pan. If distance is not $\frac{13}{32}$", Fig. 86, remove screen and bend mounting brackets to obtain this dimension when screen is reinstalled.

OIL PUMPS & REACTION SHAFT FLANGE, OVERHAUL

DISASSEMBLE FRONT PUMP & REACTION FLANGE—

1. Remove high and low accumulators and gaskets from reaction flange. Check gaskets for indication of oil leakage.
2. Before removing front oil pump, check the nuts for tightness (loose nuts would be the cause of oil leakage around pump). Remove front pump, if necessary, tapping body lightly with mallet to free it.
3. Remove front pump cover and gasket from reaction flange, and check gasket for evidence of oil leakage.
4. If check ball which is located in clutch feed passage of reaction flange is free to drop out, Fig. 87, remove ball to avoid loss in handling parts. Do not remove ball if it is securely retained by peened edge of hole.

PUMP INSPECTION—

1. Wash pump parts in clean solvent and dry thoroughly.
2. Check mounting faces of pump bodies, gears, front pump cover and rear pump cover plate for excessive wear.
3. Inspect front oil pump bushing. If bushing is loose or excessively worn replace pump assembly. If pump bushing is excessively worn or pump was noisy, always check for flywheel run-out, primary pump hub run-out, and misalignment of bell housing. Flywheel run-out should not exceed .005"; primary pump hub run-out should not exceed .007"; run-out of rear face of bell housing not over .005"; run-out of bell housing pilot hole not over .004".
4. Inspect front pump oil seal but replace it only if there is definite evidence of leakage or damage. Drive out defec-

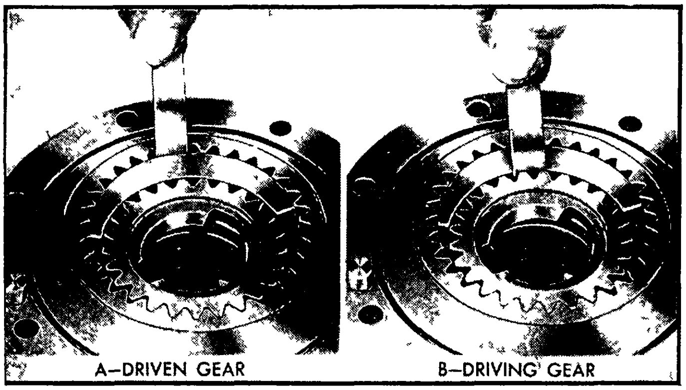


Fig. 89 Ch cking clearance between crescent and gears

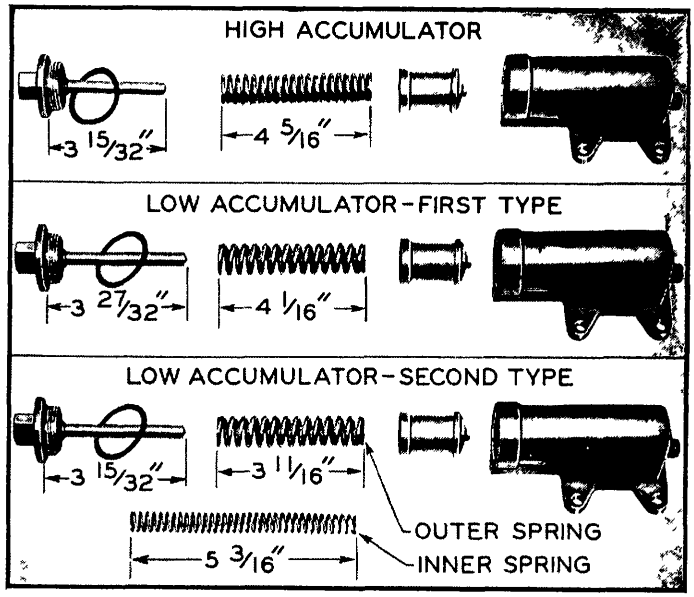


Fig. 92 Accumulator caps, springs and pist ns

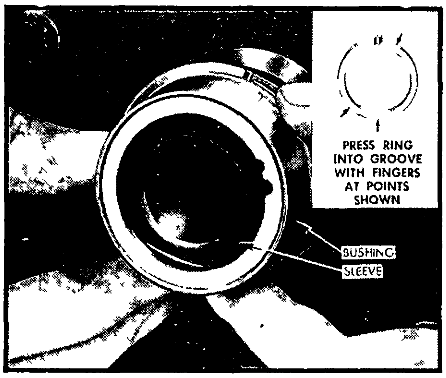


Fig. 90 S aling rings, bushing and sleeve n reaction flange hub

tive seal with a punch. Lightly coat outside of new seal with No. 3 Permatex, start seal squarely into pump body with deep groove in seal retainer outward and tap into place with hard wood block and mallet. Wipe off excess Permatex.

5. Make following checks and replace worn parts if clearances exceed specified limits. (A) Using straight edge and feeler gauge as shown in Fig. 88, clearance should be .001" to .002". (B) Using feeler gauge as shown in Fig. 89, clearance between crescent and driven gear should be .003" to .006". (C) Using feeler gauge between crescent and driving gear, clearance should be .006" to .009" on front pump, and .004" to .006" on rear pump.

6. Check front pump cover and rear pump cover plate for depth of wear caused by the gears. Replace part if depth wear exceeds .001" or surface is scored.

INSPECT REACTION SHAFT FLANGE—

1. Wash flange in clean solvent, dry thoroughly and blow out all passages with air.

2 Place straight edge on case mounting surface of reaction flange and check any low spots with feeler gauge. If out of true more than .002", replace flange assembly.

3. Inspect flange mounting face on transmission case in same manner. If face of case cannot be trued up within .002", it should be replaced.

4. Inspect surfaces of reaction flange and transmission case for nicks or burrs and remove with mill file.

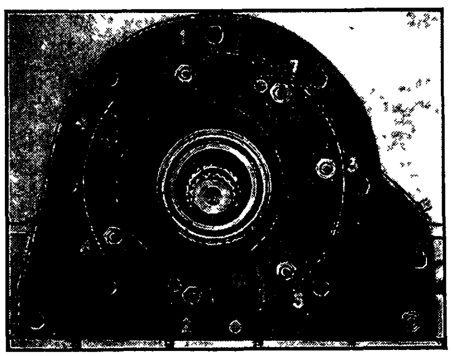


Fig. 91 Front oil pump tightening sequence

5. Inspect bronze bushing on rear hub of reaction shaft flange and the cast iron sealing sleeve pressed into the hub, Fig. 90. If these parts are worn excessively or scored, replace reaction shaft flange.

6. Inspect oil sealing rings on hub of reaction flange and replace if damaged in any way. To remove ring, apply pressure with index finger and thumbs at points indicated by arrows in Fig. 90 in order to unlock the ends by depressing one end and raising the other.

7. Check all studs for tightness and replace any with damaged threads. If stud threads are stripped in reaction flange, it will be necessary to tap out the hole for installation of step studs which are available.

ASSEMBLE FRONT PUMP & REACTION FLANGE—

1. Install check ball in clutch feed passage if ball was removed, Fig. 87. Then install a new gasket and pump cover on reaction flange.

2. Lubricate and install gears in front pump body. Driving gear must be installed with beveled side outward so that this side will be against cover when pump is installed.

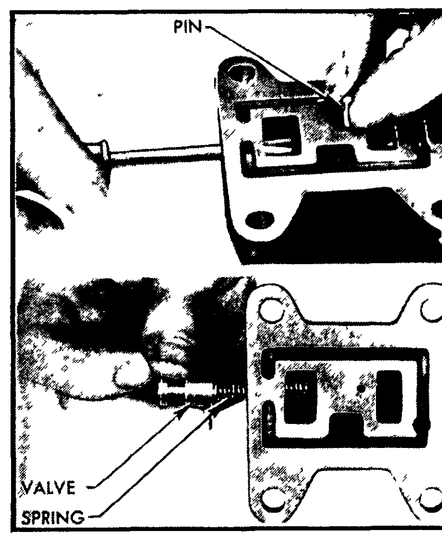


Fig. 93 Removing dump valv

CAUTION: Reversing this gear in pump body will result in severe damage to transmission.

3. Install oil pump on reaction shaft flange with lockwashers under nuts. On early jobs with steel pump cover the body must seat squarely in recess in cover. On later jobs with cast iron cover, pump is located by two dowel pins.

4. Tighten pump bolt or stud nuts to approximately 5 lbs. ft. torque in the sequence shown in Fig. 91, and then tighten in same sequence to 25-30 lbs. ft. Torque tighten cover attaching stud nut 25-30 lbs. ft.

ACCUMULATORS, OVERHAUL

1. Remove cap, gasket, spring and piston from accumulator body, Fig. 92.

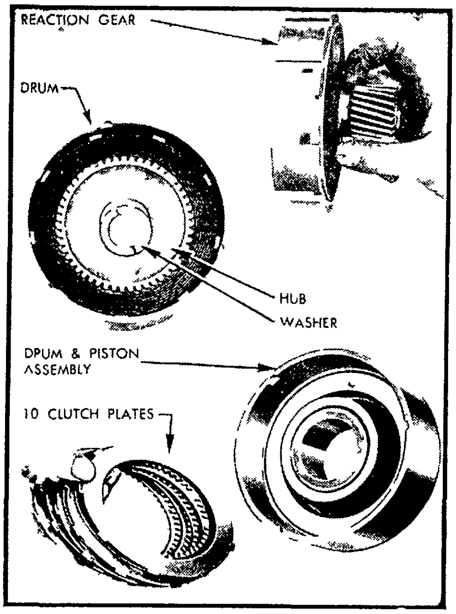


Fig. 94 Removal of reaction gear, hub and plates

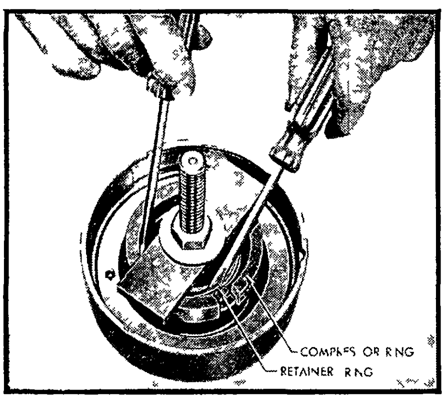


Fig. 95 Using clutch spring c mpressor J-2590

2 Remove pipe plug from top of accumulator body, depress dump valve with small screwdriver, Fig. 93, to relieve spring pressure on valve retaining pin and remove pin

3 Wash accumulator parts in clean solvent dry thoroughly and blow out all passages with air Examine all parts for excessive wear, scoring or other damage.

4 Remove any nicks or burrs from pistons or valves with an Arkansas stone.

Caution: Do not round the sharp edges of lands on pistons and valves If the sharp edges are marred or rounded, foreign particles may wedge between the part and body and cause sticking

5 With parts clean and dry, install pistons and valves and check for free sliding as body is tipped back and forth

6 Check mounting surface of body with a straight edge If surface is uneven it may be trued up by moving body in a circular motion over emery cloth placed on a surface plate. Remove all traces of emery.

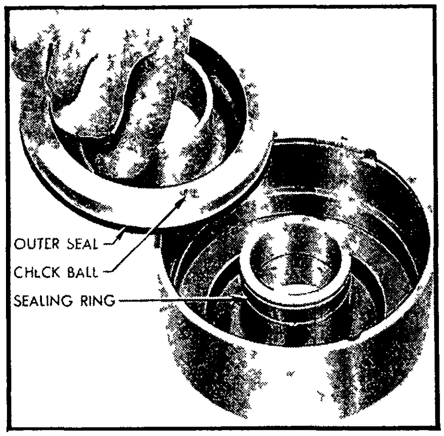


Fig. 96 Removing clutch piston

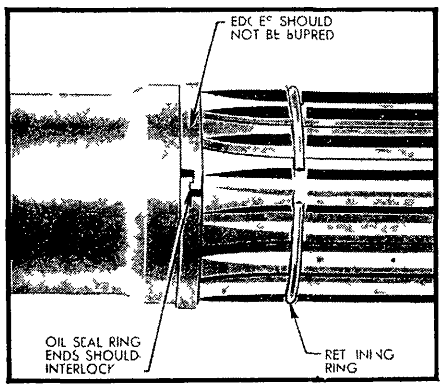


Fig. 97 Input shaft oil seal and retaining rings

7. If body, piston or valve is worn or damaged, or the parts do not slide freely after burrs are removed it will be necessary to replace the accumulator assembly because pistons and valves are not furnished separately

8 Assemble each accumulator, observing the following (A) Lubricate dump valve and install with narrow land outward (B) Lubricate piston and start squarely into body with open end outward *Do not tap or force piston into body* (C) Install the correct spring and cap in each accumulator, checking dimensions shown in Fig 92, and identification letter stamped on each cap Use *new* cap gasket and tighten cap finger tight

CLUTCH & INPUT SHAFT, OVERHAUL

DISASSEMBLE CLUTCH—

1 Remove reaction gear flange retaining ring with screwdriver and remove three flange driving keys with pointed tool

2 Remove low range reaction gear, thrust washer, clutch hub and 10 clutch plates from drum, Fig 94

3 Install Clutch Spring Compressor J-2590 in assembled drum, placing slot in compressor ring over ends of spring seat retaining ring Compress clutch spring sufficiently to remove retaining ring, Fig. 95.

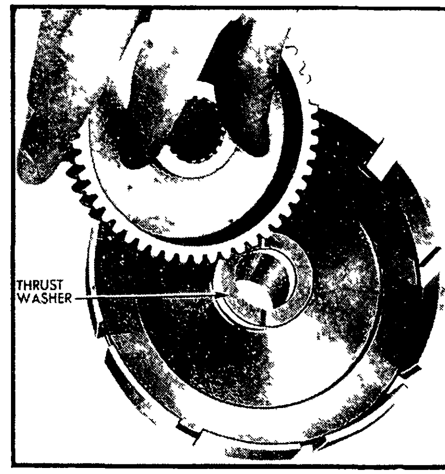


Fig. 98 Installing thrust wash r and clutch hub in reacti n gear

4 Release pressure on clutch spring, making sure that spring seat does not engage retaining ring groove in drum, then remove spring compressor, spring seat and spring

5 Forcibly rap drum, open end down, on a block of wood to remove clutch piston The steel check ball Fig 96 may come out of its seat in this operation, if it does, snap it back into place

INSPECTION—

1 Wash all parts in clean solvent and dry thoroughly Use only gasoline or kerosene to clean clutch plates and bands do not use any chemical degreaser or other commercial solvents

2 Inspect all clutch plates and replace any that are scored, burned, warped or worn excessively Check fit of any new internally splined plates on clutch hub to make certain that they slide freely on hub Tight plates will prevent full disengagement of the clutch

3 Inspect drum for cracks or scores Inspect oil sealing ring on clutch hub and if damaged, replace it as shown in Fig 90

4 Inspect clutch piston outer seal and replace if it is hardened, broken or has turned edges Install new seal with lip over smaller diameter land of piston

5. Make sure that small bleed hole in piston is open and that check ball is in place and not stuck.

6 Inspect the low band If band lining is worn smooth so that grooves are gone, replace band

7 Inspect input shaft oil seal ring and if damaged or broken, replace it as shown in Fig 90 Make sure that retaining ring is in place on shaft, Fig. 97.

ASSEMBLE CLUTCH—

1 Apply light oil to piston outer seal and inside of drum Then install piston carefully to avoid distorting or turning lip of seal When piston is fully installed in drum, top of piston will be approximately flush with shoulder on inside of drum

2 Place clutch spring in piston and place spring seat and seat retaining ring on spring Install spring compressor J-2590, Fig. 95, and compress spring un-

til retaining ring can be snapped into groove in hub of drum. Then remove spring compressor.

3. Place reaction gear on bench with flange upward, then install clutch hub thrust washer and clutch hub over hub of reaction gear, with open end of clutch hub facing up, Fig. 98.

4. Separate faced clutch plates from plain steel clutch plates. Faced plates are flat and may be installed in either direction. Plain steel plates are dished and all these plates must be installed with the dish in the same direction; however, the dish may be either up or down. Check each plate for dish with a straight edge and stack plates so that all are dished in same direction.

5. Install a faced plate over clutch hub, next to gear flange. Then install a plain steel plate. Alternately install the remaining plates. If installed correctly, the top plate will be plain steel.

6. Place drum and clutch piston assembly over reaction gear flange so that driving key recesses in drum and flange are approximately aligned, Fig. 99. Press drum evenly into place over reaction gear flange.

7. Complete alignment of driving key recesses by tapping reaction gear flange. Then install three driving keys and reaction gear flange retaining ring.

REAR BEARING RETAINER, UNIVERSAL JOINT & TORQUE BALL, OVERHAUL

DISASSEMBLE REAR BEARING RETAINER—

1. Remove clevis pin which connects valve operating rod clevis to valve operating cross shaft. Then remove rod and clevis through front end of bearing retainer.

2. Disconnect parking lock operating rod from cross shaft by unscrewing rod end from cross shaft lever.

3. Remove cross shaft bearing, using a box wrench. A socket which does not fully engage bearing, or an end wrench will distort the bearing. Remove cross shaft.

4. Screw a ¼" bolt into parking lock pawl shaft and pull shaft from rear bearing retainer, allowing end of pawl to swing free.

5. Tap parking lock operating lever toward front of rear bearing retainer, using a long punch, and remove operating lever shaft. The operating lever, lever and pawl assembly and apply spring can then be removed.

6. Remove special connector, torque converter pressure valve and spring from rear bearing retainer, using a socket or box wrench on connector; an end wrench would distort connector.

INSPECTION—

1. Wash all parts in clean solvent and dry thoroughly.

2. Inspect converter pressure valve for scoring or other damage. Inspect valve spring for distortion or breakage, and the special connector for distortion or stripped threads.

3. Inspect parking brake lock pawl, pawl locking link, and ratchet wheel for cracks and for worn teeth that would prevent positive locking.

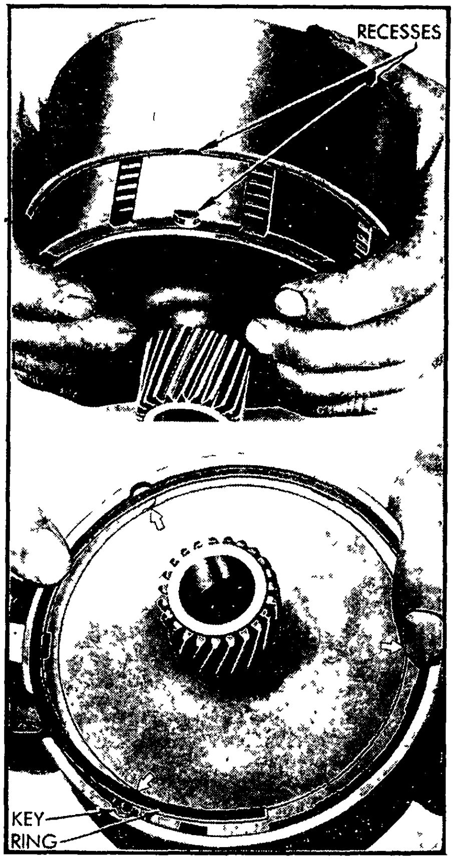


Fig. 99 Installing drum over reaction gear flange

4. Inspect valve operating cross shaft and bearing for excessive wear. Remove and discard rubber seal from bearing.

5. Inspect rear bearing retainer bushing for scoring or excessive wear. Insert output shaft in bushing and check clearance, which should be .001" to .006". If necessary, replace bushing, using Bushing Remover and Replacer J-2997. Reaming to size is not required.

UNIVERSAL JOINT & TORQUE BALL REPAIRS—

1. Inspect universal joint for wear and play between spider pins and bushings. Allowable play is .002" to .004".

2. Check fit of universal joint yokes on output and propeller shafts. Allowable backlash of rear yoke on propeller shaft splines is .0005" to .0045". Front yoke must be a tight fit, rotatively, on output shaft to prevent "snap" when alternating car movement between forward and reverse.

3. Inspect rear yoke of universal joint for excessive wear at point of contact with oil seal in torque ball. Rear yoke and bushing in torque ball must be free of scores and not worn excessively; clearance between these parts should be .004" to .006".

4. Clean and inspect spherical surfaces of torque ball and both retainers. If scored or pitted, replace these parts.

5. Inspect oil seal in torque ball and replace if worn. When installing a new seal, place it in position with the feather edge pointing into torque ball. Then press seal squarely into place, using a flat piece of metal to avoid distorting on seal. Press new seal *flush* with boss on flange of torque ball.

ASSEMBLE REAR BEARING RETAINER—

1. Install torque converter pressure valve spring valve with closed end outward, and the special connector in rear bearing retainer. Make sure all parts are clean.

2. Assemble locking pawl and lever assembly, apply spring, and parking lock operating lever with operating rod on dummy shaft as shown in Fig. 100. Note position of each end of apply spring.

3. Place assembled parts in position in rear bearing retainer. Then install operating lever shaft through retainer and lever.

4. Install parking lock pawl shaft through bearing retainer and lock pawl, making sure that tapped end is outward to permit future removal.

5. Install valve operating cross shaft and bearing. Install a *new* seal in bearing with grooved side facing inward.

6. Connect parking lock operating rod to cross shaft lever, using a lockwasher on threaded end of rod. Do not connect valve operating rod and clevis to cross shaft at this time.

PLANETARY GEAR SET & TRANSMISSION CASE, OVERHAUL

DISASSSEMBLE PLANETARY GEAR SET—

1. Remove reverse ring gear front thrust washer, if used. Units starting with A-42,475 and B-1 do not have this washer.

2. Remove three planet carrier screws and special lockwashers, using a 7/32" hexagon (Allen) wrench. A used universal joint front yoke may be placed on output shaft and held with a bar while loosening the screws.

3. Separate front and rear ends of planet carrier by carefully tapping around front flange while holding unit clear of bench.

4. Remove sun gear rear thrust washer, which may be either on sun gear or stuck in rear end of carrier. Remove reverse sun gear, Fig. 101.

5. Remove three low planet pinion assemblies, each consisting of a pinion, shaft and bearing rollers retained at each end of pinion by steel thrust washers. A retaining ring snapped into a groove in shaft will hold lower thrust washer in place as shaft is tapped out of carrier. Shaft is prevented from turning in carrier by a steel ball imbedded in end of shaft.

6. Remove three reverse planet pinion assemblies in the same manner as the low planet pinion assemblies.

7. Remove thrust washers and shafts from pinions, then remove bearing rollers. Note that the reverse planet pinions have a single set of rollers whereas the low planet pinions have two sets of rollers separated by a spacer, Fig. 102.

INSPECTION—

1. Wash all parts in clean solvent and dry thoroughly.

2. Carefully inspect shaft and rollers for excessive wear. Replace if worn.

3. Inspect reverse ring gear, sun gear and pinions for wear; remove any nicks or burrs with Arkansas stone.

4. Inspect bushing in rear end of planet carrier, and replace if worn or scored. Bushing may be removed with Bushing Remover J-3197 and new bushing may be installed, either end first, with Bushing Replacer J-2996, Fig. 103. Reaming bushing to size is not required.

5. Inspect reverse band anchor for cracks.

6. Inspect reverse band and replace if it is cracked .or if lining is worn so that grooves are gone.

TRANSMISSION CASE—

1. Wash case thoroughly and blow out all passages.

2. Carefully inspect case for cracks, breaks and stripped threads in bolt holes.

3. Inspect all machined surfaces for nicks or burrs and smooth off with a mill file.

4. If oil gauge rod base (first type filler) is bent where it enters transmission case it should be replaced to avoid oil leakage. Coat outside of new base with Permatex No. 3 and press into case until distance from top of base to surface of case is $2\frac{11}{16}''$.

5. Inspect bushing for wear and scoring. Insert planet carrier into bushing and check clearance with feeler gauge. If clearance is excessive due to wear of bushing, replace bushing.

6. To remove old bushing, place case over an opening with rear end down and drive bushing from case with Tool J-3175-1. To install new bushing, place Tool J-3175-2 in rear oil pump recess in case to serve as a pilot. Slip bushing over J-3175-1 and drive bushing into case from front side until bushing is flush with front surface of wall which supports bushing. Bushing must be installed with wide deep ends of oil grooves toward rear side of case, Fig. 104.

ASSEMBLE PLANETARY GEAR SET—

1. Reassemble planet pinions and shafts with bearing rollers and thrust washers. Bottom thrust washer goes between retaining ring on shaft and end of pinion. Each reverse planet pinion contains 24 rollers. Each low planet pinion contains 20 rollers at each end separated by a spacer, Fig. 102. Place a thrust washer on upper end of each assembly to hold rollers in place.

2. Make sure that steel ball is imbedded in each shaft to prevent turning in carrier. Then install pinion assemblies in front end of planet carrier, using care to engage steel balls in notches in carrier, Fig. 101.

3. Install reverse sun gear and place bronze thrust washer on top of gear.

4. Install rear end of planet carrier on assembled front end, making sure that assembly marks on both parts are aligned. These marks are numbers which are placed over the dividing line during the production of the carrier.

5. Install the three Allen head screws and torque tighten 25-30 lbs. ft.

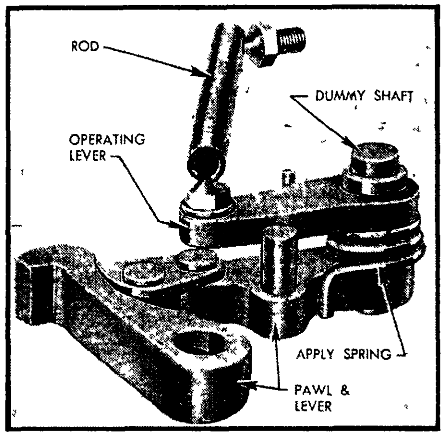


Fig. 100 Assembly of parking lock control parts and dummy shaft

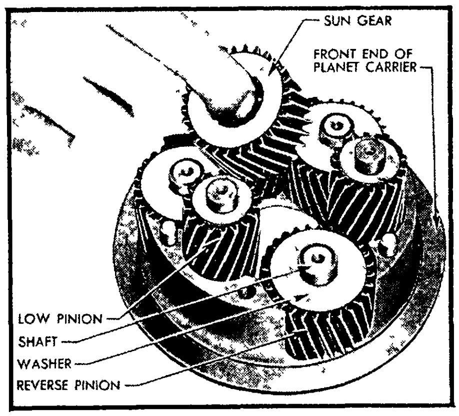


Fig. 101 Removing sun gear and planet pinions

6. Install reverse ring gear thrust washer if one was removed and ring gear has not been replaced by later type.

7. Install reverse ring gear on planetary gear set.

ASSEMBLING TRANSMISSION

GENERAL PRECAUTIONS—

1. Make certain that all parts are absolutely clean. Keep hands and tools clean to avoid getting dirt into assembly. If work is stopped before assembly is completed, cover all openings with clean cloth.

2. All moving parts should be given a light coating of 10-W oil before installation. Thrust washers should be held in place with vaseline or chassis lubricant, sparingly applied.

3. Use all new gaskets and seals to avoid oil leaks.

4. Use care to avoid making nicks or burrs on parts, particularly at bearing surfaces and surfaces where gaskets are used.

5. It is extremely important to tighten all parts evenly and in the proper sequence to avoid distortion of parts and leakage at gaskets and other joints. Use a reliable torque wrench to tighten all bolts and nuts to specified torque and in specified sequence.

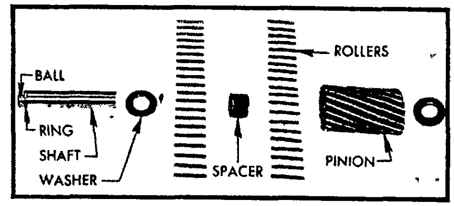


Fig. 102 Low planet pinion disassembled

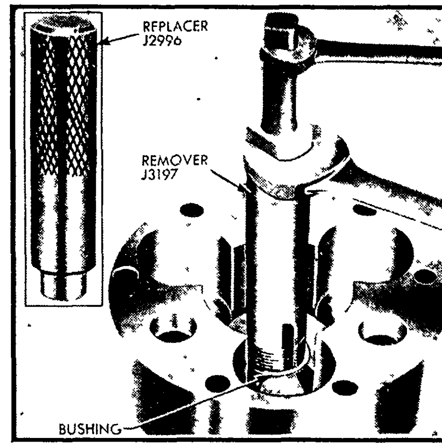


Fig. 103 Replacing planet carrier bushing

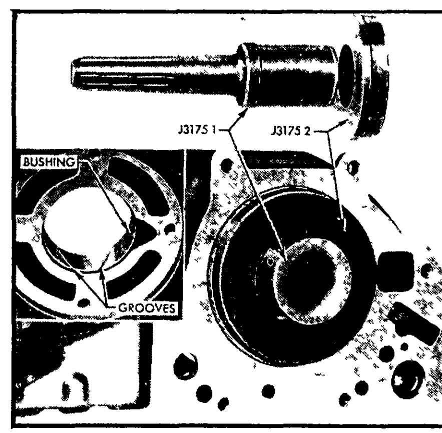


Fig. 104 Transmission case bushing remover and replacer J-3175

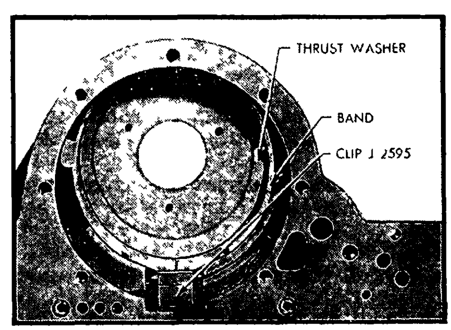


Fig. 105 Ring g ar thrust wash r and reverse band installed

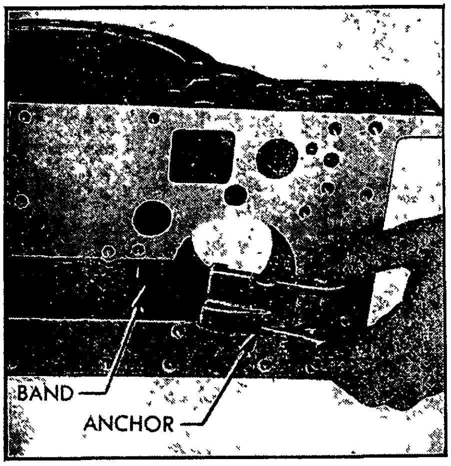


Fig. 106 Installing reverse band anchor

INSTALL PLANETARY GEAR SET—

1. Install reverse ring gear rear thrust washer in transmission case, Fig. 105.
2. Compress ends of reverse band with Band Installing Clip J-2595 and install in case, Fig. 105. Remove clip.
3. Rotate reverse band approximately 45 degrees toward servo opening, insert anchor through opening and engage with hooked end of band, Fig. 106. Then rotate band back to normal position.
4. Hold band operating lever (with offset end) in place with strut shoulder toward inside of case and insert anchor shaft through case, anchor and lever, Fig. 107. Tapped end of shaft must be outward. If adjustment screw is not centered in servo opening, low band operating lever has been installed by mistake.
5. Install planet carrier front (steel) thrust washer on carrier with three tangs engaged in holes in carrier.
6. Install planet carrier rear (bronze) thrust washer in case with three tangs engaged in holes in case. Then install assembled planetary gear set in case. If gear set is properly installed and thrust washers are in place, chamfer on output shaft journal will be flush with rear end of transmission case bushing.

INSTALL REAR OIL PUMP & PRESSURE REGULATOR VALVE—

1. Place rear oil pump gasket against transmission case, install plate and line up bolt holes. Do not use pump cover gasket, which has a smaller center hole, Fig. 108.
2. Install oil pump drive key cushion, Fig. 109, and drive key in output shaft. Then install driving gear to engage key. Install old gear in same position as before removal; install a new gear either way.
3. Lubricate both pump gears and pump body. Then install driven gear and body over driving gear (first series 70 jobs, body had separate cover and gasket).
4. Install pump bolts with lockwashers, torque tighten evenly to 5 lbs. ft. and in sequence shown in Fig. 110. Then tighten in same sequence to 25-30 lbs. ft. **Caution:** If pump body and cover are separate, be certain that cover is

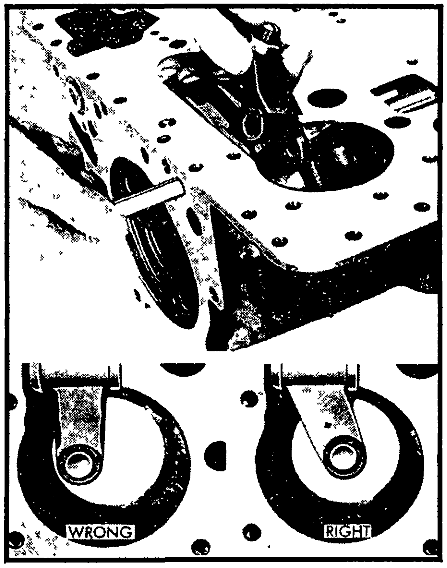


Fig. 107 Installing operating lever and shaft

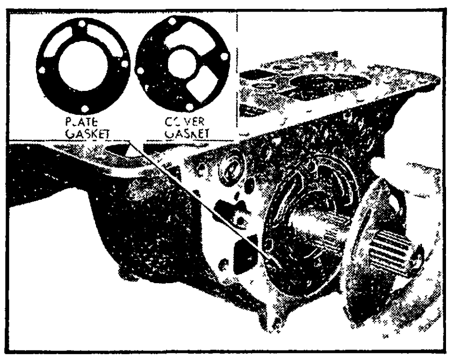


Fig. 108 Installing rear oil pump plate and gasket

centered on body, otherwise rear bearing retainer cannot be installed.

5. Turn output shaft to make sure pump operates freely.
6. Install lubrication oil pressure regulator valve spring, valve and valve seat in transmission case. Tighten valve seat with a suitable drag link socket.

INSTALL PARKING LOCK RATCHET WHEEL & REAR BEARING RETAINER—

1. Install a retaining ring in forward groove in output shaft and install ratchet wheel. Then install retaining ring in rearward groove in output shaft, Fig. 111.
2. Insert valve operating rod through square hole in front face of rear bearing retainer and connect clevis to cross shaft lever with snap fastener or clevis pin, Fig. 112. Socket on forward end of operating rod must face bottom of bearing retainer.
3. Install rear bearing retainer and gasket on transmission case, Fig. 113. Use lockwashers on attaching bolts and torque tighten to 35-40 lbs. ft.
4. Install universal joint retaining ring in groove in output shaft.

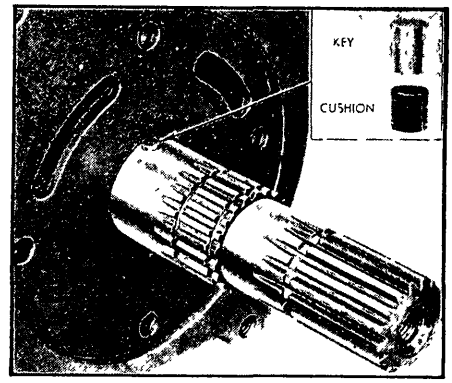


Fig. 109 Oil pump driving g ar and key install d

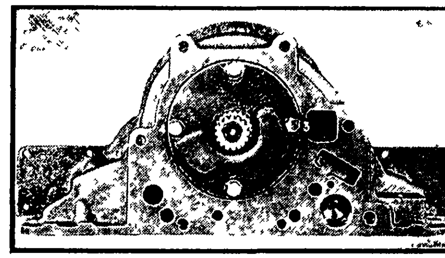


Fig. 110 Rear il pump bolt tightening sequ nce

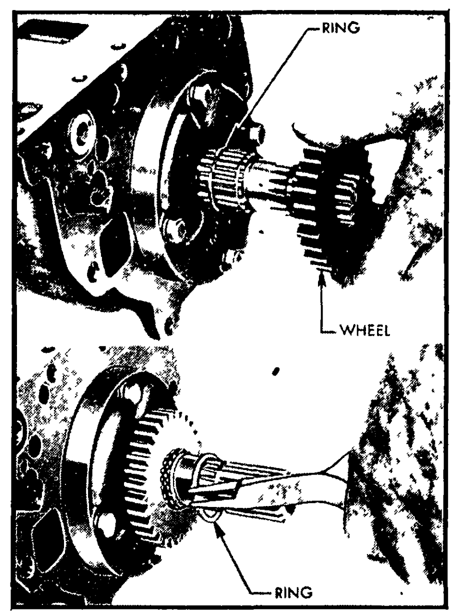


Fig. 111 Installing parking lock ratchet wheel

INSTALL LOW BAND, CLUTCH & INPUT SHAFT—

1. Install low band operating lever (with adjusting screw) and shaft on side of case having large servo opening, and install low band anchor lever and shaft on opposite side. Strut shoulders of levers must be toward inside of case and tapped ends of shafts must be outward.
2. With assembly standing on end of rear bearing retainer, install two wooden

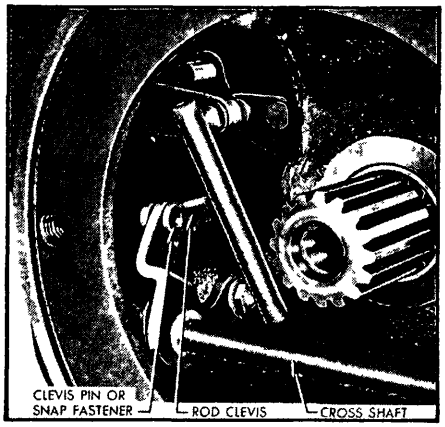


Fig. 112 Valve operating rod clevis c nn cted to cross shaft lever

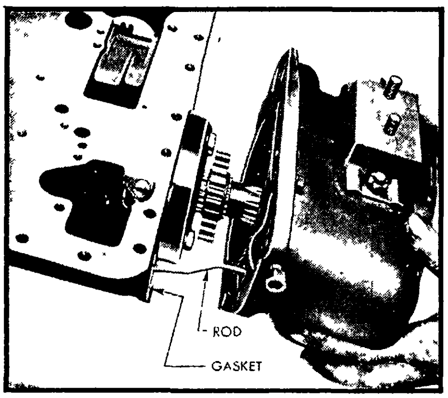


Fig. 113 Installing rear bearing retainer

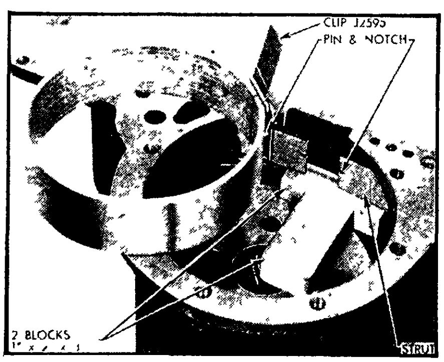


Fig. 114 Installation of l w band and struts

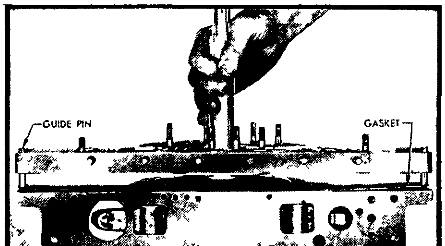


Fig. 115 Installing reacti n shaft flang and gasket

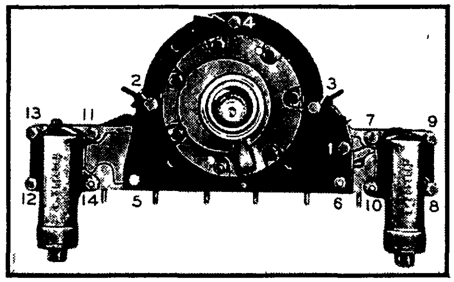


Fig. 116 Reaction shaft flange and accumulator bolt tightening sequence

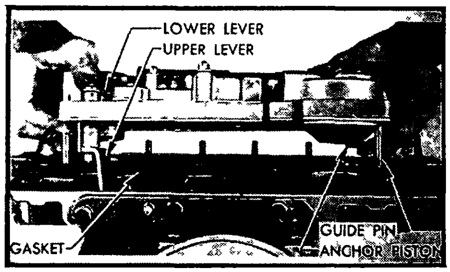


Fig. 117 Installing valve and servo body assembly

blocks as shown in Fig. 114. Set low band struts in position, with notched ends together and other ends engaged in strut shoulders of levers. Spread struts as far apart as possible.

3. Compress ends of low band with Band Installing Clip J-2595, Fig. 114. A used band must be reinstalled in original position (heaviest wear will be on anchor end); a new band can be installed either way.

4. Install band in case with ends between struts and rest band on wooden blocks. Apply operating lever and remove installing clip and blocks. **Caution:** Make certain that notches on struts straddle pins in ends of bands.

5. Place bronze reaction gear thrust washer centrally over sun gear.

6. Install clutch assembly. If drum binds against low band so that clutch does not go all the way down, use a hooked wire to lift band on side opposite struts.

7. Place bronze thrust washer on front face of clutch hub. Then use a flashlight to make sure that all four thrust washers are centrally located so that input shaft can be inserted.

8. Make sure that ends of input shaft oil seal ring are properly locked, and retaining ring is in its groove. Then install input shaft until retaining ring rests on clutch hub. It may be necessary to wiggle the shaft to get it through all four thrust washers.

INSTALL REACTION FLANGE, FRONT OIL PUMP & ACCUMULATORS—

1. Install a $\frac{5}{16}''$ guide pin in accumulator bolt hole at each end of flange on transmission case, Fig. 115.

2. Place reaction shaft flange gasket in position on case so that all holes in gasket and case are aligned.

3. Make certain that ends of oil seal rings on flange hub are properly locked. Then install flange on case, using care to avoid damaging oil seal rings, Fig. 115.

4. Install low accumulator and gasket on same side as low band operating lever and adjustment screw. Install high accumulator and gasket on opposite side of flange. Make sure holes in gaskets match holes in flange. Coat accumulator bolt threads with No. 3 Permatex (non-hardening) and install bolts and nuts with lockwashers but do not tighten. Remove guide pins.

5. Install three special bolts ($\frac{3}{8}''$ x 2") with *plain* washers in positions marked 2, 3, 4 in Fig. 116. These bolts are for assembly purposes only. Install regular pump cover bolts, nuts and lockwashers at positions marked 1, 5, 6. Coat threads of No. 5 bolt with Permatex No. 3.

6. Tighten all bolts and nuts (1 through 14) to 5 lbs. ft. torque in the numerical sequence shown in Fig. 116. Following the same sequence, torque tighten bolts 1 through 4 to 35-40 lbs. ft. and remaining bolts and nuts to 20-25 lbs. ft.

7. Remove three special bolts and tighten accumulator body caps to 40-50 lbs. ft. torque.

8. If edge of flange gasket projects beyond bottom surface of transmission case, use a sharp knife to trim it flush.

INSTALL VALVE & SERVO BODY—

1. With transmission laying bottom side up, raise reverse band operating lever and insert strut between shoulders on lever and end of band (rounded ends must be against lever and band). **Caution:** Do not lift lever during following steps because strut will fall into transmission case.

2. Install two $\frac{5}{16}''$ guide pins in transmission case to guide each end of servo body, and install servo body spacer plate gasket over guide pins.

3. Push shift control valve and lower operating lever inward to align upper lever with opening in case. Hold anchor piston in place with finger and install valve and servo body on transmission case, Fig. 117.

4. Engage pin in control valve with slot in operating lever. Install various length bolts with lockwashers according to depth of holes through bodies. *On third type valve use copper washer on center bolt adjacent to suction pipe opening.* Install operating lever stop only if oil screen is first type; stop not required with second type screen. Remove guide pins.

5. If oil screen is second type, install cork gasket, suction pipe, retaining spring, and spring support which is attached by a valve body bolt and stud nut.

6. Tighten all bolts to 5 lbs. ft. torque in numerical sequence shown in Fig. 118. Note that two different sequences are given; use the one which applies to the unit being serviced.

7. Repeating same sequence as above, tighten all $\frac{1}{4}''$ bolts and nuts to 11-15 lbs. ft. torque and all $\frac{5}{16}''$ bolts to 15-20 lbs. ft. While tightening bolts and nuts adjacent to shift control valve, operate valve to make certain that it is not binding; it may be necessary to adjust some bolts to the low torque limit to prevent valve binding.

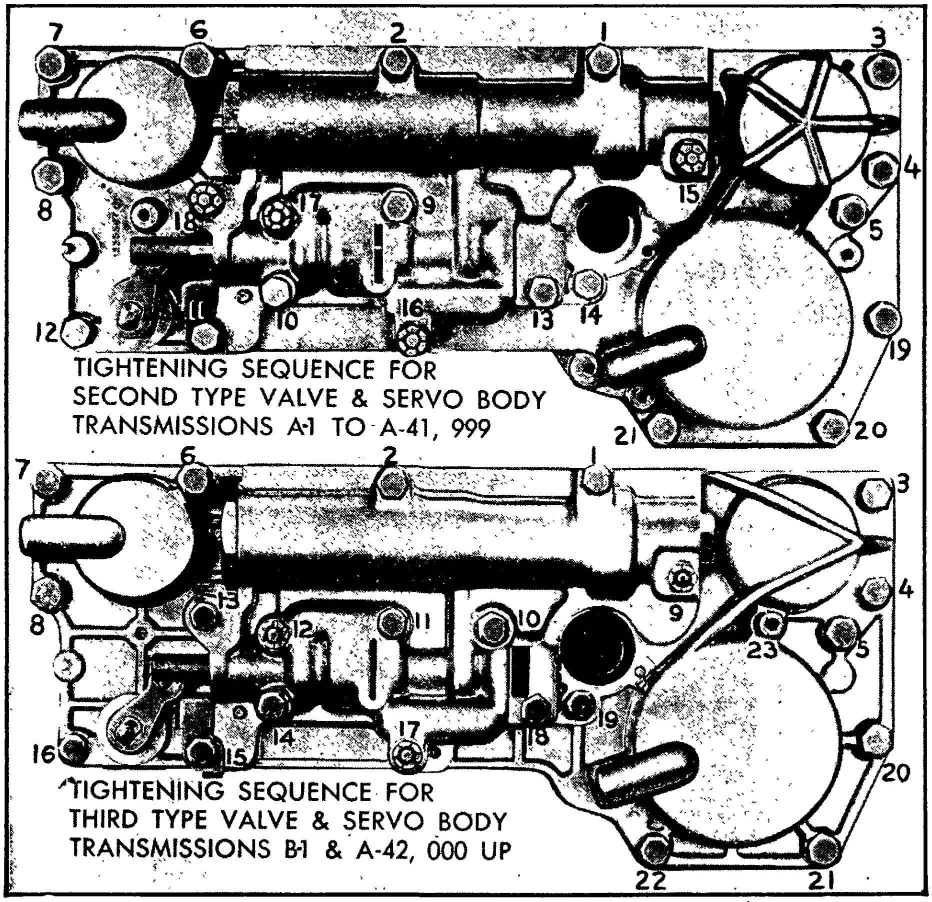


Fig. 118 Valve and servo body bolt tightening sequence

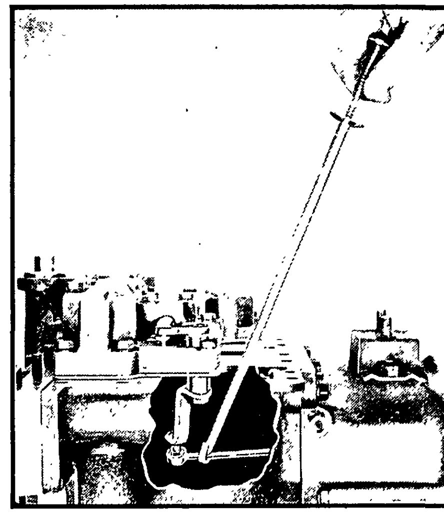


Fig. 119 Connecting valve perating rod to upper l ver

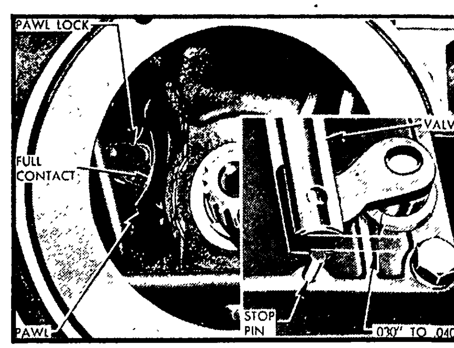


Fig. 120 Control valve linkage adjustm nt

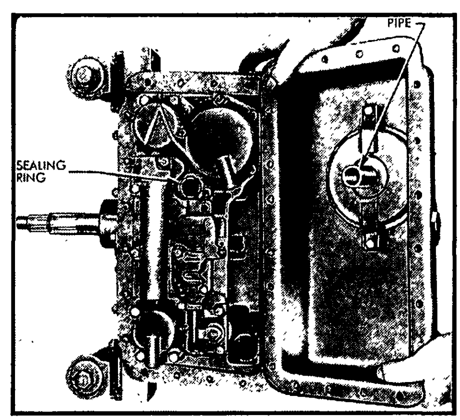


Fig. 121 Checking contact f first type oil screen suction pipe with s al

8. Using Linkage Hook-Up Finger J-2591, Fig. 119, position socket of valve operating rod under ball of valve upper operating lever and pull upward until ball snaps into socket.

9. Temporarily install shift lever on cross shaft and operate valve linkage to make sure it works freely. Move lever toward front of transmission to engage parking lock pawl in ratchet wheel. When pawl is fully engaged in wheel, pawl lock must be in full contact with pawl, Fig. 120.

10. Push shift control valve away from stop pin, *just enough to remove play from valve linkage.* Then check clearance between stop pin and end of valve, using feeler gauge. Clearance should be .030" to .040", Fig. 120. When clearance is correct, spring travel at end of shift lever will be 1/8" to 3/16" (see Fig. 41).

11. If clearance is not correct, adjust by turning clevis on valve operating rod.

12. Tighten jam nut against clevis when adjustment is completed. If clevis pin is used instead of snap fastener, be sure to install cotter pin. Remove shift lever from cross shaft.

INSTALL OIL PAN—Steps 1 through 5 are not required if oil screen is second type.

1. Install new oil screen sealing ring in recess in servo body.

2. Coat edge of oil screen suction pipe with red lead or other suitable pigment, Fig. 121.

3. Install two 5/16" guide pins in transmission case to guide oil pan.

4. Install new gasket and oil pan. Install two bolts and two stud nuts and tighten firmly.

5. Remove oil pan and check impression made by red lead on oil screen sealing ring, Fig. 121. If impression does not indicate 100 per cent contact, adjust screen mounting brackets as necessary to give required contact. This must not change the 17/32" dimension shown in Fig. 86.

6. Spread a thin coat of Permatex No. 3 on transmission case only in the area where case is cut away under oil pan gasket. This is adjacent to valve operating lever. Make sure new gasket is properly placed.

7. Install oil screen if second type. Install oil pan with bolts and stud nuts provided with heavy duty internal tooth lockwashers. Evenly tighten all bolts and nuts to 15-18 lbs. ft. torque.

INSTALL UNIVERSAL JOINT—

1. Engage parking lock pawl in ratchet wheel.

2. Make sure universal joint retaining ring is fully seated in groove in output shaft, then install universal joint. If installation cannot be made by hand, use Replacer J-865 for Series 40, 50, or J-855 for Series 70 to draw universal joint against retaining ring.

3. Install universal joint plain washer, lockwasher and bolt, using a 3/4" socket and tighten bolt to 30-35 lbs. ft. torque. **Caution:** Make certain that oil passage hole in bolt is clear.

4. Install speedometer driven gear and sleeve.

INSTALL TORQUE BALL—Correct adjustment of torque ball is very important. If torque ball is loose and has end play, it will be noisy and will act as a

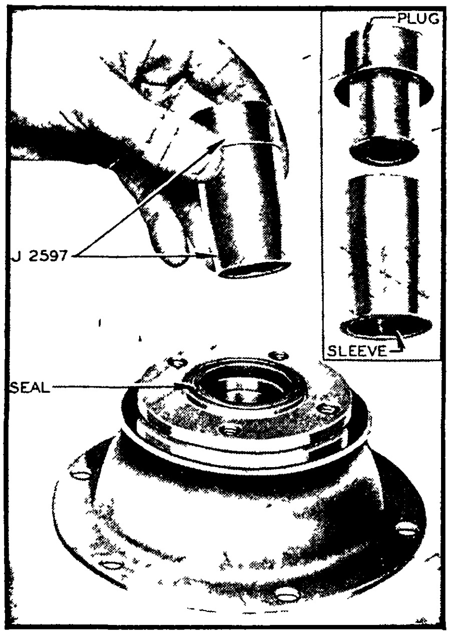


Fig. 122 Torque ball installing tool J-2597

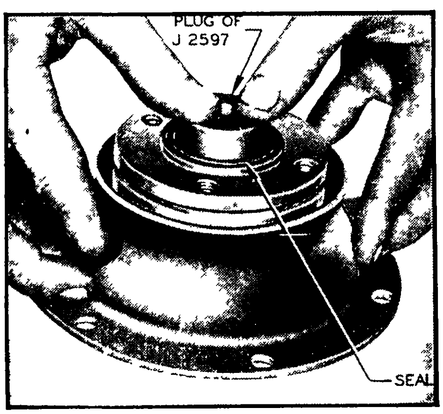


Fig. 123 Pushing installing tool into universal joint oil seal

pump to cause leakage of transmission lubricant. If torque ball is too tight, it will cause scoring of ball and retainers, and may cause breakage of bolts which attach torque ball to torque tube.

1. Install ⅜" headless guide pins in upper bolt holes in rear bearing retainer flange (see Fig. 124). Place one gasket or shim (having three notches in outer edge) and inner retainer on guide pins, with oil drain hole and notch in edge of retainer toward bottom of transmission.

2. Lubricate leather oil seal and bearing surfaces of torque ball and retainers with 10-W oil. Place torque ball in outer retainer so that "TOP" mark on ball and flat top edge of retainer are together.

3. Assemble sleeve and plug of Installing Tool J-2597 together, Fig. 122. Then push tool through *rear* side of oil seal until leather edge is on plug, at which time the sleeve will drop off plug, Fig. 123.

4. Install torque ball and outer retainer

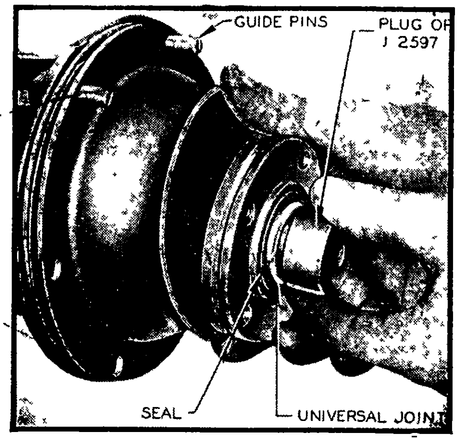


Fig. 124 Installing torque ball and retainer

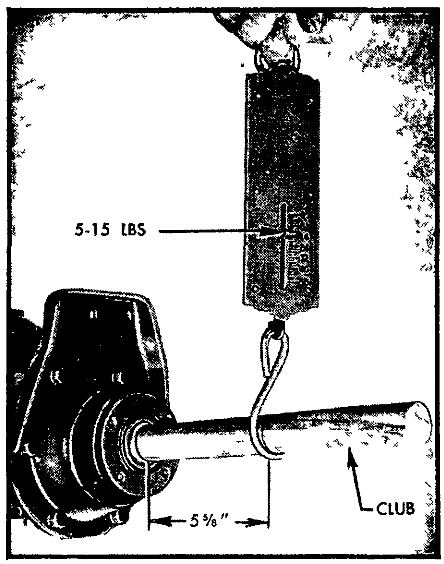


Fig. 125 Checking torque ball drag

with "TOP" sides toward top of transmission, using shims of sufficient thickness to fill space between flanges of inner and outer retainers Hold plug of installing tool firmly against end of universal joint until oil seal has moved forward upon universal joint, then remove plug, Fig. 124.

5. Install thrust plate and all attaching bolts, removing guide pins and placing short bolts in these holes; *do not tighten bolts*. Thrust plate must be installed to prevent creeping or distortion of outer retainer.

6. Insert hardwood club, Fig. 125, in universal joint and, while moving torque ball up, down and sideways, tighteen retainer bolts evenly to 35-40 lbs. ft. torque. **Caution:** It is absolutely necessary to continually move torque ball while tightening bolts in order to properly center the ball and retainers. If torque ball binds as bolts are tightened, tap outer retainer lightly at several points, using a soft mallet.

7. Attach spring scale to club at groove and test pull required to move torque ball when all bolts are tight, Fig. 125.

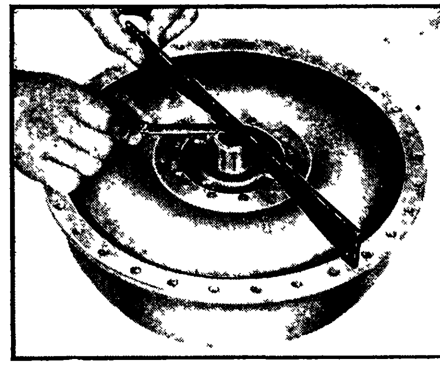


Fig. 126 Checking primary pump c ver with clearance gauge

If torque ball is too tight or too loose, loosen bolts and repeat centering and tightening operation. Then recheck drag with club and spring scale.

8. If torque ball is too tight after repeating the centering and tightening operation, remove the outer retainer and increase total thickness of shims; if ball is too loose, decrease total thickness of shims. Shims are furnished in four thicknesses and are notched on outer edge for identification as follows:

Thickness	*Notches*
.000 - .006"	3
.009 - .011"	2
.011 - .013"	1
.013 - .015"	None

9. Always use Installing Tool J-2597 when installing torque ball to avoid damage to oil seal, Fig. 124.

10. Install torque ball boot. Turn large end back over small end, engage rib in small end in groove on flange of torque ball, then turn large end forward to engage rear end of outer retainer.

INSTALL BELL HOUSING & CONVERTER—

1. Install front oil pump seal ring around pump body against pump cover.

2. Install bell housing, using lockwashers on bolts and studs. Sparingly coat threads of lower right side bolt with Permatex No. 3 because the bolt hole opens into transmission case. Torque tighten bolts and stud nut to 35-40 lbs. ft.

3. Support primary pump cover on suitable blocks. Install bearing plug of Converter Clearance Gauge J-3045 for Series 40, 50, or J-2596 for Series 70 in ball bearing in pump cover. Place gauge bar across cover with ends resting on flat surface between bolts holes, Fig. 126.

4. Check clearance between gauge plug and bar. Turn gauge 90 degrees, take a second measurement and record the average of both measurements for later use in Step 9.

5. Place stators and turbine in normal position in primary pump. Place clearance gauge bar on pump flange between bolt holes, Fig. 127. Check clearance between gauge bar and hub of turbine as shown and record this measurement for later use in Step 9.

6. Install primary and secondary pump assembly on reaction shaft, turning primary pump back and forth until lugs on

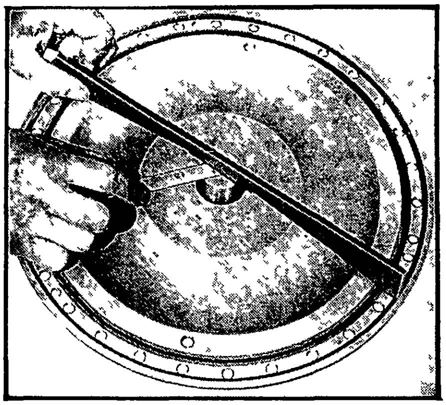


Fig. 127 Checking primary pump and turbin with clearance gauge

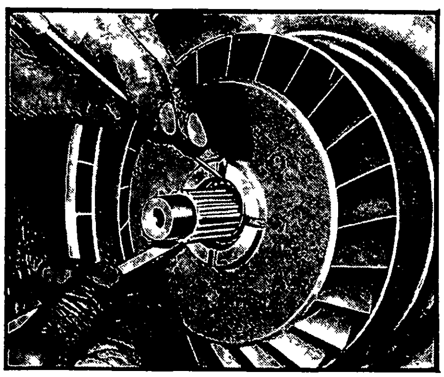


Fig. 128 Installing reaction shaft r taining ring

pump hub enter slots in front oil pump driving gear.

7. Install primary and secondary stators on reaction shaft and install reaction shaft retaining ring in groove of shaft, Fig. 128.

8. Install converter turbine on input shaft.

9. Add together the measurements obtained in Steps 4 and 5; the sum is the total clearance between turbine hub and bearing in pump cover. This clearance must be filled with a sufficient number of .018" shim washers and .060" spacers. Select the required washers and spacers and place them on input shaft.

10. Install primary pump cover with new gasket, placing all bolts with nuts on pump cover side. Install first two bolts directly in line with drain plugs. Going clockwise, omit bolt in every fifth hole to provide for flywheel-to-pump driving bolts. When bolts are of two different lengths, install long bolts through balance weights on primary pump flange.

11. When all primary pump cover bolts are installed, torque tighten them to approximately 5 lbs. ft. in the numerical sequence shown in Fig. 78. When tightening bolts, insert a wide screwdriver between flat side of bolt head and primary pump to prevent a corner of bolt head from digging into pump. Finally torque tighten all bolts in the same numerical sequence to 30-35 lbs. ft.

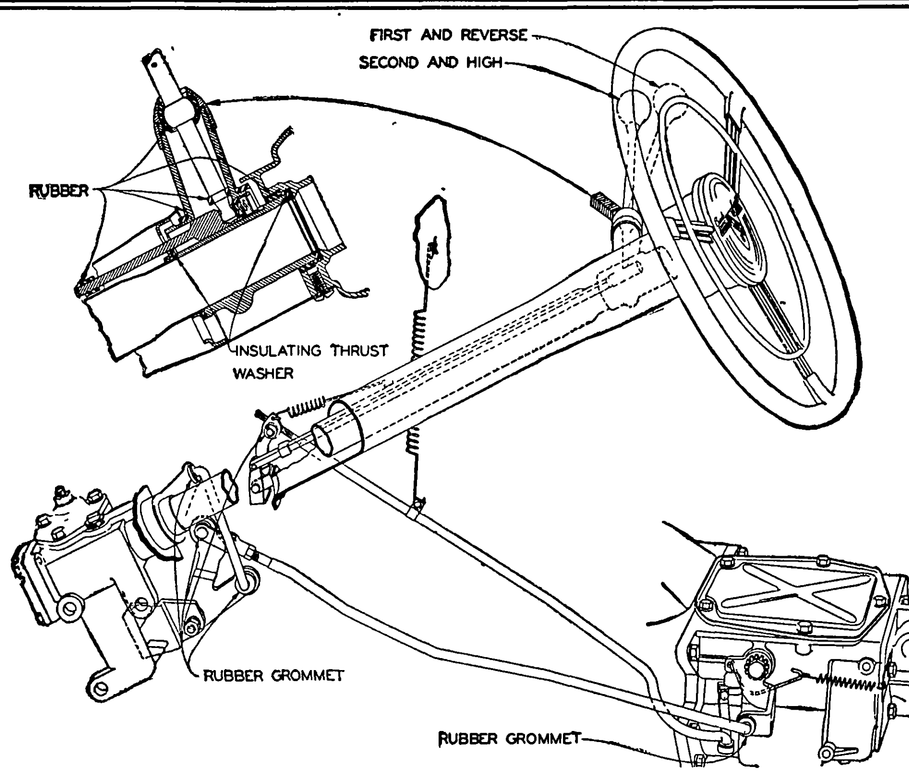


Fig. 130 Gearshift. Typical of all 1941-52 models with syncromesh transmission

12. Turn transmission over to rest on oil pan.

13. Install converter drain plugs and oil gauge rod (first type).

14. Adjust low and reverse bands as described elsewhere in this text.

15. Install transmission shift lever on cross shaft. Hold lever forward while tightening nut to avoid straining internal linkage.

16. If transmission was removed from car with oil cooler in place, reinstall cooler and pipes.

GEARSHIFT

GEARSHIFT ADJUSTMENTS

1939—1. Shift hand lever into second.

2. Loosen control shaft lever clamp bolt.

3. Loosen set screw which locks wire in selector lever trunnion.

4. Move hand lever down and forward in second gear position until 1/16" space remains between shift lever and mast jacket. (Use 1/16" scale as spacer.)

5. Set selector shaft lever in second gear position and shift it forward until detents can be felt.

6. While holding hand lever against 1/16" spacer, lock control shaft clamp bolt.

7. Leave control lever in second and push selector lever as far as possible in transmission; also push inward on selector cable wire where it extends through trunnion to center wire in cable.

8. Lock set screw in selector cable trunnion.

1940 Adjustments—See Fig. 129 for this procedure.

1941-52—Fig. 130. Two adjustments are provided: selector control lever, and the shifter rod at the idler lever. To adjust the selector control lever, place gears in neutral. Then move the selector (short) rod to the rear as far as possible and adjust the trunnion to fit into the bushing in the selector control lever.

To adjust the shifter (long) rod at the idler lever, set the gears in second speed. Then adjust the clevis at the shifter rod on the idler lever so that the control lever housing clears the opening in the mast jacket by 1/8".

REAR AXLE

REAR AXLE REMOVAL

1935-37—1. Disconnect rear shock absorber links from frame or axle.

2. Hoist rear of car.

3. Remove spring seat U bolts.

4. Disconnect brake rods (1935).

5. Unfasten brake tube from fitting.

6. Disconnect parking brake cables.

7. Separate torque ball from torque tube.

8. Unfasten springs at rear end shackles and lower to floor. (If rear wheels are removed or if rear axle is not to be moved away from car, the shackles need not be disconnected; if so, roll the axle from under the chassis.)

1938-52—Even though the torque tube is bolted to the differential carrier on 1940-52 series 40, 50, 60, 70, do not separate these parts in an attempt to short-cut service work on the differential.

1. Disconnect shock absorbers at lower end.

2. Hoist rear of car.

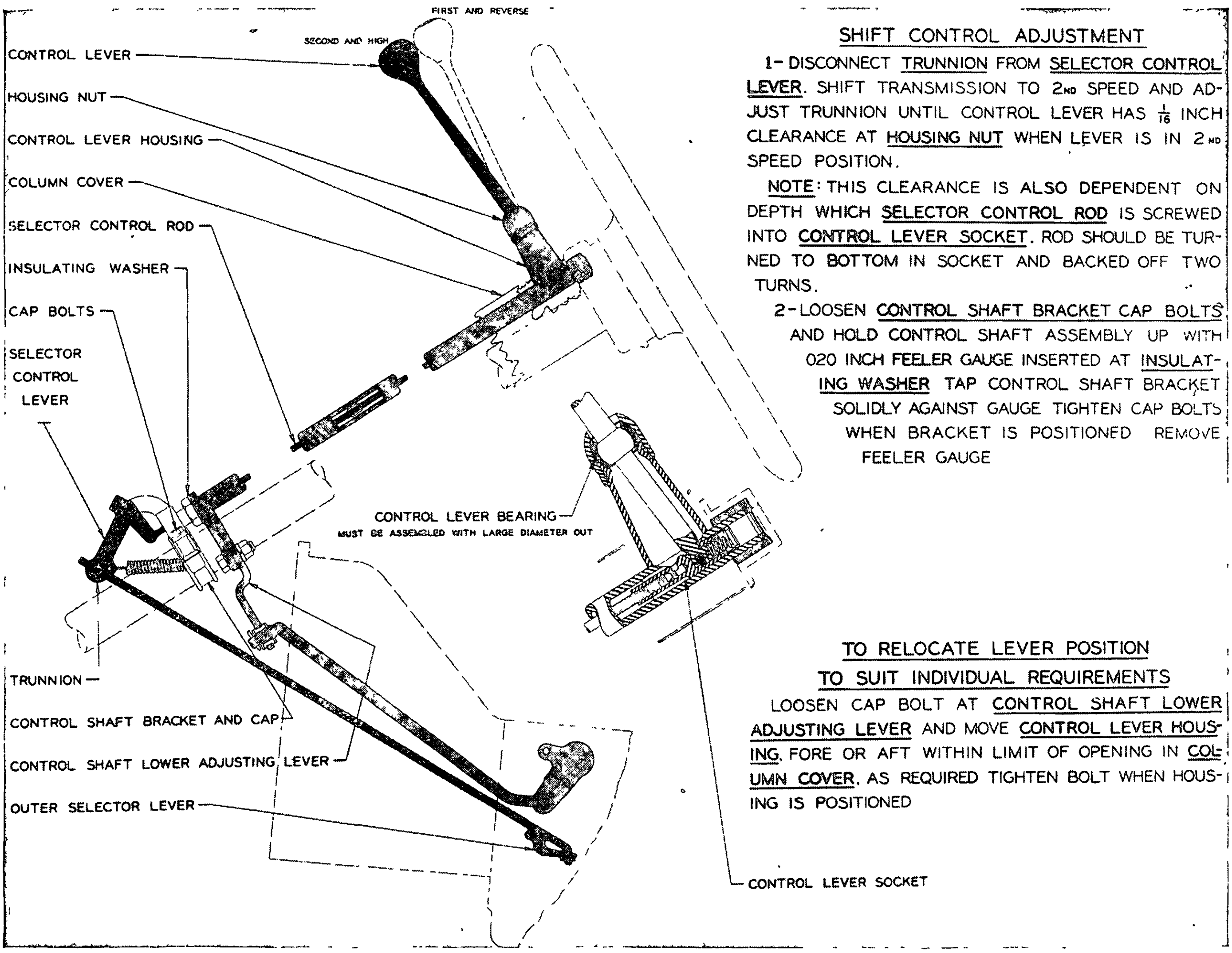


Fig. 129 1940 gearshift adjustments

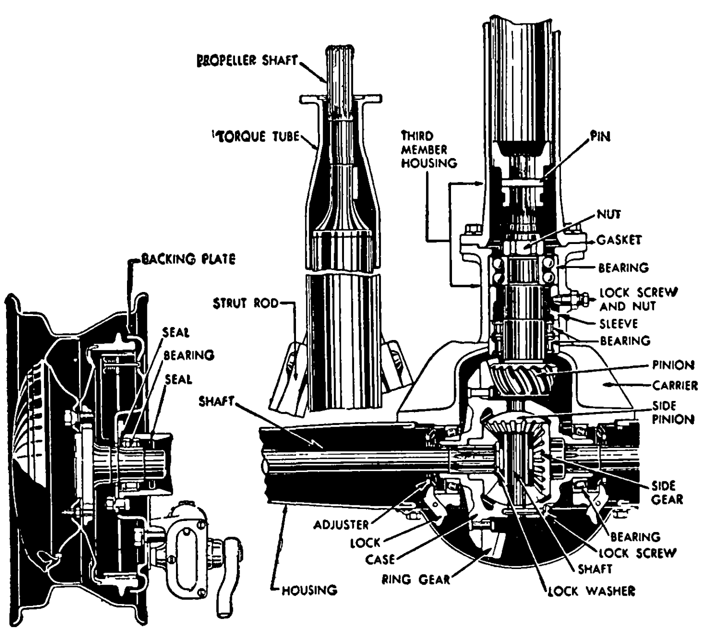


Fig. 131 Rear axle, 1948-52

3. Disconnect parking brake at equalizer.
4. Unfasten brake tube from fitting.
5. Unbolt rear radius rod at frame.
6. Disconnect rear springs at lower end and tie them to rear bumper to prevent damaging brake lines. (The retaining screw at the lower end of each spring has a left-hand thread.)
7. Separate torque ball from torque tube. (On 1939 series 40 and 60, Fig. 133, disconnect the torque ball mounting from each side of the frame X member. Do not loosen the torque ball mounting lock nut, nor allow the mountings to be exchanged from side to side, otherwise it will be necessary to realign the engine with the rear axle.)
8. Raise the car high enough to clear the axle housing and roll assembly back.

REAR AXLE, OVERHAUL

1935-52—Figs. 131 and 132 are sectional views of the two types of axles used. The chief difference between them is that in Fig. 132, the torque tube is pressed into and riveted to the differential carrier, while in Fig. 131, the torque tube is bolted to the carrier.

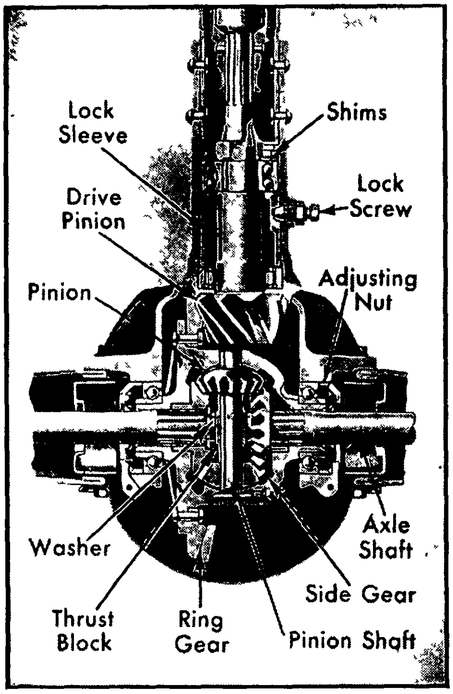


Fig. 132 Rear axle. 1936-39 all models; als 1940-42 Series 90

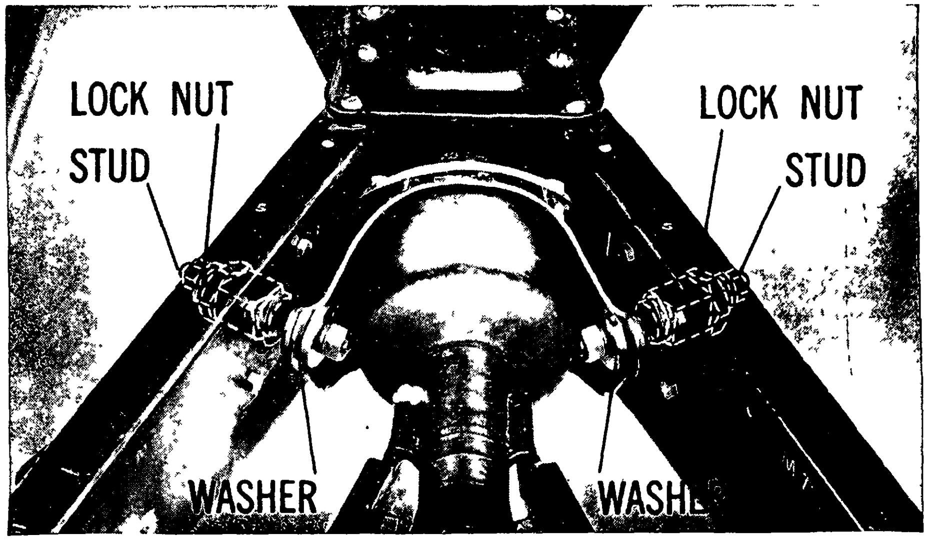


Fig. 133 Torque ball mounting. 1939 Series 40, 50

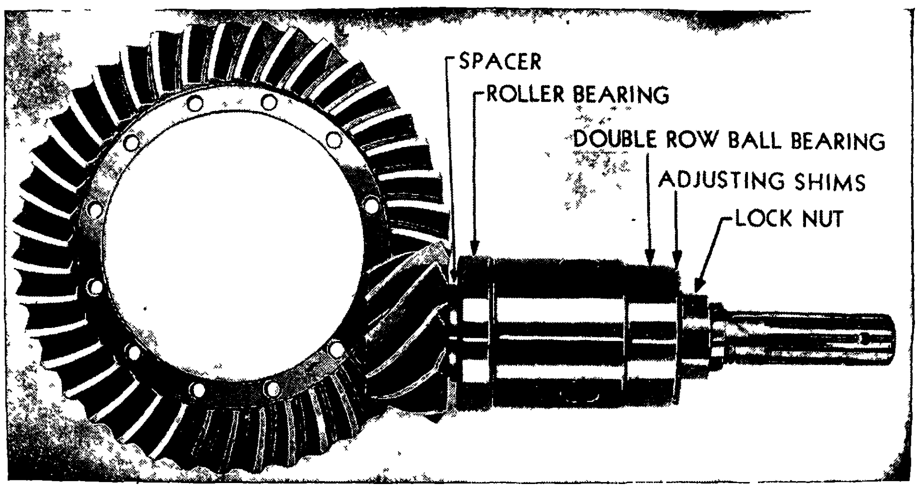


Fig. 134 Ring gear and pinion set-up, 1936-52 models. Some models have two roller bearings at rear of pinion shaft

In connection with the latter, disassembly at this point should never be made unless an oil leak develops, in which case, only the gasket designed for this joint should be used. Moreover, neither the torque tube nor carrier can be obtained separately as they are matched and aligned during production, and should always be kept as originally assembled.

In both types, the drive pinion is splined and pressed in the propeller shaft, and end movement is prevented by a pin riveted through the shaft coupling and propeller shaft. The pinion is adjusted by shims, Fig. 134, between the outer race of the double-row ball bearing and the counterbore in the propeller shaft housing. This bearing is built with no looseness or end play, nor is it adjustable for end play. If there is any looseness between the race and cone, it is probably caused by abrasive matter in the lubricant.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, riveting on the ring gear, checking ring gear and pinion backlash and other differential case operations, is given in the *Rear Axle Service* chapter. Service specifications are given in the chart.

To replace the pinion and bearings, take out the rear axle assembly as already described, unbolt the differential carrier from the axle housing, remove the axle shafts and, after removing the differential bearing caps and adjusting nuts, lift the differential from the carrier.

PINION & BEARINGS—After removing the axle shafts (described further on) and differential, remove the three tapered bearing retainer screws from the side of the carrier. Jar the carrier so that the splined end of the propeller shaft will strike on a wooden block or floor and the pinion shaft will slide out. Remove the bearing adjusting shims from the inside of the torque tube, noting their number and total thickness.

To disassemble the drive pinion from the propeller shaft, file off one head of the straight pin which fastens these parts together, and drive out the pin. Pull the pinion shaft from the propeller shaft with a suitable puller. Pounding or driving on the head of the pinion in an attempt to separate these parts will bend the propeller shaft.

To disassemble the pinion, Fig. 134, pry up the staked section of the pinion bearing lock nut and unscrew the nut, gripping the pinion on its splines. Press the double-row ball bearing from the pinion shaft by using blocks under the outer race, then remove the spacer and single-row bearing. Thoroughly wash the bearings in unused cleaning solvent. Apply a small quantity of engine oil and check for smoothness, looseness and other defects.

To assemble, install the spacer, single-row bearing and lock sleeve. Then press on the double-row bearing, using a piece of tubing of the proper size to bear directly on the inner race. Draw up the pinion bearing lock nut tightly and stake it into the notch of the pinion shaft. Assemble the pinion shaft to the propeller shaft, then rivet these parts together with a new pin.

Every time the pinion and propeller shafts are pressed together, the assembly must be straightened to correct a tendency to "whip". Checking with a dial indicator, Fig. 135, run-out should not exceed .015". To straighten the shaft, rotate the pinion to the high spot and force the end of the shaft down by hand to spring it into proper alignment.

PINION & PROPELLER SHAFT, ASSEMBLE—Install the same thickness of shims in the counterbore of the torque tube that were removed when the assembly was dismantled. Make sure the shims are flat in the counterbore and not cocked. Shims are available in several thicknesses so that a suitable combination may be selected to replace the

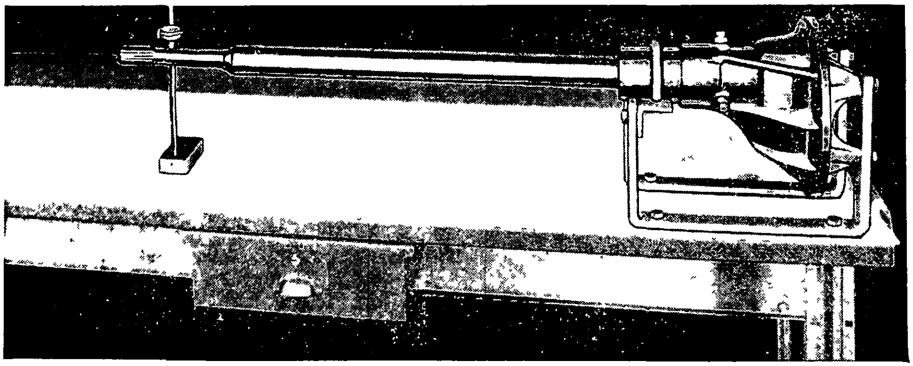


Fig. 135 Checking propeller shaft run-out. 1935-52

original ones if they are damaged, or if another combination is needed to secure proper location of the pinion if a new gear set is installed.

Lubricate the bearings thoroughly and coat the bearing surface of the lock sleeve with rear axle lubricant. Install the propeller shaft, driving it down until the bearings are seated in the housing. Tap the outer race of the single-row bearing until it seats against the shoulder of the carrier on cars with Fig. 132, and against the collar which locks against the double-row bearing in Fig. 131. This is important, otherwise the bearing rollers will bind the spacer between the single-row bearing and the pinion teeth.

SERVICE NOTE—Due to the diameter of some of the pinions used with Fig. 131, it is difficult to seat the single-row bearing outer race properly in the torque tube housing because the outside diameter of the pinion is larger than the outside diameter of the bearing. It is necessary, therefore, to insert a special tool, Fig. 136, between the pinion and bearing. With the tool in place, it is permissible to drive on the end of the pinion, using a bronze driving block to seat the rear bearing properly in the carrier after the tool is removed.

Continue with the work by checking through the bearing lock screw holes in the side of the carrier to make sure the lock sleeve is in the correct position up against the back of the double-row bearing. Install the three tapered lock screws and draw them down evenly and tightly. Then tighten the lock nuts.

If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Service* chapter.

If a correction is necessary, disassemble the parts and, if the pinion is to be moved toward the center of the axle add shims. If it is to be moved away from the center of the axle remove shims.

If no pinion setting gauge is available, assemble the differential unit and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Service* chapter.

When the adjustment is correct, set it securely with the lock screws and lock nuts as stated above.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-37 Series, 40, 37-60, All 1938-52—To remove the axle shaft, raise the car and take off the wheel. Disconnect the brake drum from the axle shaft flange. Drain the lubricant and remove the differential cover. Unscrew the differential pinion shaft screw and pull out the *pinion shaft and spacer block*. Rotate the ring gear and pick out the pinions. Remove the "C" washer from the recess in the end of the axle shaft and use a suitable puller to remove the axle shaft from the housing.

BEARING & OIL SEAL—Insert a bearing puller into the housing and pull the bearing and oil seal out as an assembly.

ADJUSTMENT—Replace the axle shaft in the reverse order and check the end play. If the total side clearance of the spacer block exceeds .008", install an oversize block. If the new block does not take up the excess clearance, new thrust washers should be installed behind the differential side gears.

NOTE—If both shafts have been removed and one is longer than the other, install the longer one on the right side.

1935 Series 50—To remove the shaft, raise the car and take off the wheel. Use a puller to remove the hub and brake drum. Unscrew the stud nuts which fasten the oil seal and brake support to the housing and remove these parts. Use a puller to remove the axle shaft and bearing.

1936 Series 60, 80, 90; 1937 Series 80, 90—The procedure for removing the axle shaft on these models is the same as described for the models included in the first paragraph under this heading except that the shaft is retained by a nut and cotter pin at its inner end. However, the spacer blocks furnished for service are either standard size or .020" oversize. If necessary, the block can be sanded down to fit.

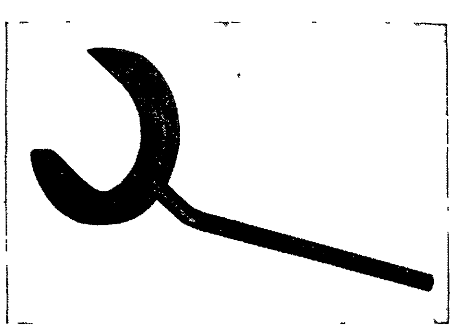


Fig. 136 Special t l f r use between pinion and bearing to assist in seating singl row bearing n 1935-48 axles

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1935 Series 50, 60, 90—To adjust caster, jack up front wheels so tires clear the floor. Loosen nuts holding control arms to upper and lower knuckle support yokes one turn. Tap yokes so they may rotate in control arms without binding in yoke bushings. Loosen clamp bolt on top of knuckle support and turn upper support bolt. Looking at the head of the bolt from the rear, turn it clockwise to increase caster, and vice versa. A ¾ turn of the bolt changes caster ¼ degree.

To change camber angle, place washers between kingpin support yokes and control arms. Each $\frac{1}{16}$ inch washer changes camber about ⅛ degree.

35-40; All 1936; 1937-40 Series 80, 90—Fig. 137. To adjust caster, jack up front wheels. Loosen nuts on anchor adjuster bolts one turn. Loosen lock nuts on front and rear bolts at the caster adjuster bolt. Measure caster at bosses on steering knuckle flanges. To increase caster angle, turn rear adjuster screw *counterclockwise,* looking at the screw head, and the front adjuster screw *clockwise,* looking at the screw head. To reduce caster, turn screws in opposite direction. Turning screws ¼ turn changes caster ¼ degree. Both adjustment screws must be tight against caster adjuster bolt when adjustment is complete.

Camber is not adjustable.

1937-40 Series 40, 50, 60, 70; All 1941-52—Fig. 138. Standard upper control arm pivot pins on 1937-42 models had a concentric middle section which provided a caster adjustment only. Replacement pins for these models are the same as the pins used as standard on 1946-52 and have an eccentric middle section to provide both caster and camber adjustments.

One quarter turn of the pivot pin changes caster one quarter degree. The eccentric section of the pin allows a camber adjustment of ⅓ degree either way from the neutral position of the eccentric. Turning the pivot pins will change both caster and camber. Therefore both angles must be checked together so that both will come within specified limits.

To adjust, jack up wheels and loosen clamp bolt at top of knuckle support. Remove grease fitting from threaded end of pin and insert wrench in hexagonal hole. Turn the pin in the desired direction to correct caster—which should be equal on both sides within ½ degree. Camber should be equal on both sides within ¾ degree. In some cases, it will be necessary to average the settings in order to bring both within the specified limits.

TOE-IN, ADJUST

All 1935-37; 1938-40 Series 80, 90—Figs. 139 and 140. Loosen bolts at ends of tie

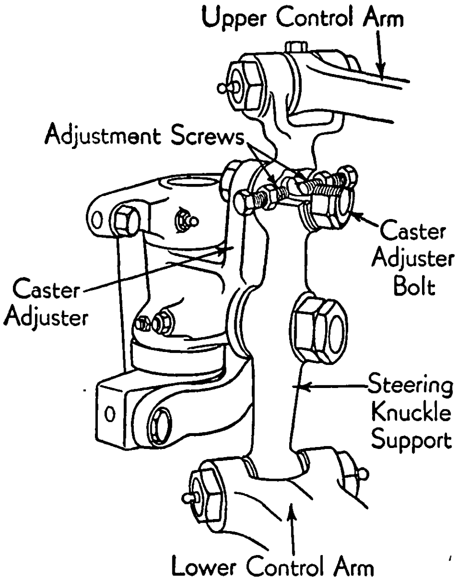


Fig. 137 Caster adjustment 1935 S ri s 40, all 1936, and Seri s 80, 90 1937-40

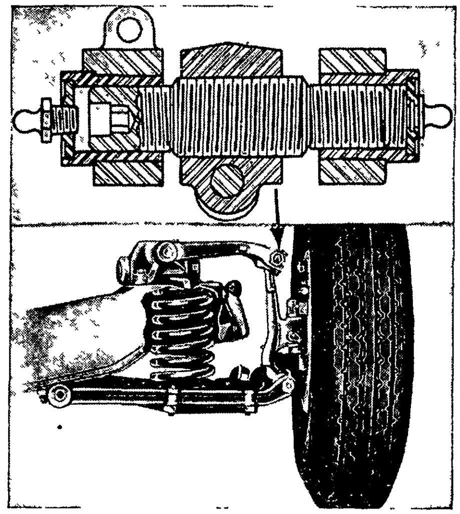


Fig. 138 Caster adjustment, 1937-40 Series 40, 50, 60, 70; all 1941-52

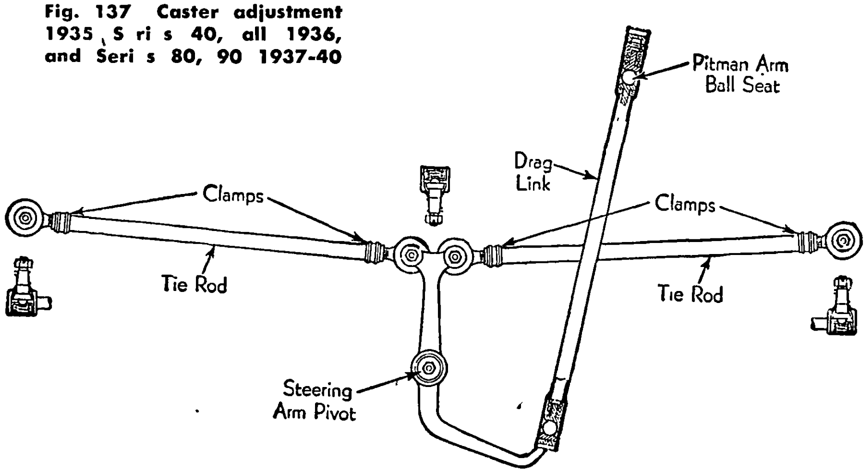


Fig. 139 Steering linkage. All 1936; 1937-40 Series 80, 90

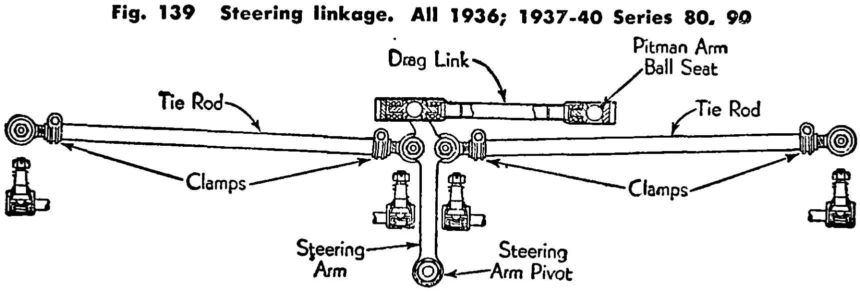


Fig. 140 Steering linkage. 1937 Series 40, 60

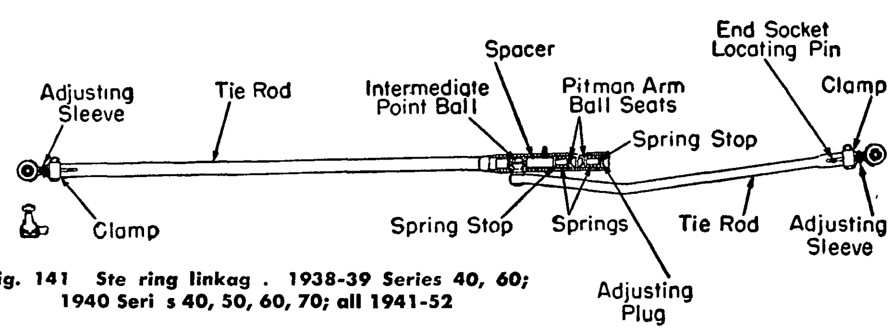


Fig. 141 Ste ring linkag . 1938-39 Series 40, 60; 1940 Seri s 40, 50, 60, 70; all 1941-52

rods and turn both rods equally when making adjustments. With correct toe-in and wheels straight ahead, the intermediate steering arms should also point straight ahead. The distance between the arm and the lower support arm bolts should be the same on both sides. To centralize the intermediate steering arm, shorten one tie rod and lengthen the other. When this is done, check toe-in.

1938-40 Series 40, 50, 60, 70; All 1941-52—Fig. 141. Adjust tie rod sleeves at outer ends. With front wheels in straight ahead position, the lower indented spoke of the steering wheel should be in center position. If not shorten one tie rod and lengthen the other. When this is done, recheck toe-in.

FRONT END SERVICE

1935-1952

Front Wheel Bearings, Adjust—

1. Tighten the spindle nut with a 10-inch wrench until bearings are preloaded at one least hex on the nut. Rotate wheel at least one revolution to make sure bearings are seated.
2. Back off spindle nut until bearings are slightly loose. Then retighten nut until all bearing looseness is just removed and line up the nut to the nearest cotter pin hole and install cotter pin.
3. Before installation of grease cap in hub, make sure that end of spindle and inside of cap are free of grease so that radio static collector makes a good clean contact. Make sure that the static collector (if equipped) is properly shaped to provide good contact between end of spindle and grease cap.

Kingpins and Bushings, Replace—

1. Jack up vehicle and remove front wheel with hub and drum.
2. Remove brake plate and steering arm from steering knuckle. Do not disconnect brake hose but support brake plate out of way to avoid strain on hydraulic brake hose.
3. Drive out kingpin lock pin.
4. Remove upper dust plug from knuckle by piercing it with a sharp punch and prying it out.
5. Drive kingpin down and out, which will drive lower dust plug from knuckle. Remove thrust bearing and shims.
6. Remove grease fittings and press old bushings from knuckle.
7. Press new bushings in place, being sure oil holes in bushings line up with hole for grease fittings.
8. Expand bushings tightly in place with a burnisher. Then line ream them to provide .0005 to .0025 in. clearance on the kingpin. Install grease fittings.
9. Install the steering knuckle by reversing removal procedure. Use shims as required between lower boss of knuckle and thrust bearing to provide .003 in. end play of knuckle support. Use new dust plugs at both ends of kingpin.
10. Lubricate and adjust front wheel bearings and check and adjust wheel alignment.

Upper Control Arm Pivot, Replace—

1. Jack up under lower control arm and remove wheel.

2. Remove clamp bolt and unscrew the pivot pin bushings and remove rubber seals.
3. Loosen clamp bolt in knuckle support and remove pivot pin, using a ¼ in. hex Allen wrench.
4. Hold knuckle support in line with hole through control arm and screw new pivot pin into knuckle support with adjusting wrench hole in pin toward split side of control arm.
5. Turn pivot pin until large diameter section is centralized in knuckle support and tighten clamp bolt. Install rubber seals on both ends of pin.
6. Centralize knuckle support boss in upper control arm yoke and start externally threaded bushing on threads of pivot pin and into threads of control arm.
7. Start the plain (grooved) bushing on threads of pivot pin, then turn opposite bushing up tight. Turn plain bushing up until hex is just clear of control arm, then install and tighten clamp bolts.
8. Install grease fitting in bushing. Install wheel assembly, adjust front wheel bearings and wheel alignment.

Front Spring, Replace—

1. Raise car with jack under lower control arm and take off wheel.
2. Support weight of car with another jack under frame side rail.
3. Disconnect stabilizer link from lower control arm and disconnect outer end of tie rod from steering arm if necessary.
4. Unfasten lower control arm inner shaft from frame crossmember.
5. Slowly lower jack under lower control arm until spring is loose and can be taken out.
6. To install, first make sure the rubberized fabric spring insulator is in place around the frame, and is in good condition.
7. Place small end coil of spring over center cup and, as lower control arm is raised, position lower end of spring so that the end coil seats in the recess provided in the spring seat.
8. Raise lower control arm and fasten its inner shaft to the frame crossmember.

Lower Control Arm Service — If the lower control arm is bent or broken it should be replaced with a new assembly which includes shaft, bushings and dirt seals. The riveted parts of the assembly are not furnished separately.

1. Remove front spring as outlined previously.
2. Remove lower control arm from knuckle support.
3. To install new parts, first install a new rubber seal (if used) over each threaded end of the new control arm shaft, with the large or bell end of the seals outward toward end of shaft.
4. Insert one end of shaft in control arm end and force opposite end of shaft into other side of arm. A two-foot board can be used as a pry.
5. Fasten the control arm securely in a vise close to one end to prevent springing or distortion. Apply a liberal amount of white lead or Lubriplate to both bushings before installing them in the arm.
6. Start the first bushing on the shaft and into the control arm at the same time. Turn the bushing until its head is tight against the arm and tighten to a minimum of 100 lbs. ft. torque.
7. Center the shaft between the arms and install the second bushing as in step 6, turning the shaft as required to thread into the bushing so that no binding exists.
8. Install front spring, and check and adjust wheel alignment.

Front Shock Absorber, Replace—A front shock absorber can be replaced by removing the upper control arm pivot pin as outlined previously, and the shock absorber attaching bolts.

When the shock absorber is installed, wheel alignment must be checked and adjusted.

STEERING GEAR

STEERING WHEEL REMOVAL

1935 Series 40, All 1936—Disconnect the horn wire at the connector at the lower end of the steering gear. Press down on the horn button until it touches the terminal. Then, compress the terminal spring by pressing the horn button ⅛" farther and rotate the button in a counter-clockwise direction for about ⅜" to the stop, then release the pressure on the button. The terminal spring will push the fingers on the lock up through the slots in the retainer, after which, the button, terminal and wire assembly may be pulled out through the wheel hub.

Back off the steering wheel nut until it is flush with the top of the steering tube and use a suitable puller to remove the steering wheel.

1935 Series 50, 60, 90 — The steering wheel is removed in the same manner as for 1936 cars except that the horn button can be rotated ⅛ turn in either direction to release the pressure on the button. The terminal spring will then push the button up through the slots in the cover plate.

1937-52 — Pry the outer edge of the horn button or monogram with a small screwdriver to remove. The horn ring of the flexible spoke wheel (if equipped) can be removed by removing the three screws on the under side of the hub.

Back off the steering wheel nut until the top of the nut is flush with the top of the steering tube. Use a suitable puller and make sure the puller adapter surrounds the fibre washer around the horn wire to avoid damage to the washer.

NOTE—On 1940-51 cars, always have the directional signal switch in the OFF position whenever removing or replacing the steering wheel to prevent hub striking pawl and to avoid switch damage.

STEERING GEAR REMOVAL

1935-42—Remove the horn button, steering wheel, left engine side pan and floor plate. Disconnect the steering column bracket from the cowl, the pitman arm from the gear cross shaft, and the gear from the frame. On cars with steering gearshift, disconnect the shift mechanism from the transmission and from the steering column. If equipped with direction signal, be sure switch is in "Off" position when removing steering wheel.

NOTE—On 1938-40 series 80 and 90, disconnect the cross shaft housing from the worm shaft housing and remove the cross shaft, then take the gear out through the engine compartment.

1946-52—1. Disconnect pitman arm from steering tie rod by unscrewing tie rod plug until bearing will release ball stud.
2. On series 70 only, remove air cleaner. Disconnect fuel and vacuum pipes from carburetor and carefully move them out of the way.
3. Disconnect clutch linkage anti-rattle spring from shift idler lever pin bracket and disconnect the upper shift rod from control shaft lower lever. On synchromesh transmission jobs, disconnect selector rod from selector control lever and unhook the anti-rattle spring.
4. Disconnect wires from horn cable connector, back up light switch, and neutral safety switch (Dynaflow cars only). Pull speedometer cable from clip and then remove horn cable connector from column jacket to avoid damage during removal of gear assembly.
5. Disconnect one end of brace at cutout in cowl and swing brace to one side.
6. Remove front seat all the way back and cover the seat and back cushions.
7. Remove dash insulator retainer and steering column pad. Pull back the floor mat and remove pedal plate attached to toe panel.
8. Remove steering wheel and the upper bearing spring and spring seat. Remove shift control lever and signal switch control lever.
9. Disconnect direction signal switch wires from terminals on fuse block.
10. Remove steering column bracket and any spacers located between bracket and support on instrument panel.
11. Remove steering gear-to-frame bolts and clamps and carefully support the steering column to avoid damaging column jacket. Move gear assembly to the rear as far as possible, turn assembly over so that pitman arm is uppermost. Then lift forward end up between engine and fender and move forward to remove gear from car. It is advisable to have a helper guide the column jacket and signal switch housing through the cut-out in cowl panel to avoid damaging the finish of these parts.

CADILLAC & LA SALLE

INDEX OF SERVICE OPERATIONS

NOTE—See appendix in back of book for data on hydraulic steering and four-barrel carburetors.

CADILLAC & LA SALLE

Year	Model Designation	Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	La Salle 8 35–50	119	In Block	3 x 4 3/8	248.0	6.25	105 @ 3600		30 @ 30
	V8 355D	C	In Block	3 3/8 x 4 15/16	353.0	6.25	120 @ 3000		30 @ 30
	V12 370D	146	In Head	3 1/8 x 4	368.0	6.00	133 @ 3400		30 @ 30
	V16 452D	154	In Head	3 x 4	452.0	6.00	169 @ 3400		30 @ 30
1936	La Salle 8 36–50	120	In Block	3 x 4 3/8	248.0	6.25	105 @ 3600		30 @ 30
	V8 36–60	121	In Block	3 3/8 x 4 1/2	322.0	6.25	125 @ 3400	234 @ 1800	30 @ 30
	V8 36–70	131	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V8 36–75	138	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V12 36–80	131	In Head	3 1/8 x 4	368.0	6.00	150 @ 3600		30 @ 30
	V12 36–85	138	In Head	3 1/8 x 4	368.0	6.00	150 @ 3600		30 @ 30
	V16 36–90	154	In Head	3 x 4	452.0	6.00	169 @ 3400		30 @ 30
1937	La Salle V8 37–50	124	In Block	3 3/8 x 4 1/2	322.0	6.25	125 @ 3400	234 @ 1800	30 @ 30
	V8 37–60	124	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V8 37–65	131	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V8 37–70	131	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V8 37–75	138	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	30 @ 30
	V12 37–85	138	In Head	3 1/8 x 4	368.0	6.00	150 @ 3600		30 @ 30
	V16 37–90	154	In Head	3 x 4	452.0	6.00	185 @ 3800		30 @ 30
1938	La Salle V8 38–50	124	In Block	3 3/8 x 4 1/2	322.0	6.25	125 @ 3400	234 @ 1800	25 @ 30
	V8 38–60	124	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 38–60S	127	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 38–65	132	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 38–75	141	In Block	3 1/2 x 4 1/2	346.0	6.70	140 @ 3400	250 @ 1700	25 @ 30
	V16 38–90	141	In Block	3 1/4 x 3 1/4	431.0	6.80	185 @ 3600	324 @ 1700	25 @ 30
1939	La Salle V8 39–50	120	In Block	3 3/8 x 4 1/2	322.0	6.25	125 @ 3400	234 @ 1800	25 @ 30
	V8 .... 39–60S	127	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 39–61	126	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 39–75	141	In Block	3 1/2 x 4 1/2	346.0	6.70	140 @ 3400	270 @ 1700	25 @ 30
	V16 39–90	141	In Block	3 1/4 x 3 1/4	431.0	6.80	185 @ 3600	324 @ 1700	25 @ 30
1940	La Salle V8 40–50	123	In Block	3 3/8 x 4 1/2	322.0	6.25	130 @ 3400	234 @ 1800	25 @ 30
	La Salle V8 50–52	123	In Block	3 3/8 x 4 1/2	322.0	6.25	130 @ 3400	234 @ 1800	25 @ 30
	V8 40–60S	127	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 40–62	129	In Block	3 1/2 x 4 1/2	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8 40–72	138	In Block	3 1/2 x 4 1/2	346.0	6.70	140 @ 3400	270 @ 1700	25 @ 30
	V8 40–75	141	In Block	3 1/2 x 4 1/2	346.0	6.70	140 @ 3400	270 @ 1700	25 @ 30
	V16 40–90	141	In Block	3 1/4 x 3 1/4	431.0	6.75	185 @ 3600	324 @ 1700	25 @ 30
1941	V8 41–60S	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 41–61	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 41–62	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 41–63	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 41–67	139	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 41–75	136	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
1942	V8 42–60S	133	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 42–61	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 42–62	129	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 42–63	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 42–67	139	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8 42–75	136	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
1946	V8 46–60S	133	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 46–61	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 46–62	129	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 46–75	136	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
1947	V8 47–60S	133	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 47–61	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 47–62	129	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 47–75	136	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
1948	V8 48–60S	133	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 48–61	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 48–62	126	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8 48–75	136	In Block	3 1/2 x 4 1/2	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30

Year	Model Designation	Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1949	V8 49-60S	133	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 49-61	126	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 49-62	126	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 49-75	136	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1950	V8 50-60S	130	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 50-61	122	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 50-62	126	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 50-75	146 3/4	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1951	V8 51-60S	130	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 51-61	122	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 51-62	126	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8 51-75	147	In Head	3 13/16 x 3 5/8	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1952	V8 52-60S	130	In Head	3 13/16 x 3 5/8	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30
	V8 52-62	126	In Head	3 13/16 x 3 5/8	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30
	V8 52-75	146 3/4	In Head	3 13/16 x 3 5/8	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30

C—Series 10, 128"; series 20, 136"; series 30, 146".

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees (Note E)	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchromesh Transmission	Automatic Transmission	
1935	La Salle	AC-46	.025	.016	21-30	16258374	A	Positive	425		60-70
	V8	AC-84	.025	.016	21-30	D	C	Positive			70-75
	V12	AC-84	.025	.022	31-37	F	C	Positive			
	V16	AC-84	.025	.016	21-30	G	C	Positive	.		
1936	La Salle	AC-44	.025	.016	21-30	16258374	A	Positive	425		
	V8	AC-45	.025	.016	21-30	H	A	Positive	.	.	70-75
	V12	AC-84	.025	.022	31-37	F	C	Positive			
	V16	AC-84	.025	.016	21-30	G	C	Positive	.		
1937	La Salle	AC-44	.025	.016	21-30	H	A	Positive	375		70-75
	V8	AC-45	.025	.016	21-30	H	A	Positive	375		70-75
	V12	AC-84	.025	.022	31-37	F	C	Positive			.
	V16	AC-84	.025	.016	21-30	G	C	Positive			
1938-40	V8	AC-104	.025.	.016	21-30	H	A	Positive	375	.	70-75
	V16	AC-104	.030	.016	21-30	J	A	Positive	.	.	70-75
1941-42	All	AC-104	.025	.016	21-30	H	A	Positive	375	375	70-75
1946-48	All	AC-104	.030	.016	21-30	H	A	Negative	375	375	70-75
1949-51	All	AC-48X	.035	.016	21-30	K	B	Negative	375	375	65-70
1952	All	AC-48X	.035	.0125	29.5-32.5	K	B	Negative	430	430	65-70

A—"IGA" or "IGN" mark on vibration damper. B—"A" mark on vibration damper. C—"IGA" mark on flywheel.
D—Odd numbers right bank; even numbers left bank. Firing order: 1-2-7-8-4-5-6-3.
E—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is as shown.
F—Odd numbers left bank; even numbers right bank. Firing order: 1-4-9-8-5-2-11-10-3-6-7-12. Wiring order: 1-10-9-6-5-12-11-4-3-8-7-2.
G—Odd numbers left bank; even numbers right bank. Firing order: 1-8-9-14-3-6-11-2-15-10-7-4-13-12-5-16. Wiring order: 1-10-9-4-3-12-11-16-15-8-7-14-13-6-5-2.
H—Odd numbers left bank; even numbers right bank. Firing order: 1-8-7-3-6-5-4-2.
J—Odd numbers left bank; even numbers right bank. Firing order: 1-4-9-12-3-16-11-8-15-14-7-6-13-2-5-10. Wiring order: Right bank, 1-9-3-11-15-7-13-5; left bank, 2-10-4-12-16-8-14-6.
K—Odd numbers left bank; even numbers right bank. Firing order: 1-8-4-3-6-5-7-2.
L—On V8, V12 and V16 engines, cylinders are numbered as viewed from the drivers seat.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935	La Salle	.006H	.008H	.015	D	C	5	40@$2\frac{1}{4}$	.001 -.002	.001 -.003	.3437	.3437
	V8	.006C	.010C	.006	D	6	2	B	.0015-.0035	.0025-.0045	.3750	.3750
	V12	Zero	Zero	Zero	D	E	5	B	.001 -.0025	.001 -.0025	.3437	.3437
	V16	Zero	Zero	Zero	D	E	5	B	.001 -.0025	.001 -.0025	.3437	.3437
1936	La Salle	.006H	.009H	.015	D	C	5	40@$2\frac{1}{4}$	.001 -.002	.001 -.003	.3420	.3410
	V8	Zero	Zero	Zero	45	E	10	62@$1\frac{15}{16}$	.001 -.0025	.002 -.0035	.3420	.3410
	V12	Zero	Zero	Zero	45	E	5	B	.001 -.0015	.001 -.0025	.3395	.3395
	V16	Zero	Zero	Zero	45	E	5	B	.001 -.0015	.001 -.0025	.3395	.3395
1937	V8	Zero	Zero	Zero	45	E	10	66@$1\frac{59}{64}$	.001 -.0025	.002 -.0035	.3395	.3395
	V12	Zero	Zero	Zero	45	E	5	B	.001 -.0015	.001 -.0025	.3420	.3410
	V16	Zero	Zero	Zero	45	E	5	B	.001 -.0015	.001 -.0025	.3420	.3410
1938-40	V8	Zero	Zero	Zero	45	E	10	66@$1\frac{59}{64}$	.001 -.003	.002 -.004	.3420	.3410
	V16	Zero	Zero	Zero	45	6	12	50@$1\frac{25}{32}$	.001 -.003	.002 -.004	.3420	.3410
1941-48	All	Zero	Zero	Zero	45	E	10	66@$1\frac{59}{64}$	.001 -.003	.002 -.004	.3420	.3410
1949	All	Zero	Zero	Zero	44	15	40	60@$1\frac{11}{16}$	.001 -.0025	.0015-.0035	.3420	.3410
1950-52	All	Zero	Zero	Zero	44	14	24	60@$1\frac{11}{16}$	.001 -.0025	.0015-.0035	.3420	.3410

A—BTDC means before top dead center; ATDC means after top dead center.
B—Inner spring 49@ $1\frac{13}{32}$″; outer spring 111@ $1\frac{37}{64}$″.
C—Six degrees after top dead center.
D—Intake 30, exhaust 45.
E—Top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935	La Salle	Below	B	B	.007	.007	.0015-.003	.0015-.003	F	G
	V8	Below	C	C	.007	.007	.0015-.003	.0015-.003	F	G
	V12, V16	Below	B	B	.007	.007	.0015-.003	.0015-.003	F	G
1936	La Salle	Below	B	B	.007	.007	.0015-.003	.0015-.003	F	G
	V8	Above	C	C	.007	.007	.0015-.003	.0015-.003	H	G
	V12, V16	Below	B	B	.007	.007	.0015-.003	.0015-.003	F	G
1937	V8	Above	C	C	.007	.007	.0015-.003	.0015-.003	H	G
	V12, V16	Below	C	C	.007	.007	.0015-.003	.0015-.003	F	G
1938-40	V8	Above	.002	11	.007	.007	D	.0015-.003	H	G
	V16	Above	.002	11	.007	.007	E	.0015-.003	F	G
1941-42	All	Above	.002	11	.007	.007	D	.0015-.003	H	J
1946-49	All	Above	.002	11	.007	.007	.0022-.0035	.0015-.003	H	J
1950-52	All	Above	.002	11	.010	.010	.0017-.0035	.0015-.003	K	K

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Piston should fall of its own weight on a .0015″ feeler, and hold on a .002″ feeler.
C—Piston should fall of its own weight on a .002″ feeler, and hold on a .0025″ feeler.
D—Top ring .0023-.0041″, lower ring .0013-.0026″.
E—Top ring .003-.0043″, lower ring .0013-.0026″.
F—Clamped in rod.
G—Thumb push fit with piston heated.
H—Floating type. Pin retained by snap rings in piston bosses.
J—Thumb push fit with parts at 70° (room temperature).
K—Press fit in rod and piston. See text for details.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935	50	E	.002–.004	2.248–2.249	.001–.003	.005–.010	50–60	C	.001–.003	.001–.004	130–140
	V8	.005–.015	.0027–.0037	2.374–2.375	.001–.0025	.006–.012	50–60	2.3725–2.3735	.001–.0015	.001–.005	130–140
	V12	.004–.008	.0011–.0026	2.4995–2.5000	.001–.0025	.006–.012	50–60	D	.001–.0015	.001–.005	130–140
	V16	.004–.008	.0011–.0026	2.4995–2.5000	.001–.0025	.006–.012	50–60	D	.001–.0015	.001–.005	100–110
1936	50	E	.002–.004	2.248–2.249	.001–.0025	.003–.006	50–60	C	.001–.003	.001–.004	130–140
	V8	B	.0027–.0037	2.459–2.4595	.001–.0025	.003–.006	50–60	2.499–2.4995	.001–.0015	.001–.005	130–140
	V12	.005–.015	.0011–.0026	2.4995–2.5000	.001–.0025	.004–.007	50–60	2.6245–2.6250	.001–.0015	.001–.005	130–140
	V16	.005–.015	.0011 .0026	2.4995–2.5000	.001–.0025	.004–.007	50–60	D	.001–.0015	.001–.005	100–110
1937	V8	B	.0027–.0037	2.4590–2.4595	.0015–.0025	.003–.006	50–60	2.499–2.4995	.001–.0015	.001–.005	130–140
	V12	.005–.015	.0011–.0026	2.4995–2.5000	.001–.0025	.004–.007	50–60	2.6245–2.6250	.001–.0015	.001–.005	130–140
	V16	.005–.015	.0011–.0026	2.4995–2.5000	.001–.0025	.004–.007	50–60	2.6245–2.6250	.001–.0015	.001–.005	100–110
1938	V8	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.003–.006	50–60	2.4995–2.5000	.0015–.0025	.001–.005	130–140
	V16	B	.0013–.0025	1.9988–1.9993	.0015–.0025	.004–.008	50–60	1.9988–1.9993	.0015–.0025	.001–.005	100–110
1939–40	V8	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4995–2.5000	.0015–.0025	.001–.005	130–140
	V16	B	.0013–.0025	1.9988–1.9993	.0015–.0025	.008–.014	50–60	1.9988–1.9993	.0015–.0025	.001–.005	100–110
1941	All	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4995–2.5000	.0015–.0025	.001–.005	130–140
1942	All	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4990–2.4995	.0015–.0025	.001–.005	130–140
1946–48	All	B	.0015–.0033	2.4590–2.4595	.0005–.002	.008–.014	60–65	2.4990–2.4995	.0008–.0025	.001–.005	130–140
1949–52	All	E	.001–.0022	2.2488–2.2493	.001–.0035	.008–.014	40–45	2.4990–2.4995	.0015–.0025	.001–.005	90–100

A—Thrust taken by No. 1 bearing on 35–50 and 36–50; No. 3 on 1936 V8 and 1935–37 V12 and V16; No. 2 bearing on 1936–48 V8; No. 5 on 1938–V16; rear bearing on 1949–51.
B—Controlled by a thrust plate at front bearing.
C—No. 1, 2.3725 to 2.3735. No. 2, 2.6225 to 2.6235. No. 3, 2.560 to 2.561. No. 4, 2.685 to 2.686. No. 5, 2.7475 to 2.7485.
D—Rear bearing, 2.499 to 2.500; all others, 2.6245 to 2.6250.
E—On early 1949 cars, end play is controlled by thrust plunger and spring; on late 1949 and all 1950–52 cars, controlled by the timing case cover.

LUBRICATION AND CAPACITY DATA

Year	Mode	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil Above +32°F.	ENGINE: Grade of Oil Above +10°F	ENGINE: Grade of Oil Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil Summer	TRANSMISSION: Grade of Oil Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil Summer	DIFFERENTIAL: Grade of Oil Winter
1935	50	16½	20	7	20	20W	10W	2½	140	90	5	140	90
	355D	20	A	8	20	20W	10W	4½	140	90	6	140	90
	370D	18⅖	30	9	20	20W	10W	4½	140	90	6	140	90
	452D	22⅘	30	10	20	20W	10W	4½	140	90	6	140	90
1936	50	16½	18	7	20	20W	10W	2½	140	90	5	140	90
	60	30	21	7	20	20W	10W	2½	140	90	5	140	90

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil: Above +32°F.	Above +10°F.	Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil: Summer	Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil: Summer	Winter
1936	70, 75	29	25	7	20	20W	10W	4½	140	90	5	140	90
	80, 85	19	25	9	20	20W	10W	4½	140	90	5	140	90
	90	22⅘	30	10	20	20W	10W	4½	140	90	6	140	90
1937	50 60	25	22	7	20	20W	10W	2½	90	90	5	90H	90H
	65, 70, 75	25	25	7	20	20W	10W	2½	90	90	5	90H	90H
	85	17	25	9	20	20W	10W	2½	90	90	5	90H	90H
	90	24	30	10	20	20W	10W	4½	140	90	6	90H	90H
1938	50	25	22	7	20	20W	10W	2½	90	90	5	90H	90H
	60, 60S	24	24	7	20	20W	10W	2½	90	90	5	90H	90H
	65, 75	25	26	7	20	20W	10W	2½	90	90	6	90H	90H
	90	30	25	11	20	20W	10W	2½	90	90	6	90H	90H
1939	50	25	23	7	20	20W	10W	2½	90	90	5	90H	90H
	60S	24½	24	7	20	20W	10W	2½	90	90	5	90H	90H
	61	24½	23	7	20	20W	10W	2½	90	90	5	90H	90H
	75	24½	26½	7	20	20W	10W	2½	90	90	6½	90H	90H
	90	30	26½	11	20	20W	10W	2½	90	90	6½	90H	90H
1940	50, 52	25	22	7	20	20W	10W	2½	90	90	5	90H	90H
	60S, 62	24½	22	7	20	20W	10W	2½	90	90	5	90H	90H
	72	24½	24	7	20	20W	10W	2½	90	90	6½	90H	90H
	75	24½	26½	7	20	20W	10W	2½	90	90	6½	90H	90H
	90	30	26½	11	20	20W	10W	2½	90	90	6½	90H	90H
1941-42	60S, 61, 62, 63, 67	25	20	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H
	75	25	24	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H
1946–48	60S, 61, 62	25	20	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H
	75	25	24	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H
1949–51	All	18	20	5	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H
1952	All	19	20	5	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90H	90H

A—For 128 and 136-inch wheelbase, 22 gallons; for 146-inch wheelbase, 30 gallons.
B—For cars with Hydra-Matic Drive, approximately 12 qts. Use Hydra-Matic fluid only.
H—Hypoid gear lubricant.

FIRST SERIAL NUMBERS

NOTE: Engine numbers identical with serial numbers

LOCATION—CADILLAC—1935 V8, 1940 V16—Upper left rear corner of cylinder block. 1935-37 V12, V16—On generator drive chain housing. 1936 V8—Top of crankcase behind fan support. 1937 V8, 1938-39 All—Parallel to dash at left rear of crankcase. 1940-41 V8—On crankcase behind left cylinder block, and on left frame side rail near steering gear. 1942-48—On engine block behind water pump, and on right frame side bar. 1949-52—Upper right corner on front face of right hand block.

LA SALLE—1935-36—Left side of cylinder block at forward end just below cylinder head. 1937-40—Parrallel to dash at left rear of crankcase, and on left frame side rail near steering gear.

Year	Model	
1935	50	2200001
	355D	3100001
	370D	4100001
	452D	5100001
1936	50	2210001
	60	6010001
	70	3110001
	75	3110001
	80	4110001
	85	4110001
	90	5110201
1937	50	2230001
	60	6030001
	65	7030001
	70	3130001

Year	Model	
	75	3130001
	85	4130001
	90	5130301
1938	50	2270001
	60	8270001
	60S	6270001
	65	7270001
	75	3270001
	90	5270001
1939	50	2290001
	60S	6290001
	61	8290001
	75	3290001
	90	5290001

Year	Model	
1940	50	2320001
	52	4320001
	62	8320001
	72	7320001
	75	3320001
	90	5320001
1941	60S	6340001
	61	5340001
	62	8340001
	63	7340001
	67	9340001
	75	3340001
1942	60S	6380001
	61	5380001

Year	Model	
	62	8380001
	63	7380001
	67	9380001
	75	3380001
1946	60S	6400001
	61	5400001
	62	8400001
	75	3400001
1947	60S	6420001
	61	5420001
	62	8420001
	75	3420001
1948	60S	486000001
	61	486100001
	62	486200001
	75	487500001
1949	60S	496000001
	61	496100001
	62	496200001
	75	497500001
1950	60S	506000001
	61	506100001
	62	506200001
	75	507500001
1951	60S	516000001
	61	516100001
	62	516200001
	75	517500001
1952	60S	526000001
	62	526200001
	75	527500001

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935	La Salle	A	(B)23⅛	2	3/16	5/16
	Cadillac	Woven	(C)26	2	1/4	5/16
1936	50, 60	A	(B)23⅛ (C)26	2	3/16	5/16
	70, 75, 80, 85	A	(B)27¼ (C)30	2¼	1/4	5/16
	90	Woven	30	2	1/4	5/16
1937	50	A	25⅞	(B)2¼ (C)2	3/16	5/16
	60, 65, 70	A	25⅞	(B)2¼ (C)2	3/16	5/16
	75, 85, 90	A	(B)27¼ (C)30	2¼	1/4	5/16
1938	50, 60, 60S	Molded	25⅞	(B)2¼ (C)2	3/16	5/16
	65	Molded	25⅞	(B)2¼ (C)2	3/16	5/16
	75, 90	Molded	(B)27¼ (C)30	2¼	1/4	5/16
1939	50, 61	Molded	24½	2	3/16	3/4
	60S	Molded	24½	(B)2¼ (C)2	3/16	5/16
	75, 90	Molded	28 11/16	2¼	1/4	5/16
1940	50, 52	Molded	24½	2	3/16	3/4
	60S	Molded	24½	(B)2¼ (C)2	3/16	5/16
	62	Molded	24½	(B)2¼ (C)2	3/16	3/4
	72	Molded	24½	(B)2¼ (C)2½	3/16	5/16
	75, 90	Molded	28 11/16	2¼	1/4	5/16
1941-42	60S, 61, 62, 63	Molded	24½	(B)2¼ (C)2	3/16	3/4
	67, 75	Molded	24½	(B)2¼ (C)2½	3/16	3/4
1946-48	60S, 61, 62	Molded	24½	(B)2¼ (C)2	3/16	3/4
1946-48	75	Molded	24½	(B)2¼ (C)2½	3/16	3/4

BRAKE DATA—Continued

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1949	60, 61, 62	Molded	24½	2¼	3/16	3/4
	75	Molded	24½	(B)2¼ (C)2½	3/16	3/4
1950 1951	60S, 61, 62	Molded	D	2½	3/16	3/4
	75	Molded	25¾	2½	3/16	3/4
1952	60, 62	Molded	(B)26 (C)22½	2½	1/4	3/4
	75	Molded	26	2½	1/4	3/4

A—Primary shoe, molded. Secondary, woven.
B—Front wheel. C—Rear wheel.
D—Riveted linings 22½"; bonded linings 19½".

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	La Salle	+1¾	+ ⅝	1/32	5
	Cadillac	A	+1⅛	1/32	4
1936	50, 60	+1¾	+ ⅝	1/32	5
	70, 75, 80, 85	+1	+ ¼	1/32	5½
	90	+1	+1⅛	1/32	4
1937	50, 60	+ ⅝	+ ⅝	1/16	5
	65, 70, 75, 85	Zero	+ ¼	1/16	5½
	90	Zero	+ ¼	1/16	4½
1938	50, 60, 60S	− ½	+ ⅛	1/16	5½
	65, 75, 90	Zero	+ ¼	1/16	5
1939	50, 61	−1¾	+ ¼	1/16	5
	60S	− ½	+ ⅛	1/16	5½
	75, 90	Zero	+ ¼	1/16	5
1940	75, 90	− ¾	+ ¼	1/16	5
	Others	−2¼	+ ⅜	1/16	5
1941-47	All	−2⅛	Zero	1/16	6
1948-49	All	Zero	Zero	3/32	6
1950-52	All	Zero	Zero	3/32	5⅚

A—For all models except series 10 and 20 on model 355D, +1 degree; for series 10 and 20 on model 355D, +3 degrees.

ENGINE

ENGINE MARKINGS

1936-52 V8s—Engines are marked in production with a system of letters stamped on the top face of the cylinder block adjacent to each cylinder bore to indicate exact diameters of cylinder bores and pistons to aid in selective fitting of pistons on the assembly line. These letters have no value in service since replacement pistons cannot be supplied according to these code letters and usually some change has taken place in cylinder bore dimensions after the engine has been in service for some time.

ENGINE REMOVAL

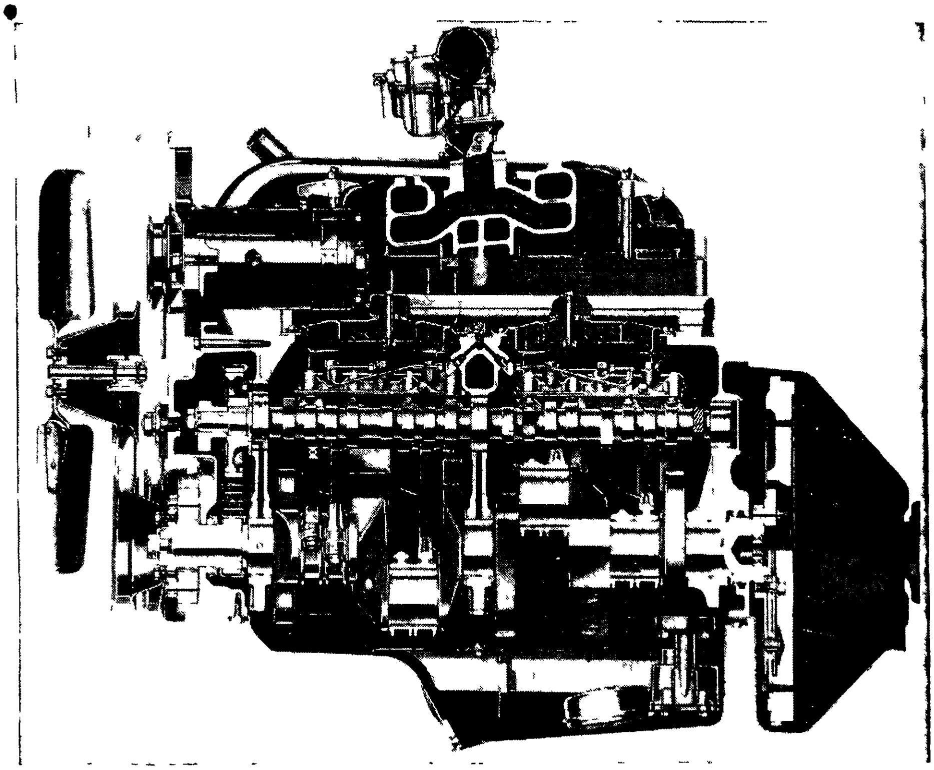
1936-48 V8—The following procedure is specifically for 1942 models but may be applied to all other models. Any items that do not apply, however, should be disregarded.

1. Block up car at four wheels.
2. Drain cooling system.
3. Disconnect battery cables.
4. Remove propeller shaft.
5. Support rear of engine.
6. Loosen transmission and slide backward into frame X-member. Be sure to support transmission at front end.
7. Remove clutch release mechanism from bell housing.
8. Remove hood.
9. Remove radio ground cables, heater hoses and windshield washer reservoir.
10. Remove all water hose.
11. Disconnect exhaust pipe at right manifold.
12. Remove carburetor and control rod.
13. Disconnect fan, generator and water pump belts and remove generator and fan.
14. Pull wiring harness for generator toward side of car so it won't interfere with engine removal.
15. Remove distributor so it won't hit cowl on removal of engine.
16. Disconnect fuel line at fuel pump.
17. Install wooden or metal shield in back of radiator core to avoid damage to fins when removing engine.
18. Hook a rope under crankshaft pulleys, then up and around exhaust crossover manifold.
19. Place chain fall or hoist over engine and hook onto rope, raising hoist to take slack out of rope.
20. Disconnect both front engine support mountings.
21. Lift engine out of car.
22. Reinstall engine in reverse order of its removal.

1949-52—To remove the engine with transmission attached from the car, proceed as follows:

1. Drain cooling system, crankcase and transmission.
2. Remove hood top panel.
3. Disconnect battery cables.
4. Disconnect hood release cable (1950-52).
5. Disconnect voltage regulator wires (1950-52).
6. Remove upper and lower radiator hose.
7. Remove radiator core.

8. Remove generator and fan belt.
9. Disconnect carburetor linkage and remove carburetor.
10. Disconnect flexible fuel line at fuel pump.
11. Disconnect heater hoses at heater.
12. Disconnect ground straps, ignition coil wires, and oil pressure gauge line at rear of block.
13. Remove fan blade and pulley.
14. Raise front of car and install stand jacks.
15. Disconnect propeller shaft at rear axle and remove assembly from car by sliding front yoke out of transmission extension housing.
16. Disconnect speedometer cable and shift linkage at transmission.
17. Remove starter from engine.
18. Disconnect front engine supports at frame.
19. Disconnect exhaust pipe from manifold.
20. Remove idler arm support screws from frame and lower idler arm and steering connecting link (1950-52).
21. Loosen hand brake cable at relay (1950-52).
22. On cars with syncromesh transmission, disconnect clutch pedal-to-release yoke rod.
23. Remove back-up light switch bracket from transmission (if syncromesh).
24. Remove stand jacks from under car and lower car to floor.
25. Install a rope or chain around intake manifold, attach to overhead hoist and take up slack.
26. Disconnect and remove rear engine support bracket from frame and extension housing.
27. Lift engine and transmission out of car.



Sectional view of V8 engine, 1936-48

CYLINDER HEAD SERVICE

1936-48 V8—Thorough tightening of cylinder head capscrews is necessary to insure a leak-proof connection. Tighten screws in the order shown in Fig. 1 once when engine is cold and again after engine is thoroughly warm. Correct torque tightness is given in the *Tune-Up Chart.*

CAUTION—The two capscrews used at the water outlet connection on each cylinder head have oversized heads and are ½" longer than the other screws. *Use these screws only at water outlet connections.* If installed at any other point, they may break through the water jacket and irreparably damage the entire engine block.

1949-52—Before checking the cylinder head capscrew torque on these engines, be sure to loosen the intake manifold. This is necessary to prevent the upper row of cylinder head screws from being under-torqued because of the bridging effect of the intake manifold. To relieve any pressure, it is merely necessary to loosen either side of the intake manifold before checking the head screw tightness, which should be 65-70 lbs. ft.

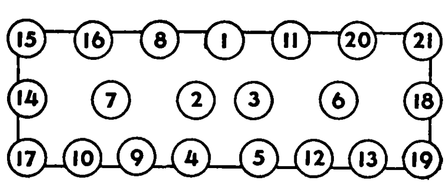


Fig. 1 1936-48 V8 cylinder head tightening sequenc

To remove the cylinder head, proceed as follows:

1. Drain radiator.
2. Remove two bolts from water pump flange at cylinder head.
3. Remove ground strap screw at rear of cylinder head.
4. Remove carburetor air cleaner.
5. Disconnect fuel line from fuel pump to carburetor.
6. Remove vacuum advance line from front of carburetor to vacuum advance at distributor.
7. Remove windshield wiper vacuum pipe from clamp at rear of intake manifold.
8. Disconnect vacuum line at intake manifold and at vacuum pump.
9. Disconnect ignition coil high tension wire and primary wire at distributor.
10. Disconnect throttle control linkage at carburetor.
11. Remove intake manifold with carburetor and heat control pipe as a unit.
12. Remove rocker arm covers and distributor cap as an assembly.
13. If right cylinder head is to be removed, remove generator.
14. Remove exhaust manifold bolts which attach manifold to head, or if preferred, the manifold may be disconnected from exhaust pipe and cross-under pipe (1949-51).
15. Remove rocker arm assembly.
16. Remove push rods from openings in cylinder head.
17. Remove remaining cylinder head bolts and lift off head.

NOTE—If both heads are to be removed, the exhaust manifolds should be supported to prevent undue strain at manifold-to-exhaust pipe connection.

INSTALLATION NOTES—

1. Cylinder head gasket is marked "TOP" and should be so installed.
2. Eight short cylinder head screws belong in outside row, five medium length screws in center row, and the four long head screws go through rocker arm shaft and head.
3. Be sure bottom of push rods are correctly seated in hydraulic lifter cups.
4. Tighten all cylinder head screws in sequence shown in Fig. 2 and to 65-70 pounds feet torque.
5. Tighten manifold screws to 25-30 pounds feet torque.
6. When installing intake manifold, be sure choke heater pipe enters hole in heater stove in exhaust manifold before intake manifold is all the way down into position.

1935-37 V12 & V16 — These heads may be removed without disturbing the rock-

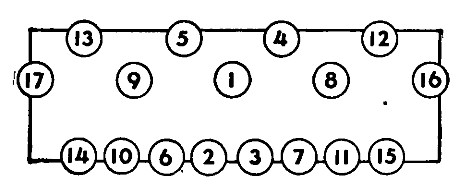
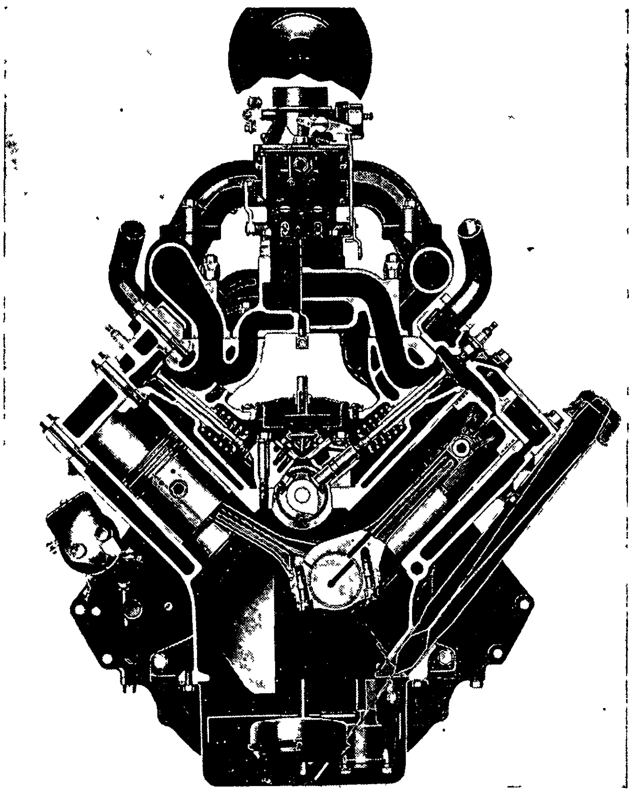
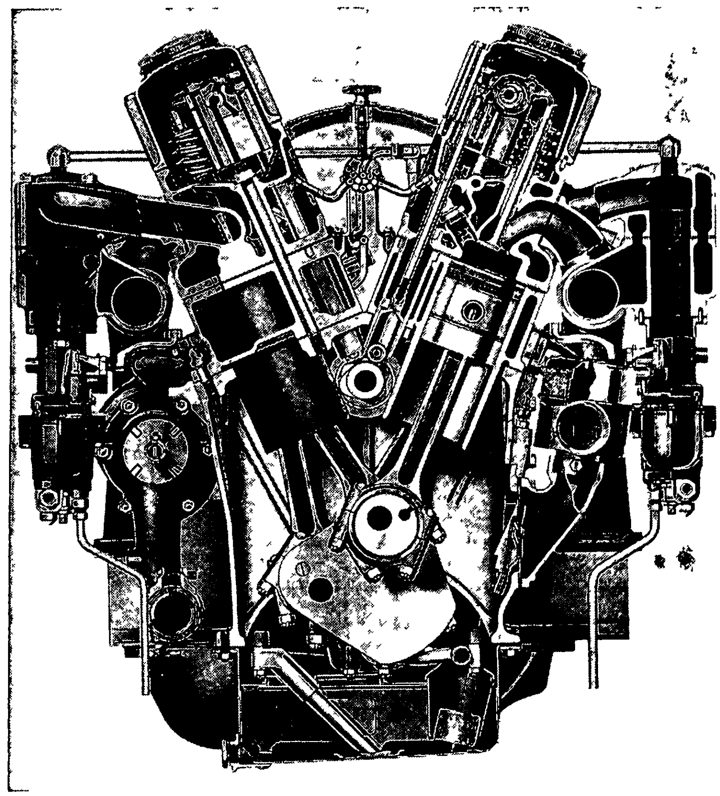


Fig. 2 1949-52 cylind r h ad tight ning sequ nce



Cross sectional view of V8 engine, 1936-48



Cross sectional view of V12 and V16 engine, 1935-37

er arm assemblies by using a 5/8" universal socket wrench on the nuts under the rocker shaft.

When tightening the hydraulic silencers or cylinder heads, release the silencers several times during the tightening process to avoid excessive strain on the mechanism. To release the silencers, insert a 1/32" diameter hook (or a bent ice pick) into the small hole in the plunger head.

To tighten the head, draw the top row of nuts down fairly tight, and after tightening the intermediate row securely, complete the operation on the top row. Finally, screw down the lower row.

ROCKER ARMS & PUSH RODS

1949-52—The rocker arms may be lifted off after removing the screws holding each assembly to the cylinder heads. Note when removing the push rods that the end with the undercut groove is *up* toward the rocker arms.

To disassemble the rocker arms, remove the cotter pin from the end of the rocker arm shaft and remove two flat washers and spring washer. Keep tension on the rocker arm springs to keep the springs from pushing the parts off the end of the shaft. This can be done by leaving the cylinder head screws in the rocker arm brackets. Slide rocker arms, brackets and springs off the shaft. Keep parts in relative position as they are removed.

Note that the center rocker arm spring is shorter than the two outer springs. This spring must be installed in the center position. Also the two outer shaft brackets have mounting holes for the rocker arm cover screws. All rocker arms are identical and can be installed in any position.

When assembling the rocker arms, note the notched end of the shaft on both the right and left shaft, Fig. 3. These must point toward the center of the engine to allow for proper lubrication. Also the rocker arm brackets with the tapped holes at the top for the rocker arm cover bolts must be positioned at each end of the rocker arm and the tapped hole must be toward the valve end of the rocker arms.

Position the rocker arms, brackets and springs on the shaft. The short spring is in the middle position while the two long springs are on the outside. Slip the screws in the rocker brackets and shaft to hold them in position when the shaft is assembled. Compress the springs and install two flat washers and spring washer on the end of the shaft. Install and spread the cotter pin.

When installing push rods make sure that the groove in each rod is up toward the cylinder head. This is important because the radius is not the same on each end. Care should be taken to see that all the push rods fit into the rocker arm sockets properly, and that push rods are properly seated on the valve lifter cups. Push rods can be bent when the head

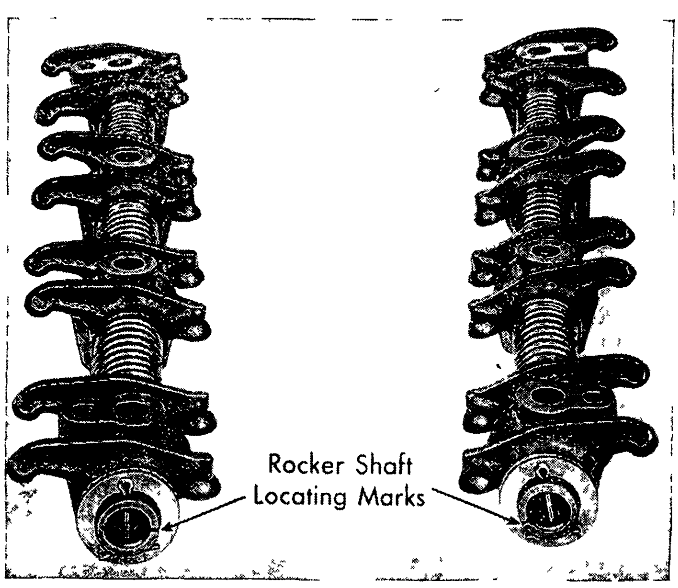
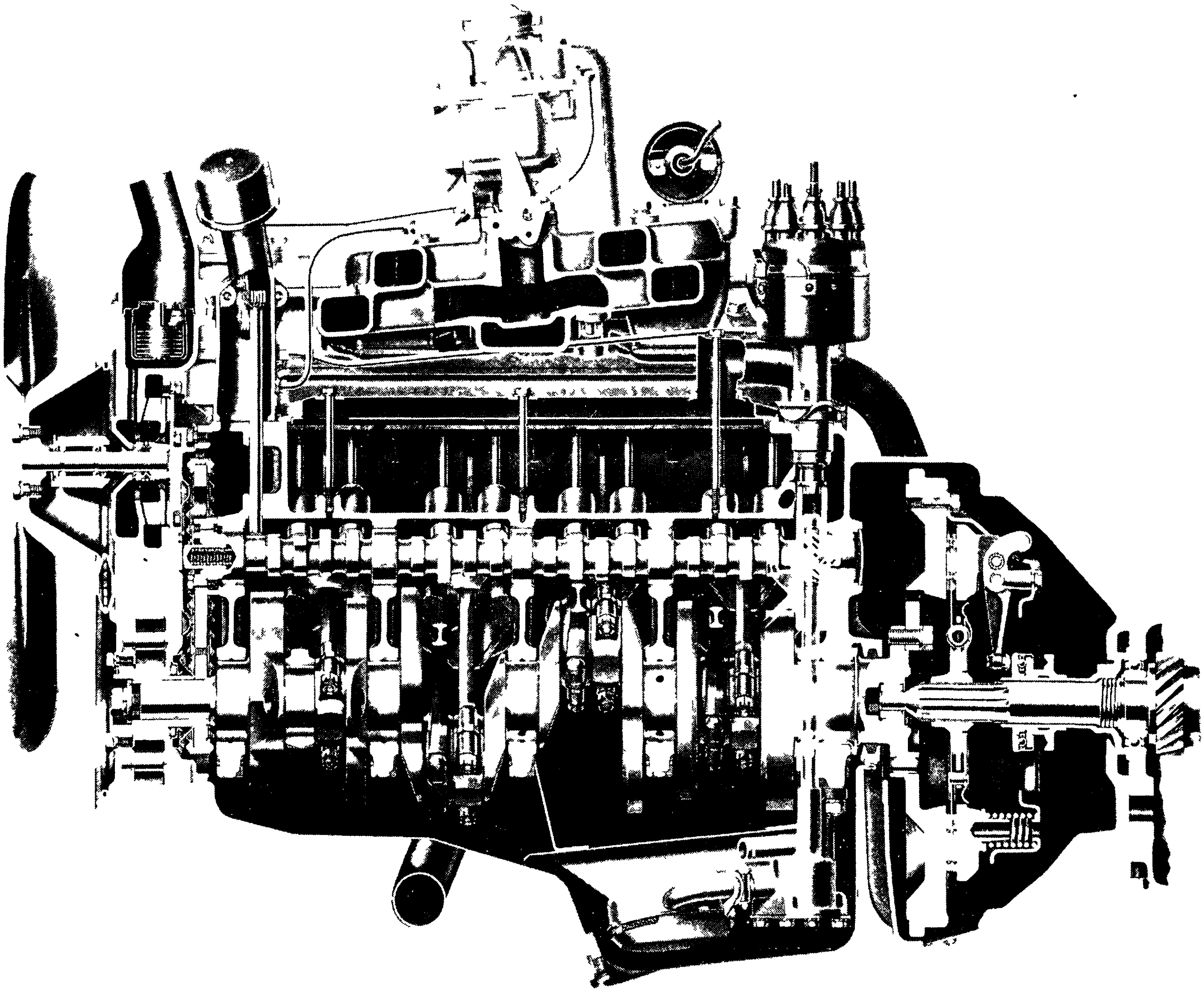


Fig. 3 Assembly of 1949-52 rocker arms



Side sectional view of 1949-52 engine

bolts are tightened if they are not in the sockets

1935-37 V12 & V16 — When installing rocker arm assemblies, the dashpot valves should be released frequently to avoid jamming the eccentrics An ice pick with its tip bent over about ⅛" will serve for this purpose as well as for holding the plungers fully released to set the initial valve clearance to 040" When released, the silencers will adjust the clearance to zero.

VALVE CLEARANCE, ADJUST

1935-36 La Salle, 1935 V8 Cadillac—On La Salle engines, the valve clearance should be adjusted with the engine hot, while on the 355D the adjustment should be made with the engine cold

When making adjustments, use the correct thickness feeler gauges, being sure they are not crimped, bent or dirty. And see that the same clearance is obtained on all valves, making sure the lifter is on the heel of each cam when adjusting each tappet See the *Valve Table* for clearance specifications

NOTE — See *Hydraulic Valve Lifter Chapter* for other models

VALVES & SPRINGS

1935-36 La Salle — To remove the valves and springs, take off the valve cover plates and cylinder head Compress the valve springs, take out the locking keys and lift out the valves and springs

1936-48 V8—To remove the valves and springs, it is necessary to take out the valve lifters first Then, with the cylinder heads removed, compress the valve springs, take out the locking keys and lift out the valves and springs

NOTE—As these engines have hydraulic valve lifters, cleanliness is a prime consideration whenever the engine is disassembled for valve grinding or other work In view of this, the following precautionary measures should be taken.

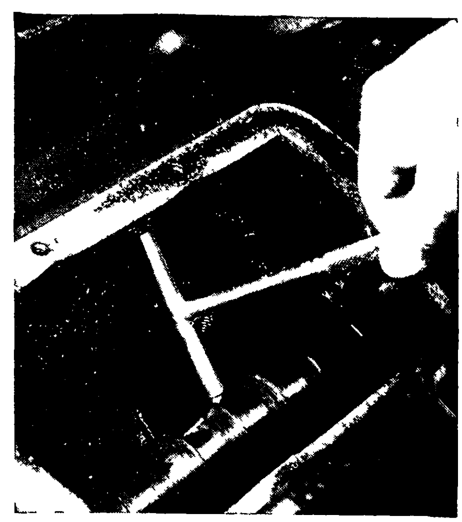


Fig. 4 Checking valv stem length. 1936-48 V8 engines

1. Before removing the valve cover plates, clean the engine Vee thoroughly, using a compressed air cleaning gun if available; if not handy, use a good cleaning solution and a brush, blowing off with compressed air.

2. Cover the intake and exhaust manifold port holes with plywood or heavy cardboard when manifolds are taken off.

3. After removing the valve lifter brackets, the openings in the crankcase should be covered with pieces of inner tube rubber cut to fit; rubber is superior to rags for preventing valve locks, etc., from falling into the oil pan as it leaves no lint in the engine and does not fray.

4. Cylinder bores should be covered with masking tape laid in shingle fashion across the entire block, and vented with a cotter pin inserted at the lower edge of each cylinder.

CAUTION — Before re-installing valve lifter assemblies, valve stems should be checked for proper length, using special valve stem length gauge J-1055 to measure the distance from the end of the valve stem to the heel of the cam, Fig. 4. If the valve stems are found to be too long when checked in the closed position, they should be ground off until the tool will slide into place with the valve seated. If Tool J-1055 is not available, it will be necessary to install valves, valve springs and lifters and check clearances between stems and lifters, which should be from .030" to .070".

NOTE—Valve lifters should be disassembled and cleaned before being reinstalled. See *Hydraulic Valve Lifter Chapter*.

1935-37 V12 & V16 — To remove the valves on these engines, take off the cylinder heads and rocker arm assemblies, compress the valve springs, take out the valve locks and lift out the valves and springs.

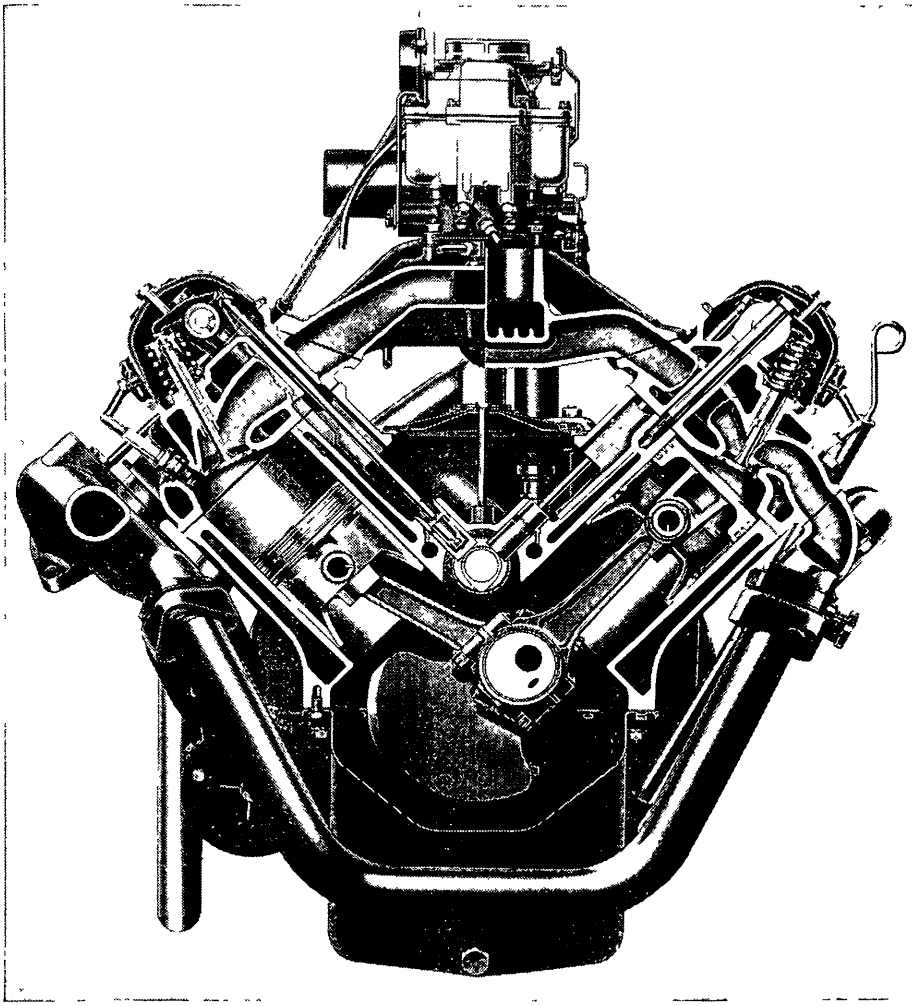
1938-40 V16 — On these engines, the valves and springs are removed in the conventional manner, that is, by removing the valve covers and cylinder heads. The lifters can only be removed after taking out the valves.

1949-52—Fig. 5 illustrates the tool used to remove and replace valves and springs. The small rubber oil seal that goes around the valve is used to keep excess oil from the valve stem. If a smoking condition develops, check the seals to see if they are in good condition.

When installing the rubber oil seals, be sure to seat them properly in the valve seat ring. To check to see that the seal has not broken while installing the retainers, place a suction cup, similar to that used when grinding valves, over the valve retainer and valve stem. If the oil seal is properly installed, the vacuum cup should stick to the end of the retainer. If there is no suction present, it is an indication that the seal is broken and the parts must again be disassembled.

Note the hardened undercut stem on the exhaust valves. The purpose of the undercut is to give greater clearance and to prevent valve sticking.

Note that the intake and exhaust valve spring retainers are different. The flare at the bottom of the intake spring



Cross sectional view of 1949-52 engine

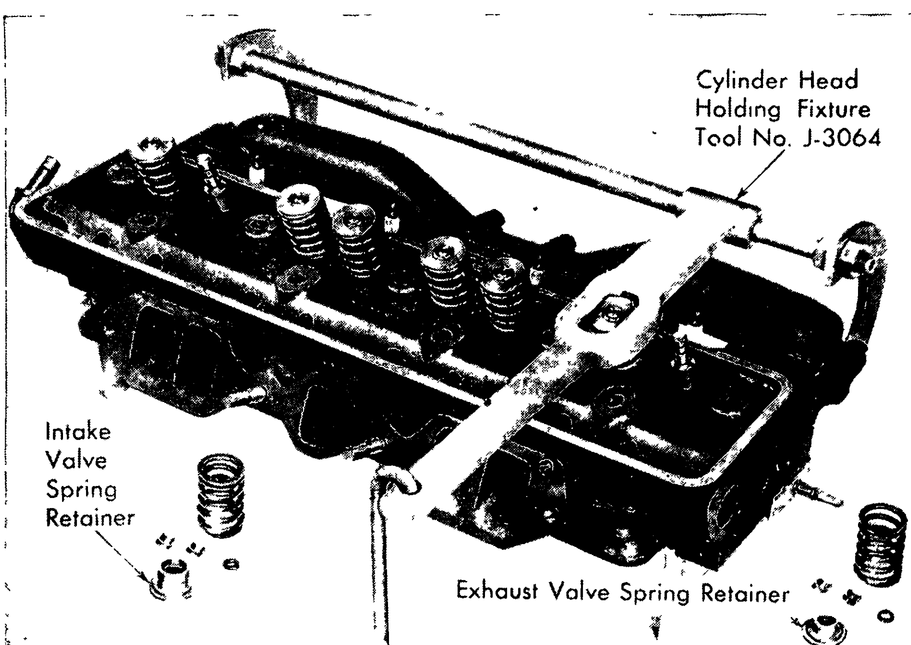


Fig. 5 Sh wing to l used f r r m ving and installing 1949-52 valv s

retainer helps to deflect the oil away from the intake valve stems.

VALVE STEM GUIDES

1935-48 — See the *Valve Table* for valve stem clearance specifications. If valve stem clearance exceeds .005", new guides must be installed. Worn valve guides are not only noisy, but may also cause excessive oil consumption, as well as improper seating of valves.

1949-52—Remove valve guides by driving them out toward the upper part of the cylinder head. When installing guides it is important that the tool shown in Fig. 6 be used. If the valve guides are not installed to an exact dimension, the undercut of the exhaust valve, Fig. 7, would not have a shearing action to keep carbon out of the guide and sticking valves would occur at very low mileage.

HYDRAULIC VALVE LIFTERS

NOTE—Operation and service on these lifters are covered in detail elsewhere in the manual under the chapter heading *Hydraulic Valve Lifters.* When installing these lifters, observe the following precautions:

1936-48 V8 and 1938-40 V16—Before installing lifters, note the following to make sure lifters are assembled properly:

1. Ball check should rattle when cylinder unit is shaken.
2. Plunger should bounce back when pressed quickly into cylinder and released.
3. Plunger spring should be locked into cylinder body with a twist of plunger.
4. Cylinder should slide smoothly into lifter body when free of oil.

INSTALLING LIFTERS—

1. Valve lifter bodies should be filled with oil and silencers set in lifter bodies.
2. Install valve lifter brackets in engine, using Tool No. J-827, which is available through Kent-Moore Organization, Detroit, Michigan. It is extremely important to use this tool when lifter bodies are filled with oil as any pumping of silencers will draw oil into silencer assemblies and render installation very difficult.
3. Engine oil should be applied to tops of silencer assemblies after they have been installed.
4. Lifter bracket oil feed pipes should be connected to *supply end only* and engine cranked until all air is expelled from lines.
5. Oil feed pipes can then be attached to bracket connection.
6. Check clearance between valve stem and top of plunger by forcing oil out of lifter and fully depressing plunger spring. Clearance should be .030-.070". If clearance is less than .030", grind off end of valve stem.

1949-52—To remove valve lifters from these engines, proceed as follows:

1. Remove right and left rocker arm covers and hang on cowl.
2. Remove intake manifold.
3. Remove three valve compartment cover screws.
4. Loosen engine ventilator pipe clamp at flywheel housing, move pipe out of way and remove valve compartment cover.
5. Remove right and left rocker arm assemblies. **NOTE**—When only one or two valve lifters are to be removed, it is not necessary to remove the complete rocker arm assembly. Compress the valve spring, slide rocker arm over and remove push rod.
6. Remove push rods.
7. Using valve lifter remover tool J-3049, Fig. 8, remove lifters from engine, being sure to keep them in order so that they can be reinstalled in the same bore from which they were removed. Turn valve lifter back and forth while lifting to remove any carbon or varnish from base of lifter.
8. Disassemble and service valve lifters as outlined in the *Hydraulic Valve Lifters* chapter elsewhere in this manual.

INSTALLING LIFTERS—

1. Install lifters in cylinder block in same bores from which removed.
2. Install push rods through openings in cylinder heads with grooved end of push rod at top, and bottom end in push rod cup.
3. Install rocker arm assemblies on cylinder heads, being sure rocker arms are

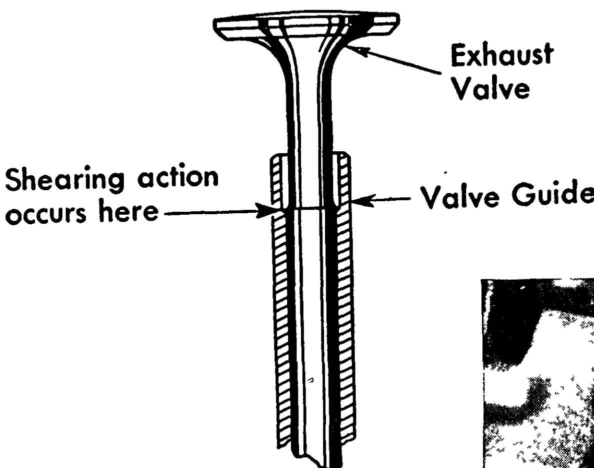


Fig. 7 Showing undercut of exhaust valve on 1949-52 engines

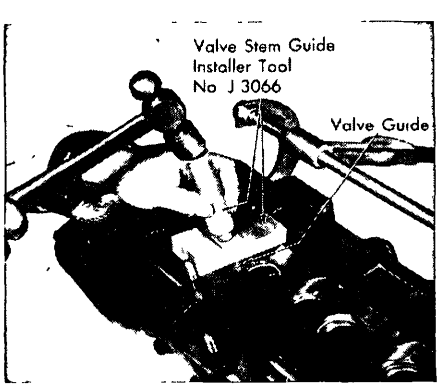


Fig. 6 Showing special t l us d to contr l p siti n f valv guid s wh n driven int 1949-52 ngines

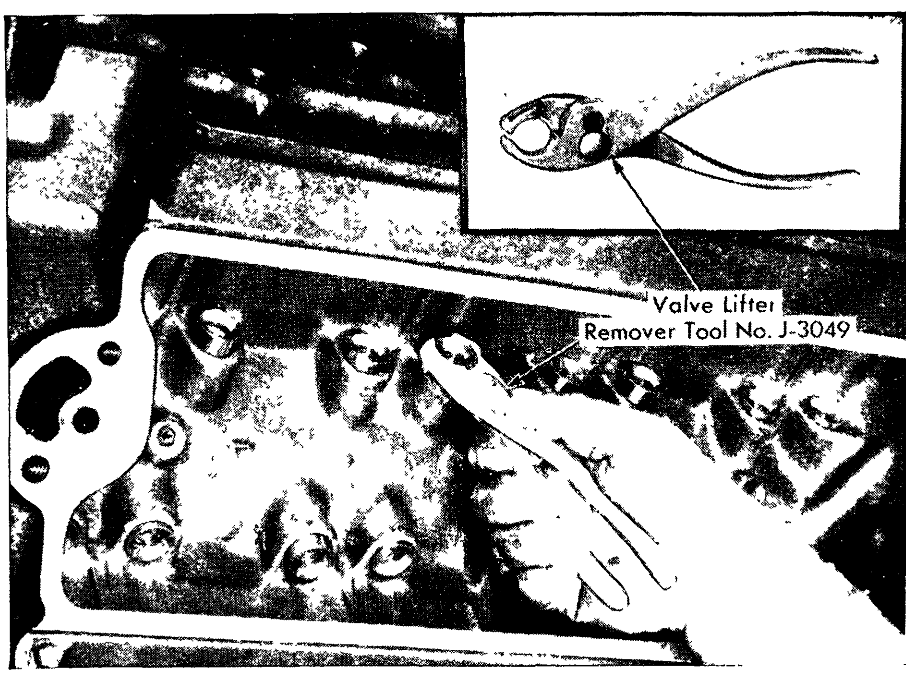


Fig. 8 Showing special pliers us d t r m v stuck valv lifters from 1949-52 ngin s

Fig. 9 Valv timing, 1936-48 V8

correctly seated over push rods and push rods are correctly seated in lifter cups.

CAUTION: Be sure all rocker shaft brackets are right side up, otherwise the rocker shaft may be sprung out of alignment when bolts are tightened down.

4. Tighten rocker shaft bolts to 65-70 pounds feet torque and recheck torque of all cylinder head bolts.
5. Install valve lifter compartment cover and insert front and center screws.
6. Place ventilator pipe over opening in valve cover, being sure cork gasket on pipe is in position and install long screw.
7. Complete the job in the reverse order of removal.

VALVE TIMING

1935-52—Timing is correct when the marks on the camshaft and crankshaft sprockets are in line as shown in Figs. 9 and 10.

TIMING CHAIN & COVER

1936-48 V8s—The chain and sprockets should be installed as a unit. A pilot tool (J-836) should be used on the end of the camshaft when the installation is made. Line up the sprocket marks as shown in Fig. 9 for correct valve timing. Do not force the sprocket onto the camshaft as damage to the distributor and oil pump drive gear may result, Fig. 10.

1949-52—To remove the timing chain and sprockets, proceed as follows:
1. Turn engine over until distributor rotor is under the number six contact in the distributor cap.
2. Remove water pump and oil pan.
3. Remove crankshaft pulley.
4. Take off chain cover.
5. Remove two capscrews attaching sprocket to camshaft. Then remove chain together with camshaft sprocket.
6. Pull crankshaft sprocket.

To install the sprockets and chain, reverse the foregoing procedure, being sure to have the sprocket marks lined up as shown in **Fig. 11** when the chain is installed.

CAMSHAFT & BEARINGS

1936-48 V8 — To take out camshaft, remove radiator core, fuel pump, timing chain cover, both exhaust manifolds, intake manifold and carburetor as a unit, valve covers, valve lifters and brackets, timing chain and retaining plate. Then on 1942-48 models, pull camshaft forward into radiator grille until shaft is clear of front end of engine and lift out. On earlier models, first remove radiator grille.

To remove the bearings, push them out of the bearing supports. To take out the rear bearing, remove the transmission and clutch housing.

Before replacing bearings, paint the outside surfaces with white lead. Then install the front bearing first, the rear bearing next, and then the center bearing, using pilot tool No. J-829 at the other two points in each instance. Be sure the oil holes in the bearings index with the oil holes in the crankcase.

1949-52—To remove the camshaft:
1. Remove radiator core and hood lock plate support.
2. Remove timing chain and sprockets.
3. Remove valve lifters.
4. Remove distributor.
5. Remove distributor drive gear.
6. Slide camshaft forward carefully until it is out of engine.

NOTE—A special Camshaft Bearing Removing and Replacing Tool No. J-3063 is available to remove and install these bearings all at the same time. To install the camshaft, proceed as follows:
1. Lower the camshaft into position between the radiator grille and engine and guide it carefully into cylinder block. Extreme care should be used not to nick or scratch camshaft bushings.
2. Install timing chain and sprockets.
3. Install hood lock plate support and radiator core.

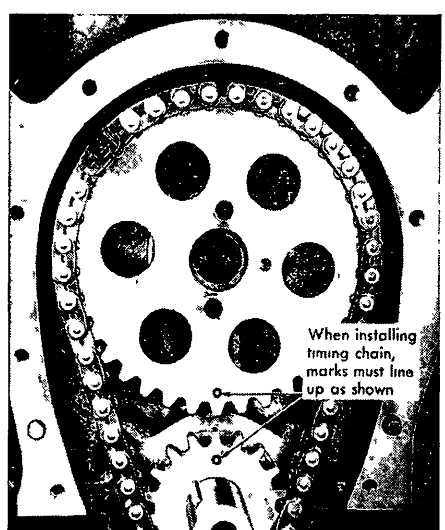


Fig. 11 Sh wing timing marks lined up f r c rr ct valv timing on 1949-52 engin s

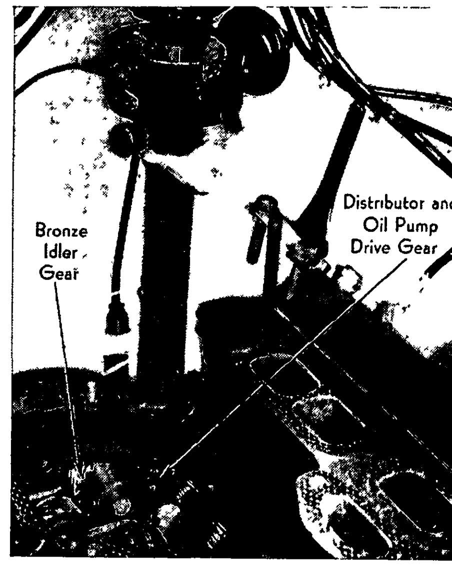


Fig. 10 Distribut r and il pump drive, 1936-48 V8

4. Install and adjust generator drive belt.
5. Install distributor drive gear over oil pump drive shaft with flat on gear engaged with flat on shaft. Be sure No. 1 piston is on top dead center and ready to fire. The timing mark "C" on the vibration damper should line up with the pointer on the timing case cover. Turn oil pump drive shaft until flat is on right side and in line with longitudinal centerline of engine.
6. Lower drive gear until it is fully meshed with camshaft gear. When the gear is installed, the slot in the stop of the gear will point about 15 degrees to the right of the engine centerline. The gear must be installed in this manner or it will be impossible to time the engine. Check the drive gear to see that it seats freely and that it has a slight amount of backlash with the camshaft gear.
7. Install the distributor, turning the rotor until the tongue on the distributor shaft lines up with the slot in the distributor drive gear. Clamp distributor in place and install hydraulic valve lifters.

1935-36 La Salle; 1935 Cadillac V8—The camshaft may be withdrawn after the timing case cover, valve lifters and brackets are removed. To prevent binding and noisy operation, be sure to install the lifters and brackets in their original position.

1935-37 V12 & V16 — The camshaft in these engines may be withdrawn in the conventional manner but it is also necessary to remove the vacuum pump and distributor drive shaft before the camshaft can be taken out.

PISTONS & RODS, REMOVE

1935-52—After removing the cylinder head, examine the cylinder bores above the ring travel area. If bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove connecting rod caps and push

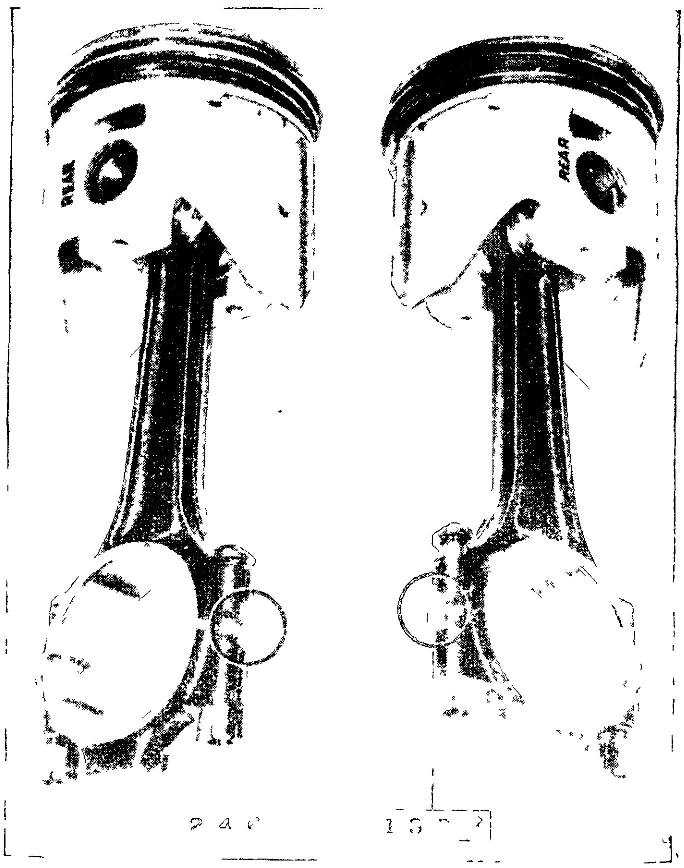


Fig. 12 1949-52 c nn cting r ds and pist ns

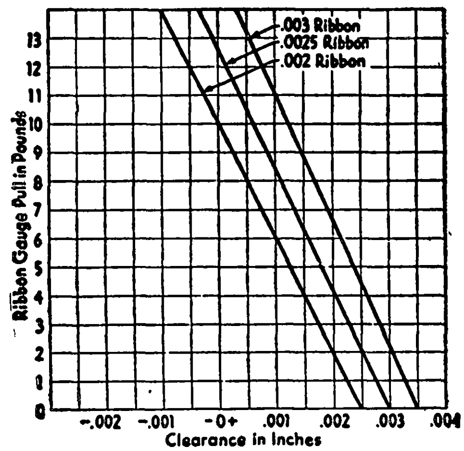


Fig. 13 Piston clearanc chart, 1935-52

the pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure that rods and pistons are properly numbered so that they can be reinstalled in original locations. It is advisable to install the caps on the rods to avoid mixing parts.

PISTONS & RODS, INSTALL

1936-48—The T-slot side of the piston should be toward the left-hand side of the engine, viewed from the driver's seat. This applies to 1936-48 V8s and 1938-40 V16s. On 1935-36 La Salle the oil spurt hole in the connecting rod must face toward the camshaft.

1949-52—Assemble and install piston and rod assemblies as shown in Fig. 12.

PISTONS

1935-52—Service replacement pistons are furnished by Cadillac in standard sizes and .010, .020 and .030 in. oversizes, with rings and pins fitted.

Before ordering pistons for replacement, it is extremely important to determine the size of the cylinder bores by actual measurement. Actual measurement at the time of replacement is the only certain way to avoid errors.

Where no micrometer or dial gauge is available to measure piston clearance, the use of a feeler gauge will serve satisfactorily as there is a definite relation between feeler gauge pull in pounds and micrometer clearance in thousandths of inches, as shown in Fig. 13, which is set up for .002, .0025 and .003 in. feeler gauge thickness.

In order to obtain the piston clearance at the upper end of the skirt, it is necessary to insert the piston into its upper extreme position, along with the feeler ribbon, which must be kept located over the vertical slot and not in excess of ½ in. below the upper end of the skirt as shown in Fig. 14. It is advisable to mark the feeler ribbon adjacent to the piston head so that its proper location on the piston can be maintained. When the proper clearance is established, it should require the amount of pounds pull on the scale shown in Fig. 13 to withdraw the feeler, depending upon the thickness of the feeler ribbon being used.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin (thrust side of piston). Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is important that refinished cylinder bores are trued up to have not over .0007 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must washed to remove all traces of abrasive and then dried thoroughly. The dry bore should be brushed clean with a power-driven fiber brush. If all traces of abrasive are not removed, rapid wear of new pistons and rings will result.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore; therefore the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees F. between parts is sufficient to produce a variation of .0005 in.

PISTON RINGS

1935-52—When new piston rings are installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bores' diameter. This is done with a "Glaze-buster" or with a hone equipped with the finest grade of stones.

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of new rings and ring clearances will be excessive.. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston and Ring Data* chart for ring groove clearances and end gap clearances.

To check the end gaps of piston rings, place the ring in the cylinder in which it will be used. Square it in the bore by tapping with the lower end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends of the ring carefully with a smooth file.

PISTON PINS

1935 All; 1936 La Salle; 1936-37 V12, V16 — To remove pins, heat the piston in boiling water and push the pin out from the locking screw side. To install, lubricate the pin with engine oil, heat the piston in boiling water and push the pin in from the side opposite the locking screw.

1936-40 V8 — To remove the pins, release the snap rings, heat the piston in boiling water and push the pin out by hand from the raised rib side of the piston pin hole boss. To install, heat the piston in boiling water and push the pin in by hand from the opposite side.

1938-40 V16 — Remove the lock screw from the connecting rod and tap a suitable spreader tool into the split. Drive the pin out of the rod and piston with a brass drift. When replacing, be sure to line up the notch in the pin with the lock screw hole in the rod.

1941-49—As these pins are fitted with a free hand push fit in both sides of the piston at normal room temperature (about 70 degrees) it is not necessary to heat the piston to remove the pin. Remove the snap rings and push the pin out by hand from either side. When replacing, install new snap rings.

1950-52—Piston pins are a matched fit with the piston and are not available separately. Piston pins are pressed in the connecting rods and will not become loose enough to cause a knock or tapping until after very high mileages. In such cases a new piston and pin assembly should be installed.

NOTE—Cadillac recommends the use of the equipment shown in Figs. 14 and 15 when necessary to install a connecting rod to a new piston and pin assembly. This method is much faster than the piston heating method—which will do an adequate job if the special equipment is not available. The special equipment is used as follows:

Removing Pin—1. Install pilot of tool on puller screw.

2. Install puller screw with pilot through piston and pin from side marked "REAR".
3. Install support over puller screw with small end of support against piston opposite from "REAR" on piston casting.
4. Install nut loosely on puller screw and place assembly in arbor press as shown in Fig. 14.
5. Press pin from piston and rod. Then remove assembly from press, remove tools and take piston pin from puller screw.

Installing Pin—1. Lubricate piston pin holes to make installation easier.

2. Position connecting rod in its respective piston, Fig. 12.
3. Enter pilot through piston and rod.
4. Lubricate piston pin and insert it in piston pin hole on side of piston marked "REAR".
5. Install puller screw through piston pin and pilot from side of piston marked "REAR".
6. Insert spacer between connecting rod and piston till it is seated on the pilot. Spacer must be installed between piston and rod on side opposite that marked "REAR".
7. Install support over puller screw with smaller diameter toward piston, opposite that stamped "REAR."
8. Install nut on puller screw and tighten with a torque wrench to start piston pin into connecting rod, Fig. 15. If pin can be started into rod with less than 25 lbs. ft. torque, the clearance between pin and rod is excessive and either piston and pin assembly or connecting rod must be replaced.
9. Install collar over piston pin. Press

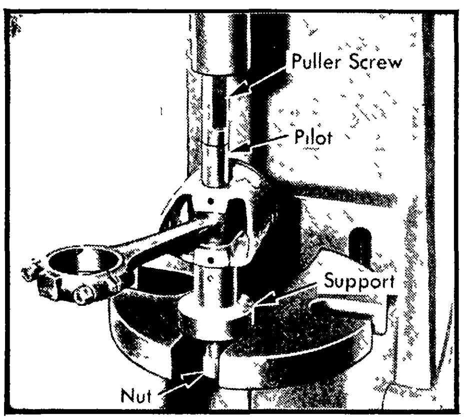


Fig. 14 Rem ving piston pin, 1950-52

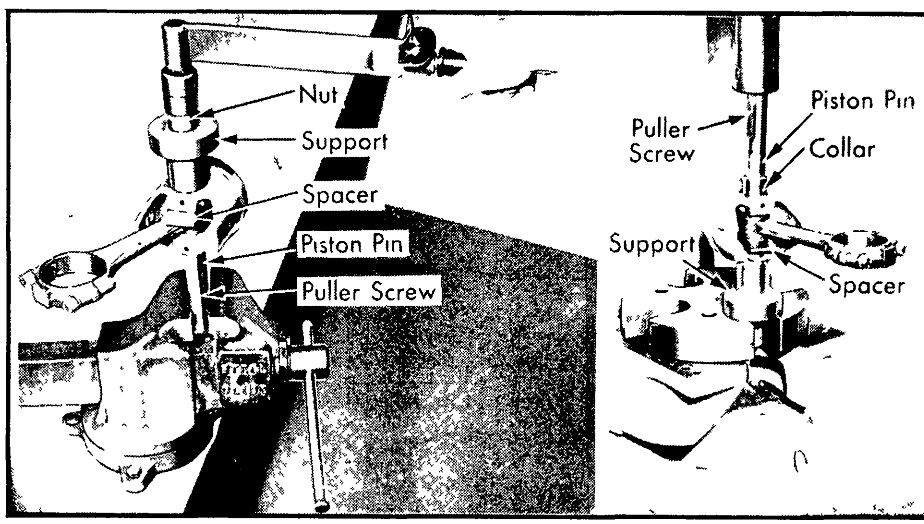


Fig. 15 Installing piston pin in piston and rod, 1950-52

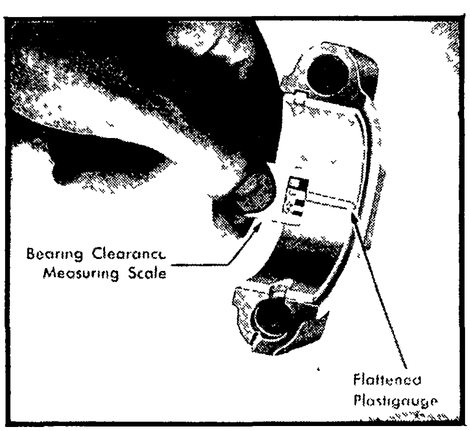


Fig. 17 Checking bearing clearanc with Plastigag , 1935-52

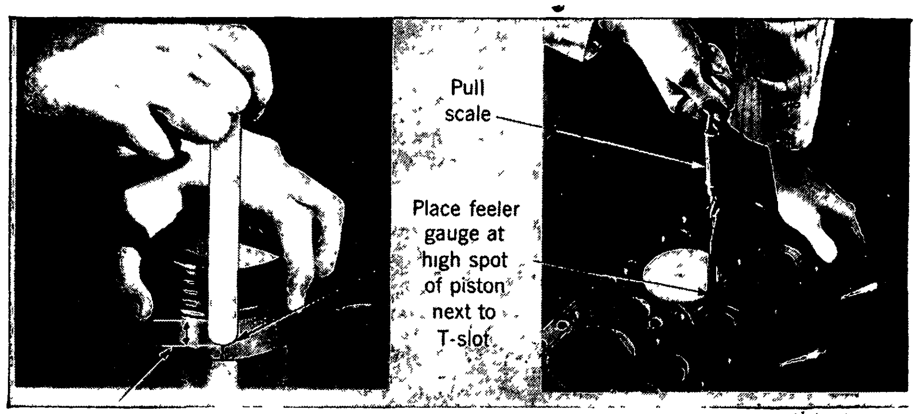


Fig. 13A Fitting pistons t cylind rs, 1936-50

puller screw down until top of pin is level with top of collar.

10. Remove collar and spacer. The pin will now project slightly from rod and this pin should be guided into the piston pin boss next to the support by hand to assure correct alignment.

11. Press piston pin in until pilot bottoms in support, properly positioning the pin in the rod.

PISTON PIN BUSHINGS

1935-49—Cadillac does not recommend replacing piston pin bushings in the connecting rods. If these are worn excessively, the complete rod assembly should be replaced.

CONNECTING ROD BEARINGS

1936-52 V8s — Connecting rod bearings are of the precision insert type, and if worn beyond .0045 in. can be replaced without removing the rod assembly by removing the cap and replacing the upper and lower halves. The clearance between the connecting rod bearing and the crankshaft can be measured by the use of Plastigage as follows:

1. Remove bearing cap and wipe oil from crankshaft journal and bearing insert.
2. With crankpin at approximately bottom dead center, place a piece of Plastigage in the center of the cap.
3. Reinstall cap and tighten to the torque value given in the *Engine Bearing Data* table.
3. Remove bearing cap and determine bearing clearance by comparing the width of the flattened Plastigage at its widest point with the graduation on the Plastigage envelope. The number within the graduation on the envelope indicates the clearance in thousandths of an inch, Fig. 17. If this clearance is greater than .0045 in., replace the bearing.

MAIN BEARINGS & CRANKSHAFT

1936-48 V8 — The crankshaft is supported by three main bearings. Main bearing caps are held in place by special cap screws and lock washers. Shell type bearings are used, and if worn more than .005 inch should be replaced. No attempt should be made to shim, file or otherwise take up worn bearings. To install new bearings:

1. Remove cap and take out worn lower shell.
2. Rotate crankshaft in reverse direction to turn upper shell out of crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.
3. Place a new upper shell on the crankshaft journal, with the locating lug in the correct position, and rotate the shaft to turn the shell in place.
4. Install the lower shell in the cap and install the cap. Always use new cork plugs in the grooves at the sides of the rear bearing cap to prevent oil leaks. Grease the plugs to make installation easier.

1949-52—Shell type bearings are used. The front four bearings are interchangeable journal to journal and upper and lower halves are also interchangaable.

Bearings worn more than .005 in. should be replaced. Bearing wear can best be measured by the use of Plastigage as explained for connecting rod bearings. When one main bearing is being checked the other four caps should be tight unless the engine is out of the chassis and upside down.

Fig. 18 Installing rear main bearing oil seal in 1949-52 engines

NOTE—New bearings may be installed in the same manner as outlined for previous models. Each bearing cap is numbered on the left side starting from the front. Do not mis-match these caps or turn them around because they are individually matched when the cylinder block is machined. Casting numbers on the caps are read from the rear of the engine.

CRANKSHAFT END THRUST

1935-48 — On La Salle 1935-36 engines, end thrust is controlled by means of a flange on the upper half of the front main bearing, and by a steel washer in back of the crankshaft sprocket.

On all V-type engines, end thrust is taken at the center main bearing. If end play exceeds the limits as given in the *Engine Bearing Table,* replace the center main bearing shells.

1949-52—Crankshaft end thrust is taken on the rear main bearing. If end play is in excess of the limits given in the *Engine Bearing Data* table, replace the rear main bearing shells.

REAR MAIN BEARING OIL SEAL

1935-48—When installing the rear main bearing cap, new plugs should be inserted in the grooves in the sides of the bearing cap to prevent oil leaks at this point. Grease the plugs liberally to facilitate their installation.

On all 1938-48 engines, packing is also used in the crankcase and rear main bearing cap. To install new packing, remove the crankshaft and take out all the old packing. To avoid damaging the rear main bearing shells, remove them also. Install a length of the packing in the groove of the crankcase and use a suitable oil seal compressor to drive the packing tightly into the groove, tapping the handle of the tool with a hammer. With the tool held in this position, cut off each end of the packing flush with the edge of the bearing. Repeat the operation in the bearing cap. The packing must fill the grooves entirely and must not be cut too short, otherwise a leak will develop.

1949-52—The oil seal corks used in previous engines have been eliminated from the side of the bearing cap because of the oil pan gasket arrangement. Packing is used in the groove in the crankcase and in the bearing cap and is installed in the same manner as described for previous engines, Fig. 18.

ENGINE OILING

OIL PAN

1935-48—Whenever the oil pan is removed, it should be cleaned thoroughly. This applies as well to the oil float, screen and tube, being sure that all openings in the screen are free and clean. If the screen has been crushed, it is better to replace it rather than attempt to make a repair.

1949-52—To remove the pan, proceed as follows:

1. Remove cross-under pipe (1949-51) and heat control valve.
3. Take off starter and place on frame side bar.
4. Remove two nuts and 18 screws which hold pan to cylinder block.
5. Remove gaskets from sides of pan, rear main bearing cap and front cover.

To install the pan:

1. Install new cork seals in rear main bearing cap and in front cover, being sure ends of gaskets are in recesses provided for them.
2. Cement pan gaskets to both sides of pan, lining up holes in gasket with those in pan.
3. Place a small amount of chassis grease on each of the four corners of the pan gasket which hang over the front and rear cut-outs which will permit the pan gasket to slide over the corks and insure a good seal.
4. Place pan in position on block over the two studs on the left side first and then press right side into position.
5. Install two screws on right side opposite the two studs but do not tighten down.
6. Install two washers and nuts on studs.
7. Install remaining screws and tighten in rotation 7 to 10 lbs. ft. torque.
8. Install oil level indicator.

OIL PUMP

1936-52 V8s—To remove the pump, drain engine oil and remove oil pan. Unfasten pump from engine and disassemble as follows:

1. Remove oil pump float.
2. Remove oil pressure regulator valve and spring from pump body.
3. Remove pump bottom cover.
4. Slide idler gear out of pump body.
5. Remove pin from collar on end of drive shaft and press collar off of shaft.
6. Slide oil pump drive gear out of pump body.

Inspect strainer screen for dirt and float for leaks. Look for nicks or burrs or nicks on pressure regulator valve which might cause leaks or binding in pump body. Inspect pump gears for nicks and burrs. Inspect bottom cover

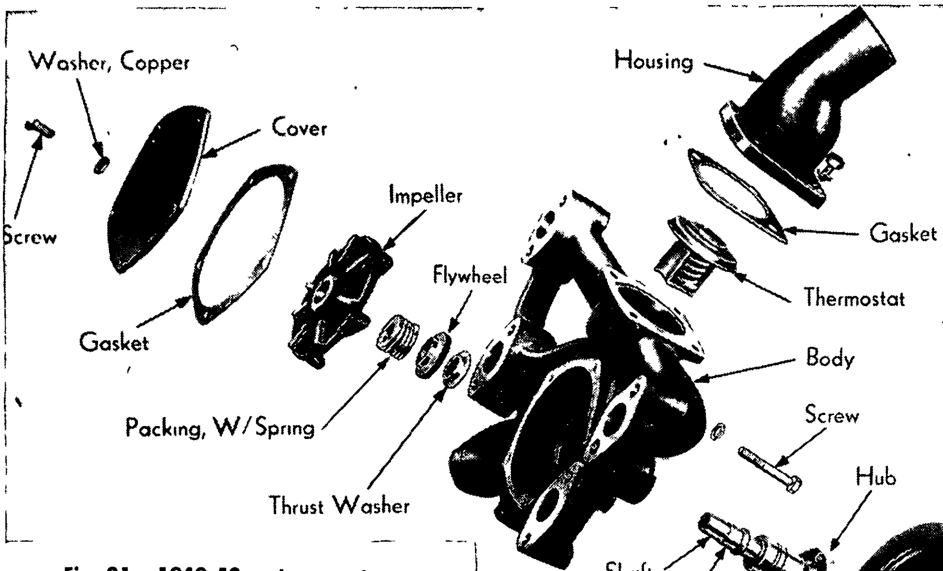


Fig. 21 1949-52 water pump and thermostaat

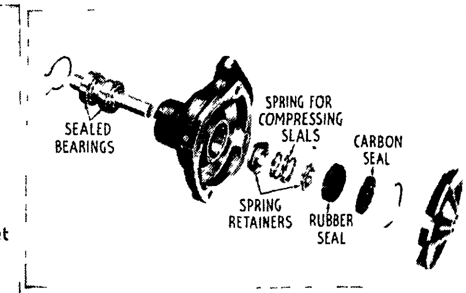
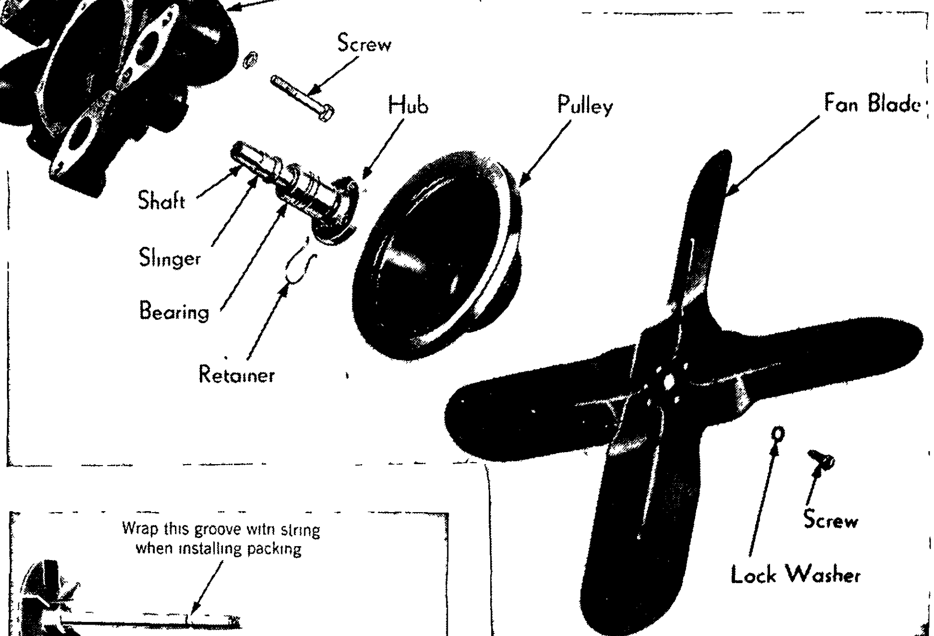


Fig. 20 Water pump on 1938-40 V16



for wear and dress down on a surface plate if necessary. Place bottom cover on pump and check drive shaft end play. If end play exceeds .006 in., replace drive and idler gears. Assemble and install oil pump in the reverse order of its removal and disassembly.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-36 La Salle—The core may be removed without disturbing the radiator shell. Remove the hood, radiator brace rods, air cleaner, water pump and thermostat unit. Loosen the radiator core from its mounting. Loosen the shell and the lower hose connection, then carefully lift the core out over the engine.

1936 Cadillac—Remove the hood and loosen the tie rods and turn them up out of the way. Take off the radiator grille. Disconnect the headlamp wires and draw the cables out from between the core and shell. Remove the shell from the fenders and core. Unfasten the bolts from the fender braces and the radiator hold-down nut from the bottom of the radiator support. Disconnect the hose connections and lift the core, together with the radiator shutter, up enough to clear the overhang of the fenders. Disassemble the shutters from the core.

1937 (Except 37-90)—The core can be removed without taking off the shell and grille. However, in order to avoid damaging the core remove the complete fan assembly. On La Salle cars, there are two brace rods which extend from the sides of the shell to the underside of the top tank which must be taken off. On Cadillac V12's, unfasten the horn assembly and ignition coils; also remove the temperature gauge bulb from its fitting in the top tank.

1937 V16—It is recommended that this operation be performed by removing the radiator and front fenders as a unit.

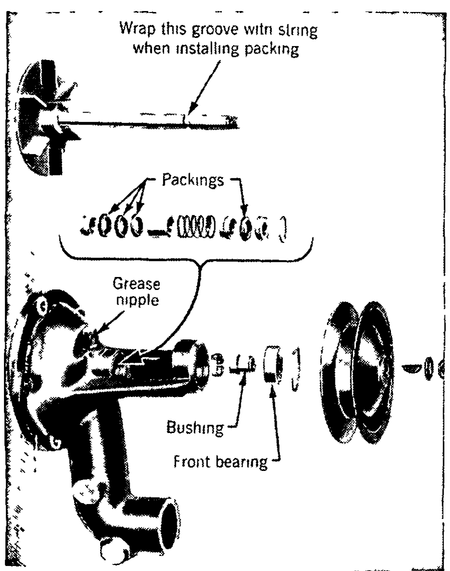


Fig. 19 Water pump. Typical of all 1936-48 V8

When this is done, disconnect the core from the shell. When installing the assembly, replace all the attaching bolts and screws loosely, and after the hood is properly aligned, tighten them securely.

1938-40—To remove the core, drain the radiator and remove the water hose and radiator tie rods. Disconnect the thermostat to shutter rod at the thermostat. Take off the ignition coils on the V-16's. On all models, remove air cleaner, generator and fan. Disconnect the headlamp wiring at the terminal block on the right fender. Loosen the headlamp harness clinch straps on the radiator and remove the harness. Disconnect the core from the cradle and lift out the core assembly.

1941-48—To remove the core, drain radiator and remove hoses, air cleaner and fan. Disconnect the core from its cradle, and lift out the core.

1949-52—Drain radiator and remove upper and lower hose. Remove capscrews holding radiator to support. Remove radiator anchor nut and spacers at frame bracket. Be sure to check the number of spacers removed and reinstall the same amount. Lift out radiator.

When radiator is installed, check space between radiator core and fan blade. This should be ½ to 1 inch and is important for efficient fan operation.

WATER PUMP

1935-36 La Salle—Remove the back cover and press the shaft out of the impeller through the front of the housing. Unscrew the packing nut and take out the packing. Press the front bushing out forward and the rear bushing out rearward.

NOTE—Removing and installing these

bushings, including the burnishing of new bushings, can best be accomplished by using Tool No, 7-830.

1935 Cadillac V-8 — After removing the shaft and impeller, the inner bushing can be removed by tapping a thread into the bushing and pulling it out with a bolt screwed into the thread. When installed, the bushings should be line reamed. To prevent a scored shaft, do not tighten the packing nut with extreme force.

1935-37 V12 & V16's—The pump shaft is mounted on two oilite bushings and has automatically adjusted packings of the chevron type, held compressed by a spring. A snap ring is used at the outer end of the shaft to hold the assembly together.

1936-48 V8—Fig. 19.—Take off the pulley and remove the snap ring which retains the front bearing. Push the shaft to the rear and take out the split washer in back of the front bearing. Remove the lock ring at the front end of the rear bushing and take out the shaft and impeller. Push the rear bushing and related parts out toward the front, carefully noting their arrangement. Force the front bearing with its bushing out toward the front.

Assemble in the reverse order, but when replacing the packings on the shaft, wind the string around the recess near the end of the shaft so that a smooth surface will be provided on which to slide the packings. Coat the packings with water pump grease before installing. The grooved side of the rear bushing should be toward the rear packing.

1938-40 V16—Fig. 20.—After removing the pulley, support the pulley drive flange in an arbor press and press the pump shaft out of the flange. Remove the front bearing lock ring, and while supporting the front end of the pump housing, press the shaft out of the impeller. Take out the rear lock ring and push out the carbon ring, rubber seal, spring and retainers, noting carefully the arrangement of these parts so assembly may be made correctly.

Assemble in the reverse order, but apply a light coating of water pump grease on the contact surfaces of the rubber seal and on the carbon ring which rides on the impeller.

When the pump is assembled, the clearance between the forward face of the impeller and the pump housing should not be less than .015" nor more than .025".

NOTE — A new or rebuilt pump may leak slightly until the carbon ring seats on the face of the impeller.

1949-52—The water pump, thermostat housing and fan hub assembly can be removed as a unit. When disassembling the pump, Fig. 21, note that the thermostat is installed with the element downward and that the jiggle valve on the thermostat hangs open, thus making it easier to fill the radiator.

To disassemble, remove the thermostat housing and lift the thermostat from the pump body. Remove the pulley, and take the bearing retainer ring from the pump body. Be careful not to compress the retainer too far as this will

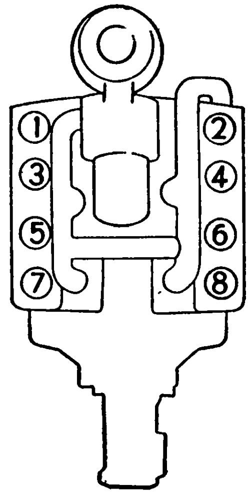


Fig. 22 Cylinder numbering, 1936-48 V8

weaken it and possibly allow the ring to come out.

Take off the cover plate. Press the shaft, bearing, hub and slinger out of the impeller and pump body toward the fan pulley end. Remove the impeller from the body, and take out the wear washer, spring and seal from the body.

It should be noted that the wear washer contacts the pump body. It is extremely important that the face in the pump body that contacts this wear washer be free from nicks, burrs or ridges. A tool for refinishing this seat is available and must be used every time a new seal is installed.

Note, also, that a permanently sealed bearing is used at the front end of the pump body and is retained by a wire retaining ring. The bellows type seal that slides over the water pump shaft holds the wear washer against the pump body. This is held in position when the impeller is pressed on the rear end of the pump shaft.

To assemble the pump, press the shaft bearing hub and slinger assembly into the body, making sure it is pressed against the end of the bearing bore in the body. Assemble the wear washer and seal over the driving lugs of the slinger from the rear side of the pump. It is important that the wear washer slides freely on the driving lug of the slinger, as any bind here will cause a leak.

Press the impeller on the shaft until the back of the impeller is .005 to .010" inside the cover face of the body but still does not touch the inner face. Be sure to support the opposite end of the shaft when pressing on the impeller to prevent damage to the housing and bearing.

ELECTRIC SYSTEM

IGNITION TIMING

1935 La Salle Before Engine No. 30-3608 —With the spark control dash button pushed in for full advance and with No. 1 piston nearing the end of its compression stroke, the stationary breaker points should open when the IGA mark on the crankshaft pulley lines up with the pointer on the chain case cover. The adjustable points should open when the IGA-6 mark, a quarter-revolution from the IGA mark, lines up with the pointer.

1935 La Salle After Engine No. 30-3608, 1936 La Salle—An eight-lobe cam and a single breaker arm are used. With the octane selector set at O, the points should break when the IGA mark on the crankshaft pulley lines up with the pointer on the timing case cover.

1935 Cadillac V8—As viewed from the driver's seat, cylinder number one is the right front cylinder and the left front cylinder is number two. The cylinders in the left block are even-numbered while those in the right block are odd-numbered.

Two distributor breaker arms, a four-lobe cam and a single ignition coil are used. There is no manual spark control. With No. 1 piston in the right bank nearing the end of its compression stroke, the stationary breaker points should open when the IG/A mark, 4 degrees or a ½" ahead of the TDC mark on the flywheel, lines up with the pointer on the opening in the flywheel housing. Then crank the engine a ¼-turn until the IG/A mark for cylinder 2 and 5 registers with the pointer. At this position, the adjustable points should break.

1936-48 V8's — As viewed from the driver's seat, cylinder number one is the left front cylinder, Fig. 22, and the right front cylinder is number two.

To set the ignition timing, adjust the breaker gap to the clearance given in the *Tune Up Chart,* and on cars with an octane selector, set the pointer at O. Disconnect the vacuum advance line at the distributor and loosen the distributor housing clamp screw. Rotate the distributor housing until the contact points just separate, when the IG/A mark on the vibration damper or timing disc is opposite the pointer on the timing case cover, and the rotor lines up with No. 1 insert in the distributor cap. Hold the cam against distributor rotation and tighten the distributor housing clamp screw, being sure the distributor does not rotate during the tightening process. (see Fig. 23).

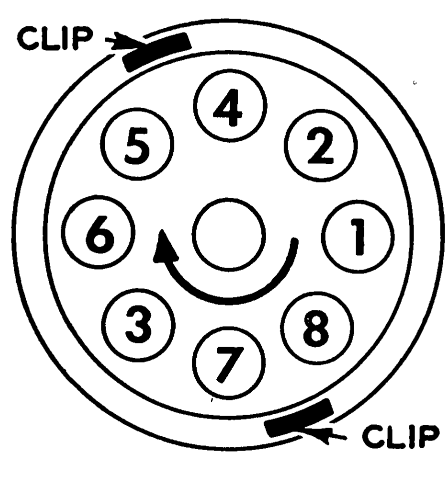


Fig. 23 Diagram f 1936-48 V8 distribut r cap sh wing firing rder, directi n of r tati n and l cati n f cap clips

1936-37 V12's — As viewed from the driver's seat, the left front cylinder is number one and the right front cylinder is number two All right-hand cylinders are even-numbered while left-hand cylinders are odd-numbered

A six-lobe cam and two breakers, each working through its own coil, are used One end of a double-arm rotor distributes current to the left bank of cylinders and the other end supplies the right bank The latter end is connected to the center terminal of the distributor, while the former is in contact with an off-center terminal

With No 1 piston in the left bank nearing the end of its compression stroke, the stationary breaker points should open when the IG/A mark, 4 degrees or 1½ inches ahead of the C1/II mark on the flywheel lines up with the pointer in the opening in the flywheel housing

Loosen the cam locking screw and turn the cam until the stationary points just break, after which, tighten the locking screw Crank the engine until the next IG/A flywheel mark, for cylinders 4 and 10, registers with the pointer In this position, the adjustable points should just break

1935-37 V16's — Right cylinders have even numbers and left cylinders have odd numbers, number one cylinder being the front left cylinder

An eight-lobe cam and two sets of breaker points, each working through its own coil, are used Otherwise the ignition system is the same as is used in the V12's, ignition is timed in the same manner except that the IG/A mark which is used for the stationary points is 4 degrees or 1½ inches ahead of the C1/15 mark on the flywheel The IG/A mark for the adjustable points is for cylinders 8 and 10

1938-40 V16's—Two coils, two condensers and two distributors are used Two breaker arms and an eight-lobe cam, Fig 24, located in the left-hand distributor housing operate for both banks of cylinders The two breakers are separate electrically The right-hand distributor contains no breaker, but has a rotor for

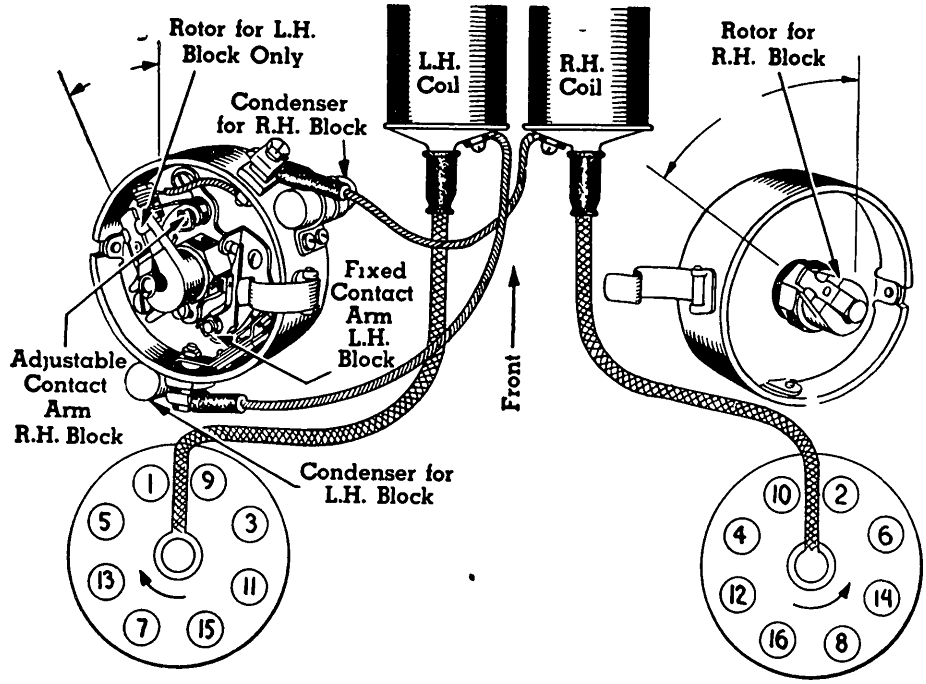


Fig. 24 Ignition circuit, 1938-40 V16

distributing the high-tension current to the spark plugs in the right bank of cylinders The two distributor shafts are driven by the same gear on the camshaft and rotate in opposite directions The left-hand distributor turns clockwise, the right-hand unit counter-clockwise, viewed from above

Adjust the distributor housing so the stationary points break for No 1 cylinder when the IG/A mark on the vibration damper aligns with the pointer Adjust the movable points to break for No 4 cylinder when the IG/A mark for that cylinder lines up with the pointer The points break at equally-spaced intervals of 45 degrees crankshaft travel Synchronize dual breakers to fire 22½ distributor degrees apart

1949-52—When setting the ignition timing the pointer should line up with the "A" mark on the vibration damper Fig 25 If spark knock occurs with the timing mark on the 'A" marking, it is probably caused by the use of regular gasoline The use of a premium fuel will very likely eliminate the knock However, if the knock still occurs with premium fuel, the timing must be retarded toward the "C" mark Then if knocking still persists, remove the cylinder heads and clean out the carbon (see Fig 26)

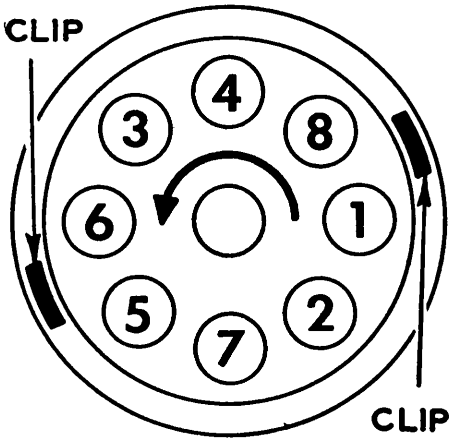


Fig. 26 Diagram f 1949-52 distribut r cap showing firing rd r, dir cti n f r tation and l cati n f cap clips

DISTRIBUTOR DRIVE SHAFT, INSTALL

1935-48 (except 1938-40 V16's)—On the V12's and V16's, remove the fuel pump before removing the distributor drive shaft On all models, turn the crankshaft to the firing position for No 1 cylinder On the V8's, mesh the gears so that the slot in the upper end of the distributor shaft is toward the rear In other words, the narrow part of the shaft, beside the slot should be to the rear

On the V12 and V16, mesh the gears so that the slot in the upper end of the distributor shaft is toward the front, or in other words, the narrow part of the shaft, beside the slot, is to the front

On the V8's, the oil pump shaft must be carefully aligned with the driving shaft, otherwise damage might result from pushing the pump shaft through the pump cover

1938-40 V16's—Locate the timing marks on crankshaft and camshaft, directly opposite each other Use distributor shaft setting gauge, No J-1212, and locate it in the dowel holes for the distributor support Note approximate position of pointers on the gauge Remove the gauge and install the distributor drive shafts as near the correct position as possible Check with the gauge The teeth in the distributor drive gear permit fine adjustment and it is essential to be accurate in aligning timing marks and aligning the drive shaft slots with the gauge pointers

The slots for the driving shafts are not offset Therefore it is possible to install these distributors 180 degrees out of time To install these units correctly, turn the crankshaft to the firing center for No 1 cylinder and install the distributors with the rotors pointing forward and to the left The left-hand rotor should point 38 degrees for the 38-90, and 33 degrees for the 39-90 and 40-90 The right-hand rotor should point 56 degrees for the 38-90, and 60 degrees for the 39-90 and 40-90

DISTRIBUTOR DRIVE GEAR

1949-52—The distributor drive gear and oil pump drive shaft may be removed after the intake manifold is taken off To do this, hold down on the oil pump drive shaft, Fig 27, and slide the drive gear up off the shaft The oil pump drive shaft may then be lifted out

To install the distributor and its drive gear, first install the oil pump drive

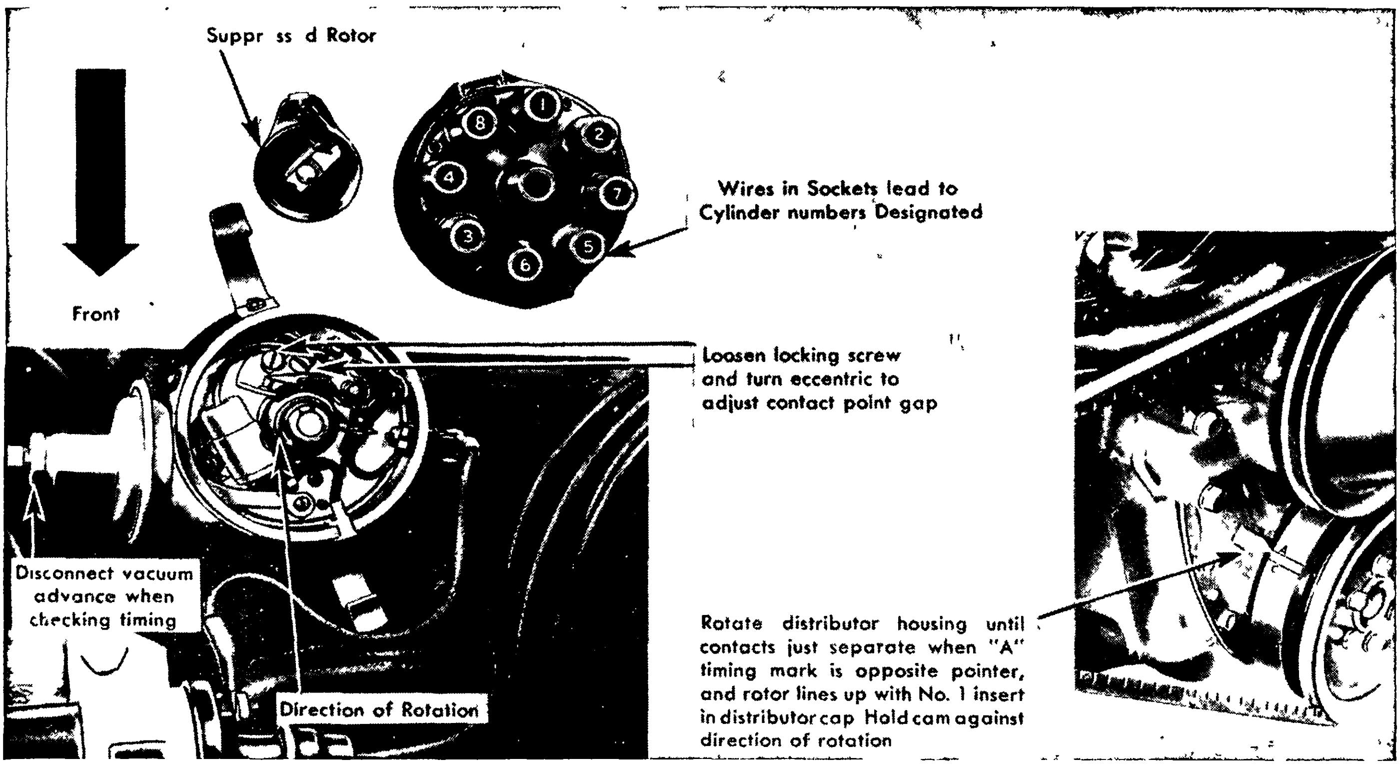


Fig. 25 Ignition timing on 1949-52 engines

shaft. Be sure the tang of the shaft is inserted into the oil pump slot, otherwise the drive gear will not seat. The shaft should be given a few turns by hand to make sure the shaft and pump right of the fore and aft centerline when are not binding. Lubricate the distributor drive gear teeth and thrust surface with engine oil before assembly (see Fig. 28).

When installing the distributor, first make sure No. 1 piston is at top dead center and ready to fire. The timing mark "C" on the vibration damper, Fig. 25, should be at the pointer. Turn the oil pump drive shaft until the flat is at the right and in line with the fore and aft centerline of the engine. Position the drive gear on the oil pump drive shaft with flats engaged. Lower the drive gear until it is fully meshed with the camshaft gear. Slots in the top of the drive gear will point about 15 degrees to the gear is fully meshed. It will be impossible to time the engine unless the gear is installed exactly this way. Be sure the gear seats freely and that there is a slight amount of backlash with the camshaft gear.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-36 La Salle—Clutch pedal free play should be from ⅞ to 1⅛ inches. To adjust, loosen lock nut and turn stop screw at lower end of pedal.

1935 Cadillac — To adjust, alter the length of the release rod to bring pedal free play to 1¼ to 1½ inches.

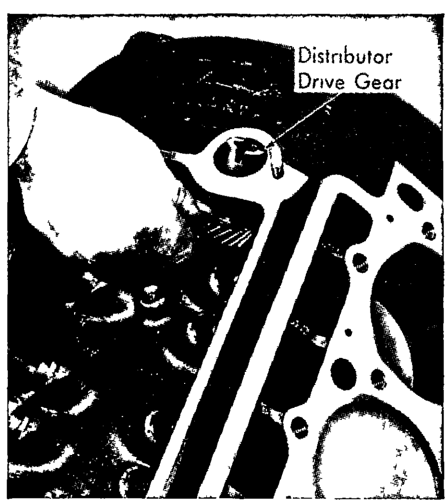


Fig. 27 Removing distributor drive gear from 1949-52 engines

1936-52 (Except 36-50) — Clutch pedal free play should be from ⅞ to 1⅛ inches and is adjusted by turning the adjusting nut on the release rod which is attached to the clutch release lever.

CLUTCH REMOVAL

1936-52 V8; 1938-40 V16—

1. Remove transmission, starter motor and lower flywheel housing.
2. Unfasten release yoke rod from release yoke.
3. Remove flywheel housing with clutch release yoke, bearing and bearing retainer.
4. Punchmark flywheel and clutch cover for correct location when assembling.

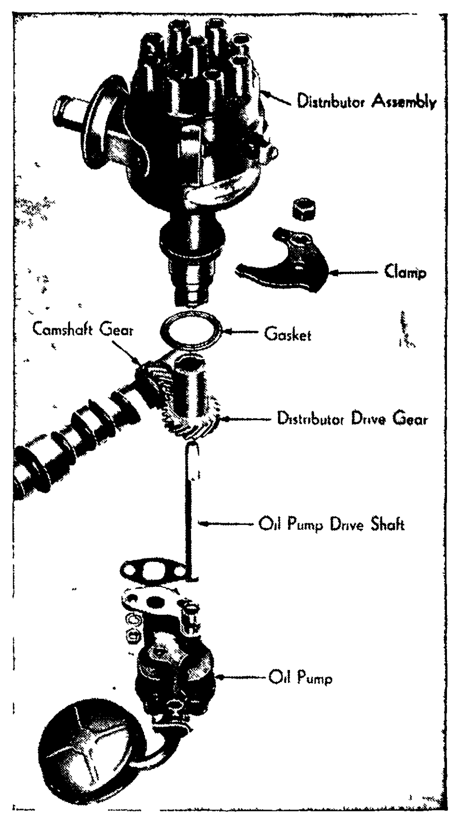


Fig. 28 1949-52 il pump and distribut r

5. Loosen retaining screws that hold clutch on flywheel a turn or two at a time until spring pressure is fully released.
6. After screws are removed, lift clutch and driven disc from flywheel.

TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1935-36—After removing floor boards:

1. Disconnect speedometer cable and drop rear propeller shaft.
2. Remove transmission rear support cross member (Cadillac only).
3. Remove front universal and propeller shaft.
4. Disconnect clutch release mechanism (not on 36-60).
5. Remove two upper mounting bolts and insert guide studs in their place.
6. Remove all other mounting bolts and slide transmission back and out.

Install in reverse order, being sure to use guide studs to guide transmission in safely.

1937 (Except V16) — After removing floor boards:

1. Support rear of engine with a jack.
2. Disconnect propeller shaft and transmission support.
3. Detach engine support stabilizer from right side of transmission by removing pin at forward end (not on 37-50, 60).
4. Unfasten exhaust pipe brace from transmission.
5. Remove transmission support cross member.
6. Disconnect speedometer cable.
7. Remove two upper mounting bolts and insert guide studs in their place.
8. Remove all other bolts and slide transmission back and out.

Replace in reverse order, using the guide studs to guide the transmission in safely.

1937 V16—After removing floor boards:

1. Drop propeller shaft and universals.
2. Remove starting motor.
3. Unbolt transmission support cross member.
4. Disconnect clutch release yoke.
5. Remove front propeller shaft and housing.
6. Insert guide studs in holes provided.
7. Remove mounting bolts and slide transmission back and out.

Install in reverse order.

1938-52—Without removing floor boards:

1. Support rear of engine with jack.
2. Remove propeller shaft and universals.
3. Disconnect transmission support.
4. Remove transmission support cross member.
5. Unfasten shift rods from transmission levers.
6. Insert guide studs in upper mounting holes.
7. Remove other mounting bolts and slide transmission back and out.
8. Insert cork plug in drain plug hole for main drive gear bearing to prevent loss of lubricant.

Install in the reverse order, using the guide studs to guide the transmission in safely. Be sure to remove the cork plug from the main drive gear bearing drain hole before sliding the transmission in all the way.

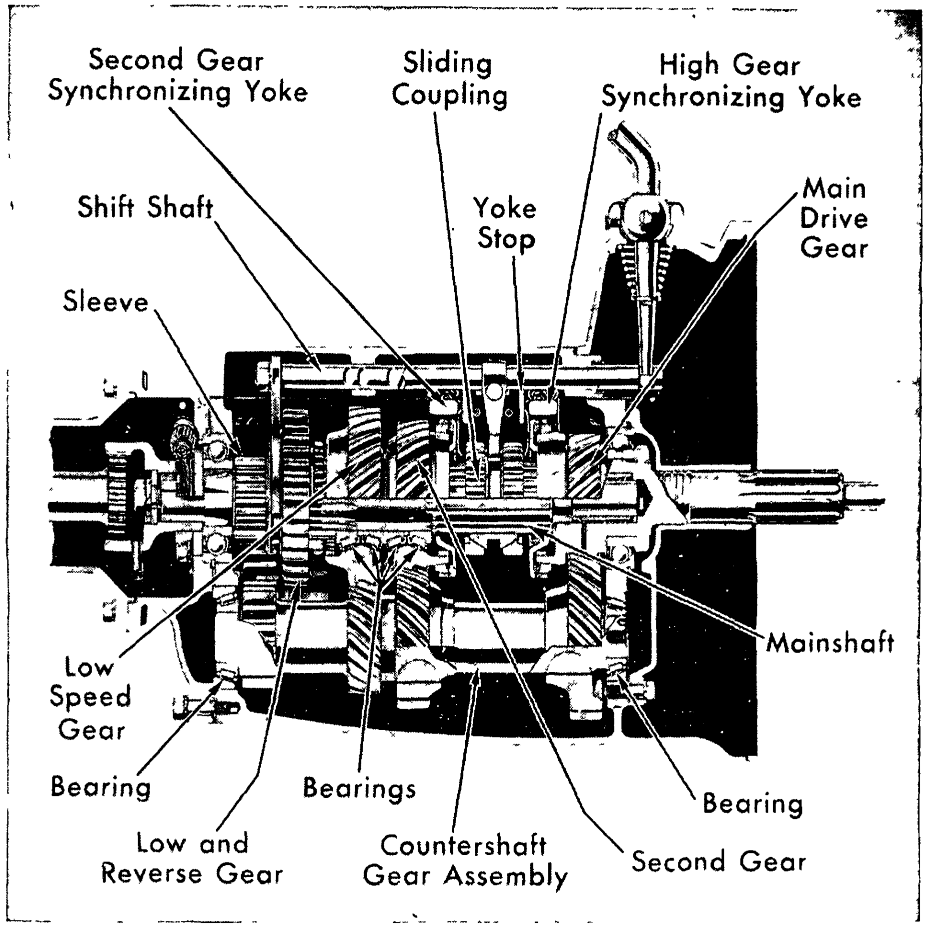


Fig. 29 Transmission. Typical of 1935 Cadillac; 1936 series, 70, 75, 80, 85, 90; 1937 V16

TRANSMISSION, OVERHAUL

1935 Cadillac; 36-70, 75, 80, 85, 90; 1937-V16—Fig. 29. After removing cover, disassemble as follows:

1. Take off yoke stop and oil trough.
2. Remove yoke adjusting quadrants, eccentrics, and yokes.
3. Detach mainshaft rear bearing retainer.
4. Remove front propeller shaft and bearing.
5. Remove front propeller shaft housing.
6. Remove speedometer driven gear and universal joint housing.
7. Loosen cap screw at end of mainshaft to remove coupling.
8. Take off idler gear cover and remove idler gear and shaft.
9. Remove countershaft bearings, which allows cluster gear to drop out of mesh with mainshaft gears.
10. Remove clutch release bearing, and drive gear bearing retainer.
11. Release snap ring and take off drive gear bearing.
12. Pull main drive gear out through front.
13. Remove rear bearing and lift mainshaft out through top.
14. Lift out cluster gear.
15. To disassemble mainshaft, pull splined sleeve together with gears and bearings from rear of shaft. Remove synchronizer mechanism from front.

ASSEMBLY NOTES — When assembling the shift yokes, measure the distance between the top of the rear yoke when in neutral and when in the rear position, to determine the clearance between the rear drum and the cone. This clearance should be $\frac{3}{32}$ to $\frac{5}{32}$ inch. Repeat this procedure with the front yoke. To increase the travel of the high gear yoke, turn the high speed adjusting quadrant clockwise; to decrease the travel, adjust the quadrant counterclockwise. Turning the second gear quadrant clockwise decreases yoke travel, and vice-versa. Quadrants must be adjusted equal amounts to avoid unequal wear.

TRANSMISSION, OVERHAUL

1935-36 La Salle; 36-60 Cadillac — **Fig. 30.** After removing cover, disassemble as follows:

1. Remove mainshaft rear bearing retainer.
2. Drive countershaft out rearward, allowing cluster gear to lie in case.

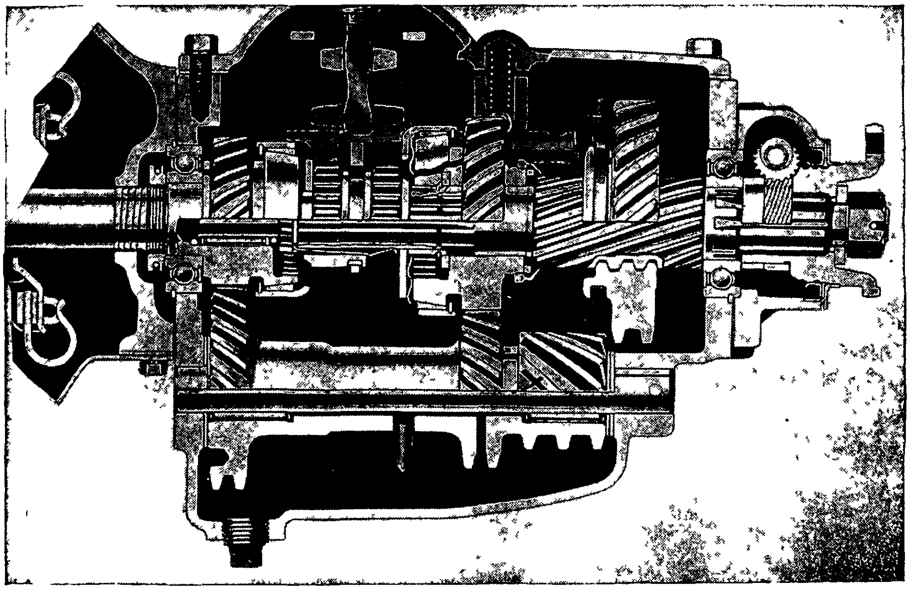


Fig. 30 Transmission 1935-36 La Salle; 36-60 Cadillac

3. Remove drive gear bearing retainer lock ring, and the snap ring from the inner circumference of the high speed drum.
4. Pull synchronizer clutch forward as far as possible but do not remove.
5. Remove mainshaft rear bearing.
6. Shift mainshaft back and lift out through top.
7. Lift main drive gear out through top.
8. Remove cluster gear with washers and bearings.
9. Remove reverse idler shaft through rear and lift gear out through top.
10. To disassemble mainshaft, remove low and reverse gear, mainshaft pilot bearing, high speed drum and sliding gear, being careful not to lose six flat springs Release snap ring and take off second speed drum. Remove snap ring and take off second speed gear.

ASSEMBLY NOTES—Allow the cluster gear to lie in the case until after the main drive gear is installed; then drive in the countershaft.

Install the long flat springs so they engage the high speed drum and the short ones so they engage the second speed drum. Be sure they are installed alternately around the mainshaft.

TRANSMISSION, OVERHAUL

1937 V8 — Fig. 31. After removing the shift lever, disassemble as follows:

1. Remove transmission extension housing.
2. Take off bottom cover.
3. Drive countershaft out rearward and lift out cluster gear.
4. Remove shift rails and forks.
5. Slide mainshaft to rear as far as possible.
6. Pull drive gear forward and remove from bottom of case.
7. Remove synchronizer, push mainshaft forward, release second gear snap ring and slide gears from mainshaft.
8. Drive reverse idler shaft out rearward and lift out gear.

Reverse the order of the above procedure to assemble.

TRANSMISSION, OVERHAUL

1938-52 — Fig. 31. After removing the transmission extension housing, disassemble as follows:

1. Remove bottom cover.
2. Drive countershaft out rearward and lift out cluster gear.
3. Pry main drive gear out through the rear and remove gears.
4. Tap mainshaft out through the rear and remove gears.
5. Tap reverse idler shaft out rearward and lift out gear.
6. Remove shifting levers on outside of case and take shift shafts out from inside, being careful not to lose the interlock springs, balls and tubes.

Assemble in the reverse order.

HYDRA-MATIC DRIVE

1941-52 — A step-by-step pictorial procedure for servicing the Hydra-Matic Drive is given in a special chapter elsewhere in this book. The following material covers external adjustments.

MANUAL CONTROL LINKAGE

1941-42—Fig. 32. To adjust the manual control lever:

1. Remove clevis pin from lower end of lower control rod.
2. Move hand control lever to reverse.
3. Move manual shift lever on transmission into reverse position.
4. Adjust length of control rod clevis so clevis pin slips in freely when shift lever is held all the way back.

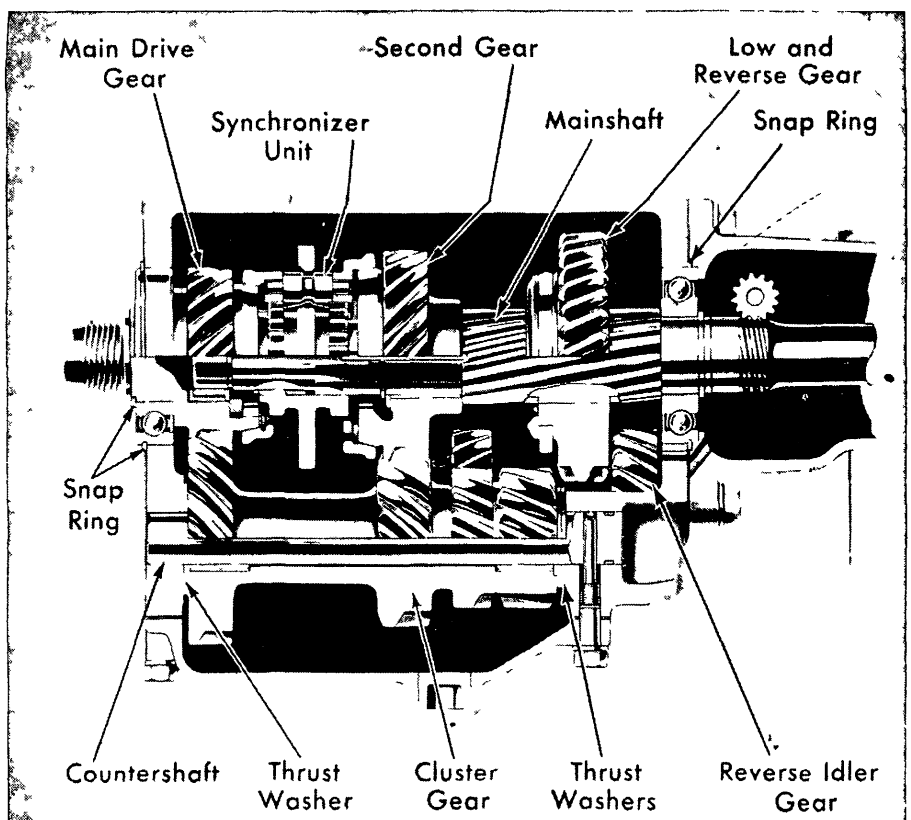


Fig. 31 Standard transmission. 1938-52
Same as 1937 except f r shifter mechanism

5. Tighten lock nut against clevis, insert cotter pin in clevis pin, and check control lever in all positions for free operation.

1946-52 — To adjust the manual control linkage, see Figs. 33 and 34.

1. Disconnect manual control rod from lever at transmission.
2. Move control lever at transmission to extreme forward and upward position.
3. Move hand lever at steering wheel against stop in neutral position.
4. Adjust clevis on lower end of control rod until clevis pin can be inserted freely through clevis and lever. Reconnect rod to lever.

THROTTLE LINKAGE

1941-42 — Before adjusting the throttle linkage, make sure the idling speed is set correctly, then proceed as follows:

1. See that throttle is completely closed against slow idle step of fast idle cam.
2. Loosen throttle rod adjusting nut at carburetor.
3. Insert a .248 inch dowel pin in the relay arm, Fig. 32, to hold rods in correct position.
4. Tighten adjusting nuts at carburetor end of throttle-to-relay rod.
5. Adjust trunnion at throttle valve rod so that pin can be installed freely when throttle lever is against stop.
6. Remove dowel from relay arm.

If these adjustments are correctly made and transmission does not shift in proper ranges, the cause is probably a bent intermediate throttle rod. Check rod against dimensions shown in Fig. 32.

1946-48—To make throttle linkage adjustments, see Fig. 33 and proceed as follows:

To adjust the throttle rod, set the engine idle at 375 R.P.M. Disconnect the throttle rod trunnion at the carburetor by removing the forward end of the retracting spring. Install the gauge pin through the hole in the upper relay and into the hole in the distributor support. Adjust the trunnion so that it slides freely into the throttle lever with the throttle valve on slow idle. Install retracting spring.

To adjust the lower relay, leave the gauge pin in place and disconnect the clevis at the throttle lever at the transmission and the lower end of the vertical rod from the upper relay. Insert another gauge pin through the hole in the lower lever and into the hole in the bell housing. Adjust the vertical rod by bending fore and aft at the original bend, taking care to preserve the original alignment.

To adjust the throttle valve lever, remove the gauge pin from the lower lever. Do not remove the pin from the distributor relay. Hold the throttle lever at the transmission against its stop toward the rear of the car and pull the lower horizontal rod back to remove all play in the linkage. Adjust the clevis

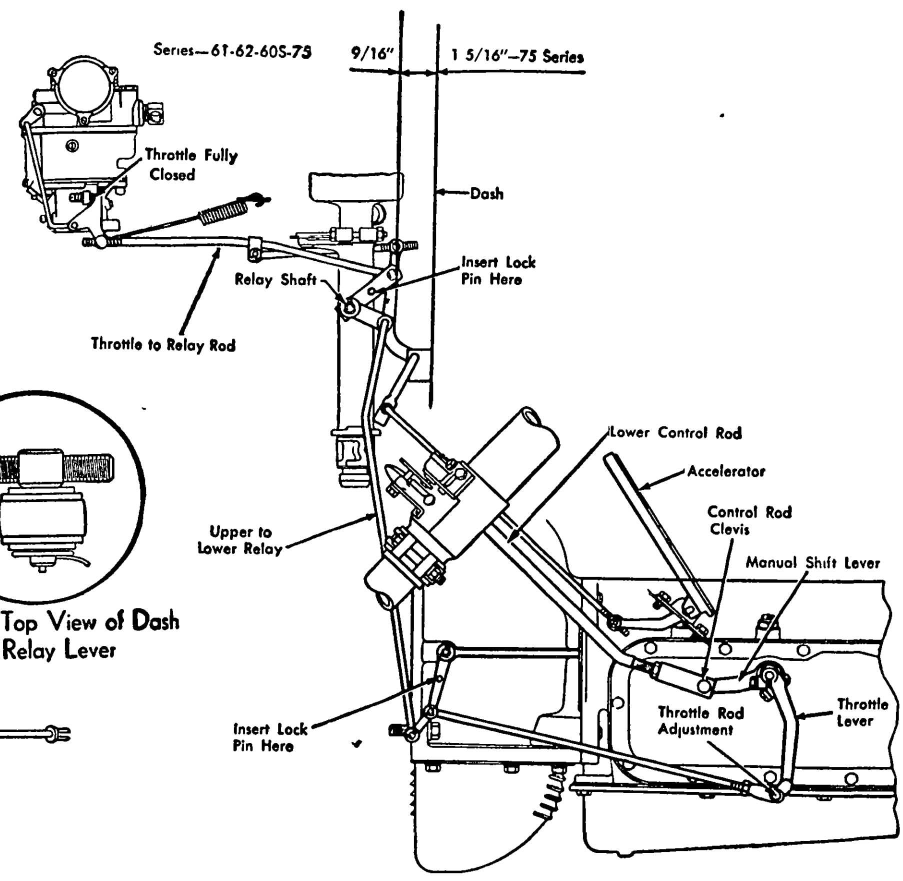


Fig. 33 Hydra-Matic manual and throttle linkage adjustments, 1946-48

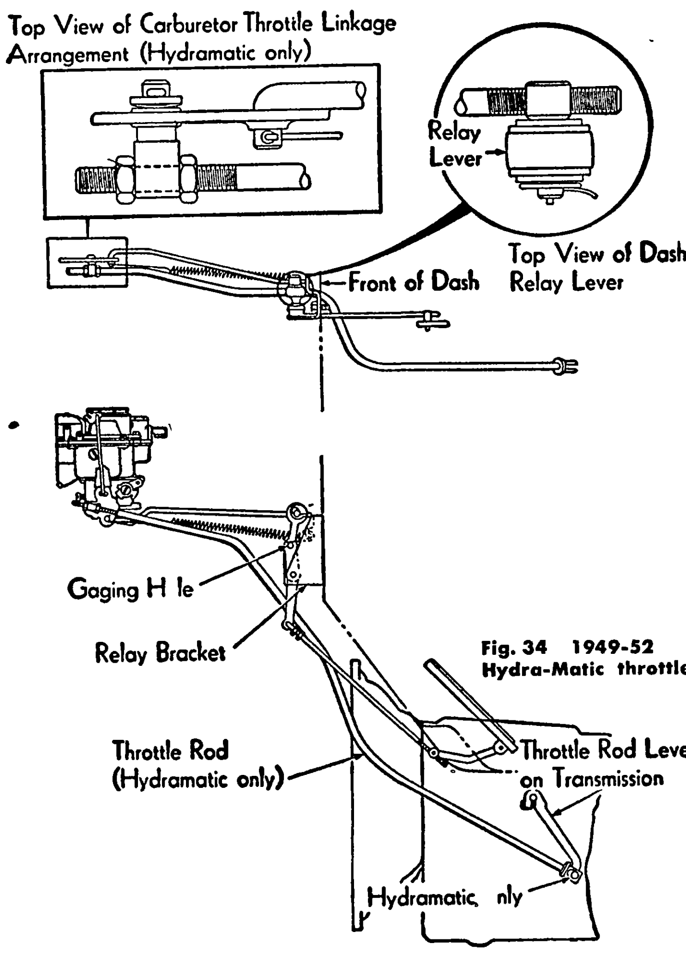


Fig. 34 1949-52 Hydra-Matic throttle linkage

so that the pin freely enters the hole in the throttle lever. Then screw the clevis three complete turns forward on the rod and connect by installing the clevis pin and cotter pin.

To adjust the relay on the dash, leave the gauge pin at the distributor relay in position. Disconnect the trunnion on the horizontal rod to dash relay upper lever and turn the trunnion until it will slide freely into the relay upper lever when the center of the hole in the upper lever is $\frac{9}{16}$ inch from the face of the dash. On 75 models, the method for

adjusting remains the same but the distance should be 1$\frac{5}{16}$ inch from the center of the hole to the face of the dash.

To adjust the accelerator pedal rod, remove the gauge pin from the upper relay. Disconnect the accelerator pedal rod at the dash relay lower lever. With the throttle rod held wide open and accellerator pedal on the floorboard, turn the rod in the trunnion until the rod slips freely into the dash relay lower lever. Recheck this adjustment to be sure that the throttle lever is against its wide open stop when the tip of the accelerator pedal is on the floorboard.

1949-52 -To adjust the throttle control linkage, Fig. 34, remove the transmission throttle lever clevis pin and check the lever position with Throttle Lever Checker Tool No. J-3065, by fitting the tool to the rear face of the transmission case and inserting the clevis pin through the lever and the hole in the tool while the lever is in its rearward position. If the throttle lever is misaligned, bring it into alignment by bending with Throttle Lever Bending Tool No. J-2029. Then adjust the throttle control as follows:

1. Assemble linkage to transmission throttle lever and install a new cotter.
2. Remove spring clip from carburetor-to-dash relay rod trunnion at relay and remove trunnion from dash relay lever.
3. Place ¼″ drill shank through hole in dash relay lever and into dash relay bracket.
4. Set carburetor throttle in hot idle position.
5. Adjust carburetor-to-dash relay rod trunnion to allow it to enter freely into dash relay lever.
6. Install spring clip in trunnion.
7. Back off both jam nuts on throttle rod on carburetor to allow free movement of rod in trunnion.
8. Push on end of throttle rod to position transmission throttle valve against its stop.
9. Bring rear jam nut up against trunnion and back off two complete turns.
10. Tighten front jam nut, making certain linkage moves freely.
11. Remove ¼″ drill shank from dash relay and check wide open throttle position of accelerator pedal. Pedal should just touch floor mat (allow ½″ clearance if mat has been removed) when throttle is wide open.
12. Adjust accelerator pedal position at pedal end of dash relay-to-accelerator pedal rod.

GEARSHIFT

SHIFTER RODS, ADJUST

1938-52 — On cars with synchromesh transmission, see Fig. 35 and adjust the shifter connecting rods as follows:

1. Place control lever in neutral.
2. Lengthen or shorten adjustable end of low and reverse connecting rod until control rod can be fitted onto low and reverse shifter lever without interference.
3. Repeat the adjustment for high and second gears.

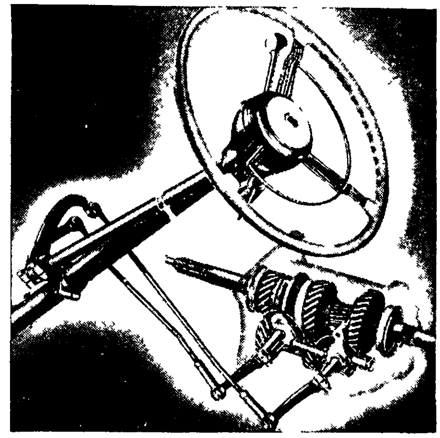


Fig. 35 Gearshift, 1938-52 cars with synchromesh transmissi n

REAR AXLE

DIFFERENTIAL CARRIER

1935-52—To remove the differential carrier assembly, disconnect the rear universal joint and remove the axle shaft as described further on. Remove the cap screws holding the carrier to the axle housing and take out the carrier.

NOTE—Any service on the differential carrier should be made by replacement of the complete assembly. Cadillac does not recommend any disassembly or adjustments of this unit.

NOTE—In case of lubricant seepage between the differential carrier and the axle housing, first make sure that the cap screws are tightened to the recommended tension of from 30 to 35 pounds feet. If this does not stop the leakage, install an extra gasket, using a good sealing compound. The additional cushioning effect of the extra gasket will prevent further seepage.

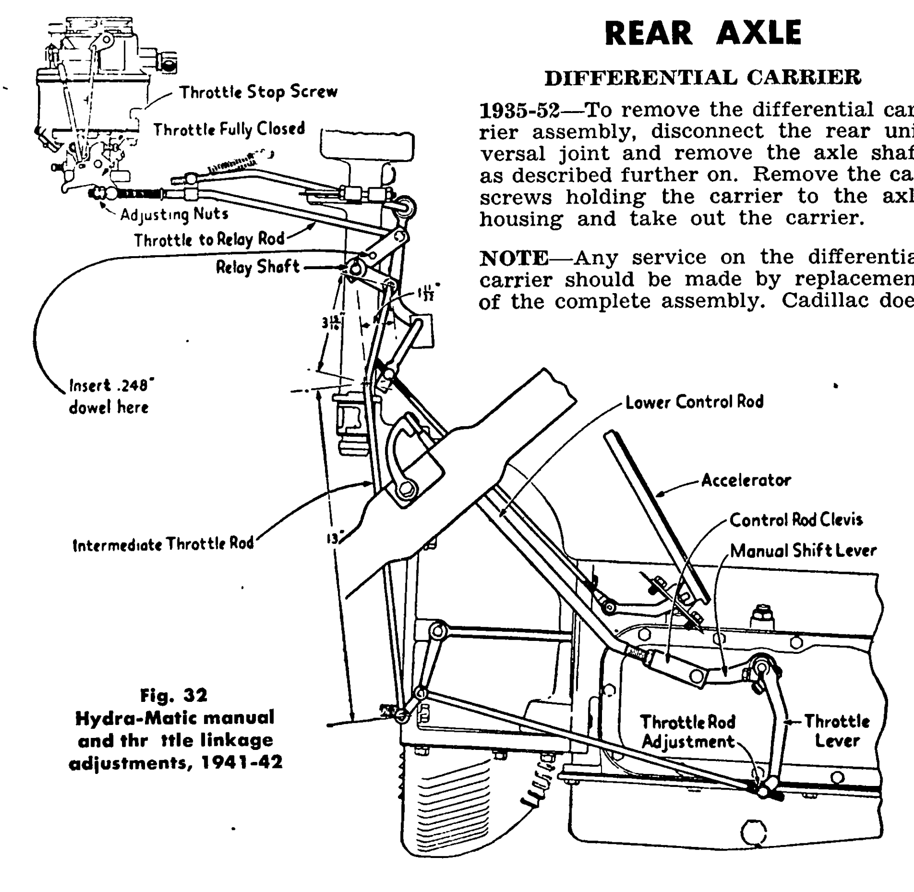


Fig. 32 Hydra-Matic manual and thr ttle linkage adjustments, 1941-42

AXLE SHAFTS, BEARINGS & OIL SEALS

1935 La Salle, 1935-52 All (Except 36-90, 37-90)—To remove an axle shaft, dismount the wheel. Use a puller to remove the hub and brake drum from the axle shaft. Disconnect the hydraulic brake line and remove the brake backing plate. The axle shaft is held in place in the housing by the backing plate which bears against the outer race of the wheel bearing. Use a puller to remove the axle shaft and bearing.

NOTE—The axle shaft oil seals are located at the outer ends of the axle tubes and may be replaced after the axle shaft and bearing are removed. However, before installing a seal, wipe the counterbore in which the seal is pressed and carefully remove any nicks or burrs. That portion of the shaft against which the seal bears should also be polished to remove any minute nicks or burrs. Never install an oil seal unless it has been thoroughly soaked in oil until its leather is soft and pliable.

1935 Cadillac, 36-90, 37-90—To remove an axle shaft, take off the hub cap and wheel. Remove the bolts from the flange of the wheel hub, after which, the axle shaft and wheel hub can be removed.

WHEEL ALIGNMENT

CASTER, ADJUST

1935 Cadillac, 36-90—Loosen the yoke on the lower suspension arm and turn the threaded pin to the right (clockwise) on the right side of the car to move the

top of the steering knuckle support toward the rear. To decrease the caster, turn the threaded pin counter-clockwise.

On the left side of the car, the caster adjusting pin is installed with its head toward the front. Therefore, the left pin must be turned to the left (counter-clockwise) to increase the caster, and to the right to decrease it.

One complete turn of the pin changes the caster ½ degree. After completing the adjustments, lock the threaded pins securely in position. Make sure that both sides have the same amount of caster.

35-50; 36-60 Before Eng. No. 6014008, 36-70; 75, 80, 85; 37-65, 70, 75, 85, 90; 38-65, 75, 90; 39-75, 90; 40-75, 90—Loosen the clamp screw at the upper end of the steering knuckle support and remove the lubrication fitting from the front bushing at the upper suspension arm. Insert an Allen wrench through the hole from which the fitting was removed and adjust the caster by turning the threaded pin until the desired caster setting is secured.

Turning the threaded pins in a clockwise direction increases caster and counter-clockwise decreases it.

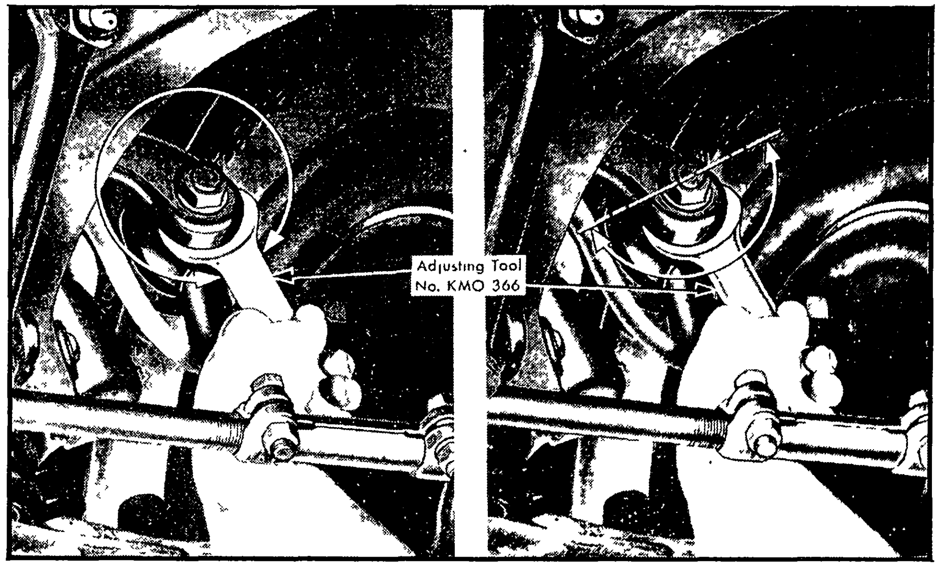


Fig. 35A Caster (left) and camber (right) adjustments, 1950-52. Procedure is the same on previous models except than an eccentric pin is used instead of an eccentric bushing

36-50; 36-60 After Eng. No. 6014008; 1937-38 Series 50, 60; 1939 Series 50, 61, 60s; 1940 Series 50, 52, 62, 60s, 72; All 1941-49—Loosen the clamp screw at the upper end of the steering knuckle support. Remove the lubrication fitting from the front bushing at the upper control arm. Insert an Allen wrench in the hole from which the fitting was removed and adjust the caster by turning the threaded pin until the desired caster is obtained.

NOTE—It is important to turn the pins in complete turns only so as not to change the camber setting. Turn the pins clockwise to increase caster, and vice versa.

1950-52—Loosen the clamp screw at the upper end of the steering knuckle support. Turn the eccentric bushing in complete turns only until correct caster angle is obtained, Fig. 35A.

If it is necessary to secure a greater range of adjustment than is provided by the eccentric bushing, this can be made by removing the lower control arm inner shaft from the frame and turning the shaft so that the threaded ends move the entire suspension arm assembly forward or rearward as required. Screwing the shaft rearward moves the control arms forward and increases the amount of positive caster.

Tighten the clamp screw on the steering knuckle support.

CAMBER, ADJUST

1935 Cadillac, 36-90 — It is only possible to decrease the camber by placing shims between the steering knuckle support yoke and the lower suspension arm. No change can be made to increase the camber at the upper end of the support or at the lower suspension arm. A $\frac{1}{16}$-inch shim changes the camber approximately ⅛ degree.

35-50; 36-60 Before Engine No. 6014008; 36-70, 75, 80, 85; 37-65; 70, 75, 85, 90; 38-65, 75, 90; 39-75, 90; 40-75, 90—Remove the retaining nut and spacers from the steering knuckle support yoke at the lower suspension arm. Remove this yoke and reinstall with spacers arranged so as to secure the correct camber.

Normally, there is one spacer between the yoke and the suspension arm, and one between the suspension arm and the retaining nut. To decrease the camber, place both spacers between the yoke and the suspension arm. To increase camber, place both spacers between the suspension arm and the retaining nut.

36-50; 36-60 After Engine No. 6014008; 1937-38 Series 50, 60; 1939 Series 50, 60s, 61; 1940 Series 50, 52, 60s, 62, 72; All 1941-49 — Loosen the clamp screw at the upper end of the steering knuckle support and remove the lubrication fitting from the front bushing at the upper support yoke. Insert an Allen wrench through the hole from which the fitting was removed and adjust the camber by turning the threaded pin until the desired adjustment is secured. Make adjustments on each side as nearly equal as possible.

NOTE — Since the camber adjustment is controlled by the eccentric action of the threaded pin, ½ turn in either direction gives the maximum adjustment.

1950-52—Loosen the clamp screw at the upper end of the steering knuckle support. Rotate the eccentric bushing, Fig. 35A, to give the correct camber setting at each front wheel.

Do not rotate the bushing more than ½ turn as this will give maximum camber adjustment at the eccentric bushing and any additional turning will affect the caster adjustment.

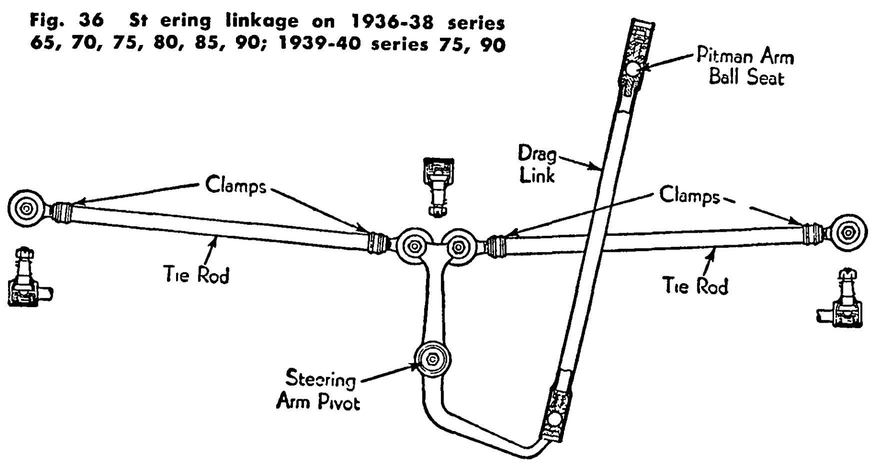
If correct camber adjustment cannot be obtained, the angle of the steering knuckle pin should be checked. An incorrect angle indicates damaged control arms or a bent steering knuckle support.

After adjustment has been made, tighten the clamp screw and recheck.

TOE-IN ADJUST

1935 Cadillac, 36-90 — When making the

Fig. 36 St ering linkage on 1936-38 series 65, 70, 75, 80, 85, 90; 1939-40 series 75, 90



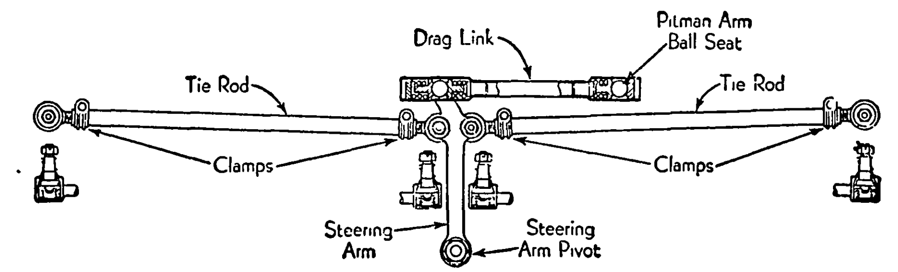


Fig. 37 Steering linkage on 1937-39 series 50, 60, 60s

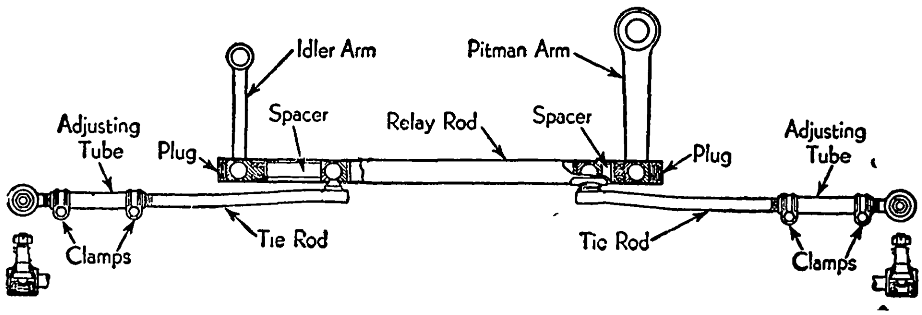


Fig. 38 Steering linkage on 1939 series 50, 61; 1940 series 50, 52, 62, 72; all 1941-52

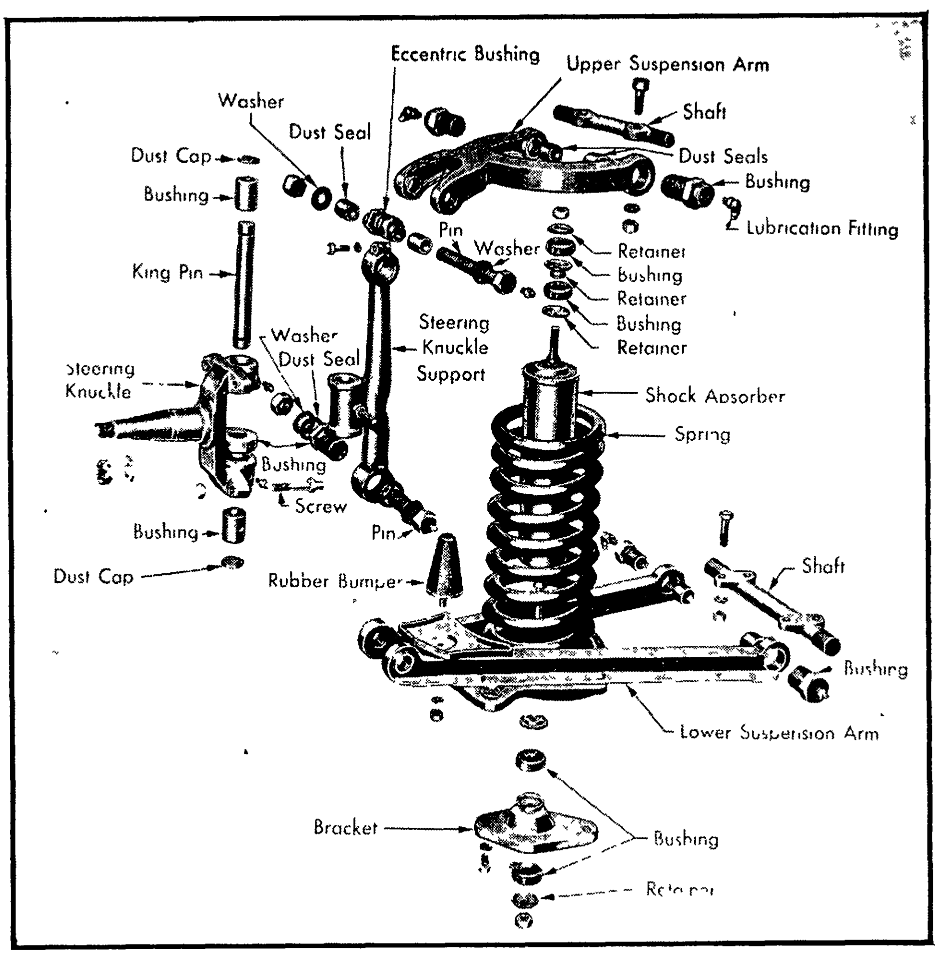


Fig. 39 Front suspensi n, 1950-52

adjustment, the rear end of the intermediate steering arm must be exactly at the center of the car. Both tie rods are then turned an equal amount to retain the same distance between the rear end of the intermediate steering arm and the front wheels. Turning the tie rod in the same direction as the wheels revolve, when the car moves forward, decreases the toe-in, and turning in the opposite direction increases it. Large errors in toe-in indicate bent steering arms.

35-50; 36-60 Before Engine No. 6014008; 36-70, 75, 80, 85; 37-65, 70, 75, 85, 90; 38-65, 75 90; 39-75, 90; 40-75, 90—Fig. 36. With the front wheels in the straight-ahead position, turn both the rods an equal amount in order to maintain the correct position of the steering gear high spot.

36-50; 36-60 After Engine No. 6014008; 1937-38 Series 50, 60; 1939 Series 50, 60s, 61; 1040 Series 50, 52, 60s, 62, 72; All 1941-52 — With the front wheels in the straight-ahead position, turn both tie rods an equal amount in order to maintain the correct position of the steering gear high spot, Fig. 37.

On 1939-52 models, Fig. 38, a cross drag link and an idler lever are used. With the idler lever parallel to the fore and aft centerline of the car, adjust both tie rods an equal amount.

FRONT END SERVICE

1950-52

Front Wheel Bearing Adjustment — In adjusting the front wheel bearings, first make sure that the wheel is all the way on the spindle. Tighten the adjusting nut to 16 lbs. ft. torque to be sure all parts are properly seated and threads are free. Then back off nut and retighten to approximately 4 lbs. ft. torque. If the cotter pin cannot be installed in this position, loosen the adjusting nut until it can be installed.

When adjusting front wheel bearings, care should be taken not to mistake play in the kingpin bushings for play in the wheel bearings.

Steering Knuckle, Remove—Fig. 39.

1. Lift front end of car from floor with jack.
2. Remove front wheel, hub, brake drum and wheel bearings.
3. Remove brake dust shield with brake shoes attached. Do not damage the hydraulic line which does not have to be removed in this operation.
4. Drive lock pin from steering knuckle support.
5. Remove dust caps at upper and lower knuckle pin holes, and remove steering knuckle and thrust bearing from knuckle support.

Kingpin Bushings, Install—

1. If these bushings are to be replaced, slot them lengthwise with a hacksaw and drive them out with a chisel.
2. Press new bushings into steering knuckle, being sure that the oil hole in each bushing lines up with the oil hole in the knuckle, Fig. 40. Reaming of bushings is not necessary provided care is used when making the installation.

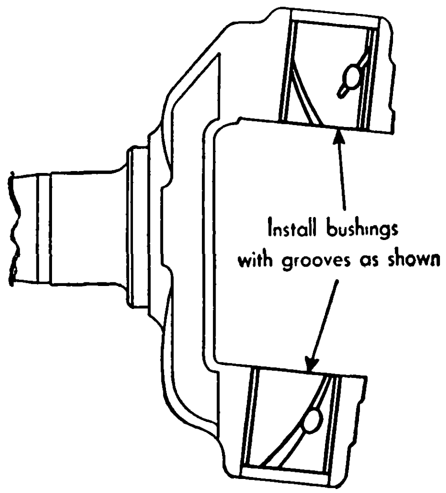


Fig. 40 Kingpin bushing installation, 1940-52

Steering Knuckle, Install—Fig. 39.

1. Assemble steering knuckle to support with thrust bearing in position between support and lower face of steering knuckle.
2. Drive lock pin in from front of support.
3. Use new plugs at both ends of kingpin.
4. Install grease fittings and lubricate thoroughly.
5. Install brake assembly, lubricate and adjust front wheel bearings after installing wheel.

Knuckle Support, Remove—Fig. 39.

1. Remove steering knuckle as outlined previously.
2. Place jack under lower control arm to support coil spring while disconnecting knuckle support.
3. Remove nut from rear end of upper pivot pin.
4. Remove threaded pivot pin and rubber dust seals.
5. Remove nut from rear of lower pivot pin.
6. Remove lower pivot pin and rubber dust reals.
7. Place support in vise and loosen clamp screw at upper end of knuckle support.
8. Remove upper and lower bushings from support.

Knuckle Support, Install—Fig. 39.

1. Install eccentric bushing in knuckle support so that it is centralized and install clamp screw lightly.
2. Install bushing in lower end of knuckle support, tightening bushing firmly so that there is no clearance between bushing shoulder and knuckle support.
3. Install lower end of knuckle support, with bushing, between outer ends of lower control arm. Install rubber dust seals between control arm and support on both sides.
4. Install threaded pivot pin, holding support so that space between support and arms is equal on both sides.
5. Install upper end of support in position between ends of upper control arms and install rubber seals.
6. Install upper pivot pin and nut with upper end of support centralized between ends of upper control arms.
7. Install steering knuckle and adjust caster, camber and toe-in.

Upper Control Arm, Remove—Fig. 39.

1. Jack up car at front frame cross member and also place a jack under the lower control arm on the side that is being serviced.
2. Remove upper steering knuckle support pivot pin and nut.
3. Remove bolts attaching upper control arm inner shaft to frame.
4. Remove arm and shaft as a unit.
5. Place mounting shaft in vise and remove bushings from arm and shaft and remove shaft from control arm.

Upper Control Arm, Install—Fig. 39.

1. Install new seals on inner shaft and lubricate threads of shaft.
2. Install shaft in position in control arm and install bushing into arm and onto one end of shaft.
3. Tighten bushing to 140-150 lbs. ft. torque.
4. Install upper control arm spreader, Fig. 41, and tighten finger tight. Then, using a wrench, tighten tool two additional flats.
5. Install bushing in arm and onto shaft, tightening to 140-150 lbs. ft. torque.
6. Remove tool from arms and center shaft between arms by turning shaft in bushings.
7. Install grease fittings in bushings.
8. Install control arm on frame member and install and tighten mounting bolts to 150-160 lbs. ft. torque.
9. Position knuckle support in fork of upper control arm and install rubber seals on both sides of support.
10. Install upper pivot pin while holding knuckle support so that space between arm and support is equal on both sides.
11. Tighten pivot pin nut to 70-90 lbs. ft. torque.
12. Remove jacks and check caster and camber.

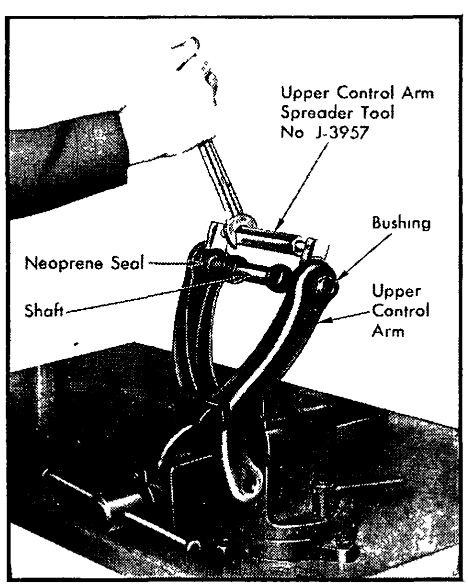


Fig. 41 Spreading upper contr l arm, 1950-52

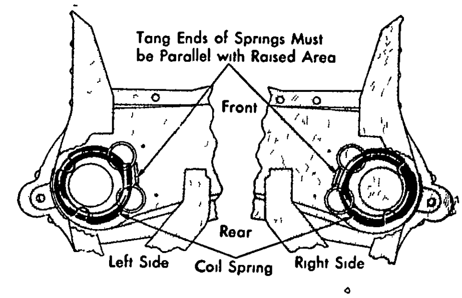


Fig. 42 Front spring l cati n in upper seat, 1950-52

Lower Control Arm & Spring, Remov

1. Jack up car at center of front cross member and also place a jack under the lower control arm to be removed, to support spring.
2. Disconnect front stabilizer link from side being serviced.
3. Remove shock absorber as outlined further on.
4. Remove lower pivot pin and nut from steering knuckle support.
5. Lower jack under control arm to remove spring.
6. Unfasten lower control arm shaft from frame and remove assembly.
7. Place assembly on bench and remove threaded bushings and rubber seals and remove shaft from control arm.

Lower Control Arm & Spring, Install—

1. Assemble mounting shaft to lower control arm, centralizing it in arms and install rubber seals and threaded bushings. Tighten bushings to 195-205 lbs. ft. torque.
2. Bolt mounting shaft to frame, tightening bolts to 60-70 lbs. ft. torque.
3. Install spring with tang end in cross member upper seat, Fig. 42.
4. Place jack under lower control arm, guiding bottom of spring into lower spring seat as control arm is raised by jack. It may be necessary to drive or pry bottom of spring into seat after it has been compressed about 2 in. due to the fact that the bottom of the spring will not set in its seat when fully distended.
5. Raise jack under lower control arm until outer end of arm can be attached to knuckle support.
6. Install rubber seats between support and arms and install pivot pin and nut while holding support midway between outer arms.
7. Connect stabilizer link to lower spring seat.
8. Remove jacks and check caster, camber and toe-in.

Front Shock Absorber—Fig. 39.

1. Raise hood and remove shock absorber upper retaining nut, retainer and rubber grommet. The shock absorber upper stem is square at the top so that it may be held by a wrench to prevent stem from turning when removing nut.
2. Remove two nuts holding lower shock absorber retaining bracket to spring seat.
3. Remove shock absorber and lower bracket from spring.
4. Remove lower bracket, rubber

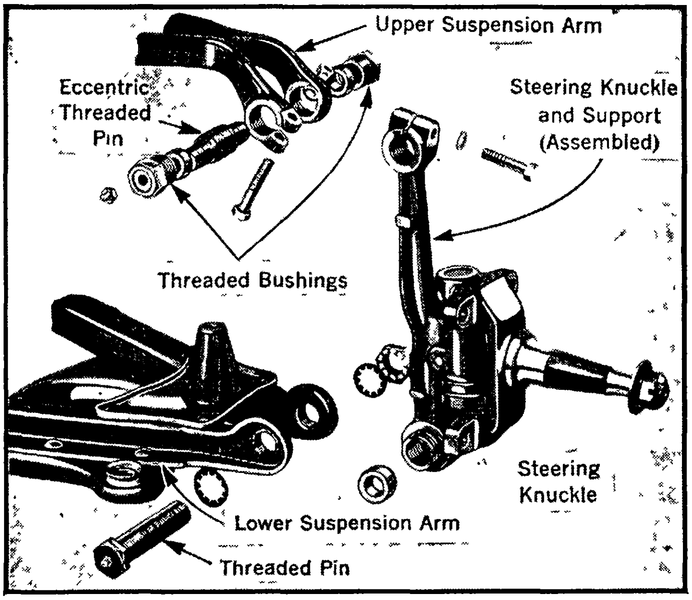


Fig. 43 Steering knuckle assembly which is typical f all 1936-39 m dels n t equipped with rem vabl knuckle supp rt y kes

grommets and retainers from shock absorber stem.

5. Reverse the above procedure to install the shock absorber.

FRONT END SERVICE, 1935-49

Front Wheel Bearing Adjustment—Follow procedure outlined previously for 1950-51 models.

Steering Knuckle, Remove—Fig. 43.

1. Lift front end of car from floor with jack or hoist.
2. Remove front wheel, hub and brake drum, and wheel bearings.
3. Disconnect tie rod at steering knuckle arm pivot ball joint.
4. Remove brake dust shield and steering knuckle arm.
5. Drive lock pin from steering knuckle support.
6. Remove dust caps at upper and lower kingpin holes, tap out kingpin, and disassemble steering knuckle from knuckle support.

Kingpin Bushings, Install—Follow procedure outlined previously for 1950-51.

Steering Knuckle, Install — Reverse removal procedure to install the knuckle, lubricate thoroughly and adjust caster, camber and toe-in.

Knuckle Support, Remove—Fig. 43.

1. Remove steering knuckle.
2. Place jack under lower control arm to support coil spring while disconnecting knuckle support.
3. Disconnect front stabilizer on side being serviced.
4. Loosen clamp screw at upper end of knuckle support.
5. Loosen clamp screw in upper control arm at threaded pin.
6. Remove threaded bushing at rear end of eccentric (upper) threaded pin.
7. Remove threaded bushing at front of eccentric pin.
8. Insert an Allen wrench in the front end of the éccentric pin and turn pin out of knuckle support.
9. Swing support outward at top. The front spring can be removed at this point by lowering the jack under the lower control arm.
10. Take off nut and remove threaded pin at lower control arm, which will release steering knuckle support.

Knuckle Support, Install—Fig. 43.

1. Centralize lower end of knuckle between the lower control arms, line up the holes and screw the threaded pin with washer in from the front.
2. Install washer and nut on rear end of pin.
3. Install car spring (if removed).
4. Hold knuckle support so that hole in upper end is in line with holes in upper control arms.
5. Insert eccentric pin into knuckle support, making certain that the hole for the hexagon wrench is toward the front. See that the eccentric on the pin is centralized between both surfaces of knuckle support.
6. Install rubber seals on each end of eccentric pin.
7. Start rear bushing (threaded on outside) on threads of pin and in threads of upper control arms and tighten to 145 to 155 lbs. ft. torque with the shoulder against seat.
8. Start front bushing (threaded on inside) on threads of pin. Then tighten, leaving approximately $\frac{1}{32}$ in. between shoulder and seat. This distance may need to be slightly changed to allow free fit of threads between bushing and eccentric pin.
9. Assemble steering knuckle, front brake mechanism, and front wheel.
10. Connect front stabilizer and check and adjust caster and camber.

Lower Control Arm & Spring — Follow the procedure outlined for 1950-51 models for removing and installing a lower control arm and front spring. However, disregard the item referring to front shock absorber.

Front Shock Absorber — A front shock absorber can be removed by removing the knuckle support upper pivot pin as outlined previously, and the shock absorber attaching bolts.

When the shock absorber is installed by reversing the removal procedure, caster and camber must be checked and adjusted.

STEERING GEAR

STEERING WHEEL, REMOVE & REPLACE 1935-41—To remove the wheel, press the horn button down and turn it in either direction until catch is released, and remove the cap. Remove the gasket, contact and cushion, horn button spring and steering wheel hub nut, after which, take off the wheel.

To install, slip the steering wheel over the end of the steering column shaft so that the middle spoke is vertical and directly opposite the notch in the end of the steering column shaft on standard wheels, or that the two spokes are exactly horizontal on "Special" wheels. Tighten the wheel hub nut down, using a wrench with an 18-inch handle. Place the small end of the horn button spring over the horn terminal and install the contact. Place the sponge rubber ring around the edges of the wheel hub and press the horn cap down in place, turning it in either direction until the lugs slip under the hub clips.

1942-52—To remove the wheel, depress the horn button and turn it counterclockwise until the catch is released and remove the button. Remove the horn button retainer ring and spring, and the steering wheel hub nut. On the "Special" wheel, remove the horn ring, take out three screws holding the retainer and rubber gasket to the horn ring and remove them. Use a suitable puller to remove the wheel.

To install, slip the wheel over the shaft so that the center spoke points directly toward the driver. On the "Special" wheel, install the retainer and gasket in the horn ring, and replace the ring. Screw on the wheel hub nut and replace the horn button retainer ring and spring, after which, install the horn button making sure the emblem is in proper position.

STEERING GEAR, REMOVE & REPLACE

1935-52—The following instructions are specifically for 1942-52 models but may be used as a guide for previous models, disregarding, of course, any item which is not pertinent to the model being serviced.

To remove the steering gear assembly, raise the front end of the car until the front wheels are approximately 6 inches from the floor. Remove the steering wheel as described under that heading. Remove the horn wire from the terminal on the steering column. Loosen the clamp holding the lower steering jacket to the upper steering jacket. Tap the clamp down over the lower jacket. Disconnect the steering connecting rod at the pitman arm. Unscrew the bolts holding the steering gear to the frame, after which, pull the steering gear assembly out from below.

Reverse the order of removal to install the gear.

CHEVROLET

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Standard 6	EC	107	In Head	3 5/16 x 4	206.8	5.60	74 @ 3200		12 @ 50
	Master 6	ED	113	In Head	3 5/16 x 4	206.8	5.60	80 @ 3200		12 @ 50
	Master 6	EA	113	In Head	3 5/16 x 4	206.8	5.60	80 @ 3200		12 @ 50
1936	Standard 6	FC	109	In Head	3 5/16 x 4	206.8	6.00	79 @ 3200		12 @ 50
	Master 6	FD	113	In Head	3 5/16 x 4	206.8	6.00	79 @ 3200		12 @ 50
	Master 6	FA	113	In Head	3 5/16 x 4	206.8	6.00	79 @ 3200		12 @ 50
1937	Master 6	GB	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
	Master De Luxe 6	GA	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
1938	Master 6	HB	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
	Master De Luxe 6	HA	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
1939	Master 6	JB	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
	Master De Luxe 6	JA	112 1/4	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	13 @ 50
1940	Master 6	KB	113	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	15 @ 43
	Special De Luxe 6	KA	113	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	15 @ 40
	Master De Luxe 6	KH	113	In Head	3 1/2 x 3 3/4	216.5	6.25	85 @ 3200	170 @ 900	15 @ 40
1941	Special De Luxe 6	AH	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Master De Luxe 6	AG	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
1942	Stylemaster 6	BG	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Fleetmaster 6	BH	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Fleetline 6	BH	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
1946	Stylemaster 6	DJ	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Fleetmaster 6	DK	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
1947	Stylemaster 6	EJ	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Fleetmaster 6	EK	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
1948	Stylemaster 6	FJ	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
	Fleetmaster 6	FK	116	In Head	3 1/2 x 3 3/4	216.5	6.50	90 @ 3300	174 @ 1200	14 @ 40
1949	Special 6	GJ	115	In Head	3 1/2 x 3 3/4	216.5	6.60	90 @ 3300	174 @ 1200	14 @ 40
	De Luxe 6	GK	115	In Head	3 1/2 x 3 3/4	216.5	6.60	90 @ 3300	174 @ 1200	14 @ 40
1950	Special 6	HJ	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	174 @ 1200	14 @ 40
	De Luxe 6(A)	HK	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	174 @ 1200	14 @ 40
	De Luxe 6(B)	HK	115	In Head	3 9/16 x 3 15/16	235.5	6.75	105 @ 3600	193 @ 2000	14 @ 40
1951	Special 6	JJ	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	176 @ 1500	14 @ 40
	De Luxe 6 (A)	JK	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	176 @ 1500	14 @ 40
	De Luxe 6 (B)	JK	115	In Head	3 9/16 x 3 15/16	235.5	6.70	105 @ 3600	193 @ 2000	14 @ 40
1952	Special 6	KJ	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	176 @ 1500	14 @ 40
	De Luxe 6 (A)	KK	115	In Head	3 1/2 x 3 3/4	216.5	6.60	92 @ 3400	176 @ 1500	14 @ 40
	De Luxe 6 (B)	KK	115	In Head	3 9/16 x 3 15/16	235.5	6.70	105 @ 3600	193 @ 2000	14 @ 40

A—De Luxe without Powerglide transmission. B—De Luxe with Powerglide transmission.

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees Note B	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935–36	All	AC-46	.032	.022	31–37	153624	A	Negative	350		75–80
1937–40	All	AC-44	.040	.022	31–37	153624	A	Negative	350		75–80
1941–42	All	AC-104	.040	.022	31–37	153624	A	Negative	350		75–80
1946–48	All	AC-M8	.040	.022	31–37	153624	A	Negative	350		75–80
1949–52	All	AC-46-5	.035	.022	31–37	153624	A	Negative	450–500	500	75–80

A—Steel ball in flywheel.
B—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is as shown.

Year	Model	Fitting Pistons With Scale			Rings				Pins	
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Ring Gap, Minimum (Note A) Compression	Ring Gap, Minimum (Note A) Oil	Clearance in Groove Compression	Clearance in Groove Oil	Type	Fit
1935–40	All	Above	B	B	.005	.005	.0015–.003	.0015–.0035	D	E
1941–42	All	Above	B	B	.005	.005	.0015–.003	.002 –.0035	D	E
1946–52	All	Above	B	B	C	.005	.0015–.003	.002 –.0035	D	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Piston should pass on a .002″ feeler with light pressure, and lock on a .003″ feeler.
C—On 235 cu. in. engine, .007″ for top ring and .005″ for second ring. On 216 cu. in. engine, .005″.
D—Clamped in rod.
E—Thumb push fit with parts at 70° (room temperature).

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935-36	All	Free–.003	.002–.0035	2.123–2.124	.0005–.001	.004–.012	55–60	B	.001–.003	.004–.007	100–110
1937-38	All	Free–.003	.002–.004	2.311–2.312	.0015–.0025	.004–.012	55–60	D	.0015–.0035	.004–.007	100–110
1939-40	All	Free–.003	.002–.004	2.311–2.312	.0015–.0025	.004–.012	55–60	C	.0015–.0035	.004–.007	100–110
1941-47	All	Free–.003	.002–.004	2.311–2.312	.001–.0025	.004–.012	55–60	C	.0015–.0035	.004–.007	100–110
1948	All	Free .003	.002–.004	2.311–2.312	.0003–.0013	.004–.012	55–60	C	.0007–.0024	.003–.009	100–110
1949-52	All	Free–.003	.002–.004	2.311–2.312	.0003–.0013	.004–.012	40–50	C	.0007–.0028	.003–.009	100–110

A—Thrust taken by No. 2 bearing on 1935–36 models and by No. 3 bearing on 1937–51 models.
B—Front, 2.058 to 2.059. Center, 2.1205 to 2.1215. Rear, 2.183 to 2.184.
C—Front, 2.6835 to 2.6845. No. 2, 2.7145 to 2.7155 No. 3, 2.7455 to 2.7465. No. 4, 2.7765 to 2.7775.
D—Front, 2.6855 to 2.6865. No. 2, 2.7165 to 2.7175. No. 3, 2.7475 to 2.7485. No. 4, 2.7785 to 2.7795.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil Above +32°F.	Grade of Oil Above +10°F	Grade of Oil Above −10°F.	Capacity, Pounds or Pints	Grade of Oil Summer	Grade of Oil Winter	Capacity, Pounds or Pints	Grade of Oil Summer	Grade of Oil Winter
1935	EC	10	11	5	20	20W	10W	1½	140	90	3	140	90
	EA, ED	11	14	5	20	20W	10W	2½	140	90	4½	140	90
1936	FC	15	14	5	20	20W	10W	1½	140	90	3	140	90
	FA, FD	15	14	5	20	20W	10W	2½	140	90	4½	140	90
1937-39	All	14	14	5	20	20W	10W	1½	90	90	3	90H	90H
1940-41	All	14	16	5	20	20W	10W	1½	90	90	3½	90H	90H
1942-48	All	15	16	5	20	20W	10W	1½	90	90	3½	90H	90H
1949-52	All (A)	D	16	5	20	20W	10W	1½	90	90	3½	90H	90H
1950-52	De Luxe(B)	D	16	5	20	20W	10W	9 Qts.	C	C	3½	90H	90H

A—Without Powerglide transmission. B—With Powerglide transmission. C—Automatic transmission fluid. H—Hypoid gear lubricant.
D—16 quarts on 1949–50; 15 quarts on 1951-52.

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935	All	.006H	.013H	.006	30	4	4	94@1 9/16	.001–.003	.002–.004	.3437	.3437
1936–37	All	.006H	.013H	.006	30	9	B	94@1 9/16	.001–.003	.002–.004	.3407	.3397
1938–39	All	.006H	.013H	.006	30	9	B	125@1 1/2	.001–.003	.002–.004	.3413	.3403
1940–46	All	.006H	.013H	C	30	3	5	125@1 1/2	.001–.003	.002–.004	.3413	.3403
1947	All	.006H	.013H	C	30	D	5	125@1 1/2	.001–.003	.002–.004	.3413	.3403
1948–49	All	.006H	.013H	C	30	E	9	125@1 1/2	.001–.003	.002–.004	.3413	.3403
1950–52	(F)	.006H	.013H	C	H	E	9	125@1 1/2	.001–.003	.002–.004	.3413	.3403
	(G)	Zero	Zero	Zero	H	16	17 1/2	160@1 1/2	.001–.003	.002–.004	.3413	.3403

A—BTDC means before top dead center; ATDC means after top dead center.
B—One degree before top dead center.
C—See text under VALVE TIMING.
D—Prior to Eng. No. 572,254, intake opens 3 degrees before top dead center. After Eng. No. 572,253 intake opens 1 degree after top dead center.
E—Intake opens 1 degree after top dead center.
F—Cars without Powerglide.
G—Cars with Powerglide.
H—Intake 30, exhaust 45.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-36	All	.004–.006	Shims	None	.000–.014
1937-39	All	.004–.008	Shims	None	.000–.014
1940-48	All	.005–.007	Shims	None	.000–.014
1949-52	All	.005–.008	Shims	None	.000–.014

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	EC	Woven	20 1/8	1 1/2	3/16	1/4
	EA, ED	Woven	24 19/32	1 3/4	3/16	1/4
1936	All	Woven	22 5/8	1 3/4	3/16	1/4
1937-41	All	Molded	22 5/8	1 3/4	3/16	1/4
1942-48	All	Molded	22 5/8	1 3/4	3/16	7/16
1949-50	All	Molded	20 5/8	1 3/4	3/16	7/16
1951-52	All	Molded	21	(A)	.212	7/16

A—Front. 2"; rear 1 3/4.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin, Inclination Degrees
1935	EC	+1 3/4	+1	1/8	7 1/6
	ED	+3	+1	1/8	7 1/6
	EA	Zero	+1/4	1/8	7 3/4
1936	FC	+2 3/4	+1	1/8	7 1/6
	FD	+3	+1	1/8	7 1/6
	FA	Zero	+ 1/4	3/32	7 3/4
1937–38	GB, HB	+2 1/4	+1	1/8	7 1/6
	GA, HA	Zero	+ 1/4	3/32	7 3/4
1939	JB	+2 1/4	+1	1/8	7 1/6
	JA	Zero	− 1/4	1/32	4 3/4
1940	KB	+2 1/4	+1	1/8	7 1/6
	KA, KH	Zero	− 1/4	1/32	4 3/4
1941–48	All	Zero	− 1/4	1/32	4 3/4
1949–52	All	+1/2	+ 1/2	1/16	4

ENGINE

ENGINE REMOVAL

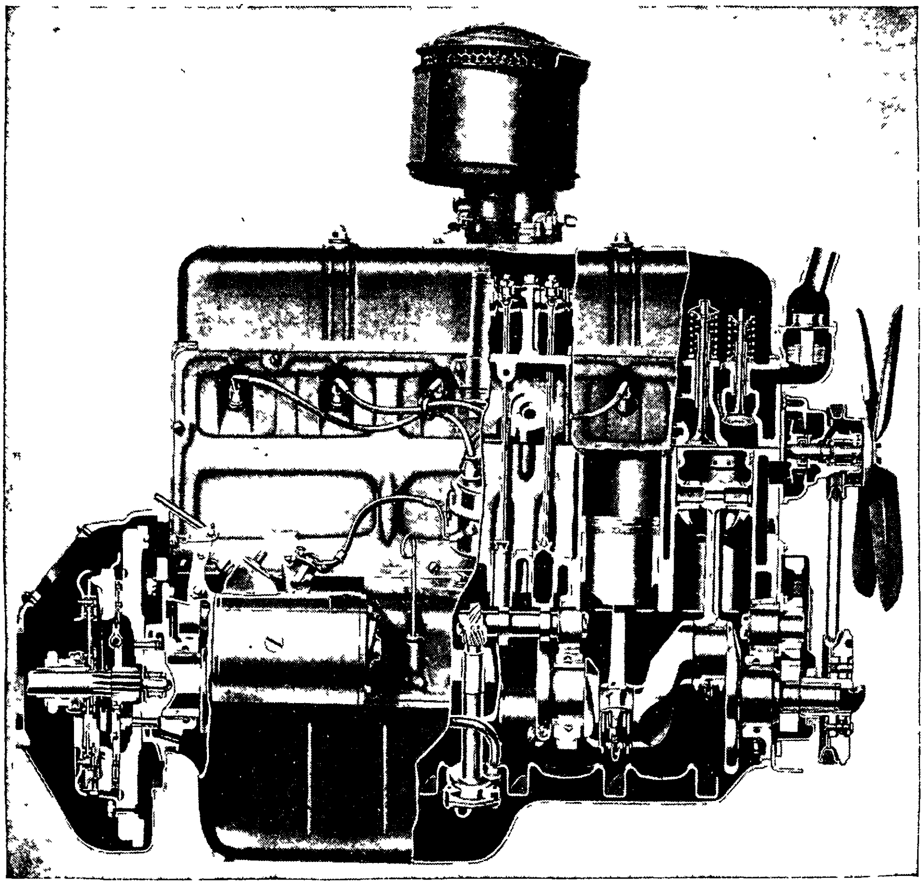
1935-39—After performing the conventional operations such as disconnecting wires, fuel lines and removing necessary accessories, remove the third cylinder head bolt from the rear on the left side. Install an engine lifting eyebolt in this hole and attach a hoist to the eyebolt. Then remove the radiator, separate the universal joint, unfasten the engine mountings and hoist the engine out of the chassis.

1940-48—After performing the conventional operations such as disconnecting wires, fuel lines and removing necessary accessories, take off the radiator and fenders as an assembly. Remove the third cylinder head bolt from the rear on the left side. Install an engine lifting eyebolt in this hole and attach a chain hoist to the eyebolt. Then separate the universal joint, disconnect the vacuum shift linkage, unfasten engine mountings and hoist the engine out of the chassis.

CAUTION—On 1940 models, after disconnecting the vacuum cylinder piston rod and valve link from the reactionary levers, replace the clevis pin through the piston rod yoke and valve link in order not to upset the vacuum valve adjustment.

1949-52—After draining cooling system and oil pan, proceed as follows:

1. Remove radiator hose, hood, radiator and battery.
2. Disconnect wiring harness from right junction block and pull harness through header bar.
3. Remove radiator core support and header bar.
4. Disconnect all necessary wires, fuel and vacuum lines, carburetor controls, oil gauge line and temperature element from cylinder head.
5. Unfasten exhaust pipe from manifold.
6. Remove accelerator pedal.
7. Disconnect shift control rods from transmission levers.



Engin and clutch. Typical of all 1937-47. 1948 and later engines are similar except that insert type main bearings are used

8. Disconnect speedometer cable from transmission and clutch link from clutch pedal arm.

9. Split universal joint.

10. Unfasten transmission support from transmission.

11. Unfasten engine mountings.

12. Remove third cylinder head bolt from rear on right side and fourth head bolt from rear on left side and install a suitable engine lifting tool in these holes.

13. Connect a hoist to the lifting attachment and raise the engine, clutch and transmission from the chassis as a unit.

CYLINDER HEAD & VALVE SERVICE

1935-52—Extreme care should be exercised when servicing the cylinder head and valves to maintain correct valve stem - to - guide clearance, correctly ground valves, valve seats of correct width and correct valve adjustment.

Valv Adjustment — Before adjusting valves, it is extremely important that the engine be thoroughly warmed up to normalize the expansion of all parts. Tests have shown that valve clearances will vary as much as .005 in. from a cold check through the normalizing range. Consequently the engine should be run approximately 30 minutes to properly normalize all parts.

Covering the radiator will not materially hasten the normalizing process because even with the water temperature quickly raised to 185 degrees it does not change the rate at which the oil temperature increases or the engine parts become normalized.

1. Remove rocker arm cover.
2. Run engine at fast idle and check oil temperature with a thermometer at the overflow pipe on the valve rocker shaft connector. When oil temperature remains constant for five minutes, engine is normalized and ready for valve adjustment.
3. Tighten all manifold bolts, rocker arm nuts and cylinder head bolts.
4. Lubricate valve stems with engine oil to insure free movement of valves in their guides.
5. Adjust valve clearance to the specifications given in the *Valve Data* chart.
6. Install rocker arm cover, using a new gasket. Tighten cover nuts to 5 lbs. ft. torque and check for oil leaks.

Hydraulic Valve Lifter Adjustment—Detailed service requirements on these lifters are given in the *Hydraulic Valve Lifters* chapter. The use of these lifters eliminate the need for service adjustment. However, an initial adjustment is required after valves have been refaced, whenever the setting of the adjusting screw has been disturbed for any reason, or whenever valve lifters are removed and installed.

FIRST SERIAL NUMBERS

LOCATION — 1935-36 Plate on right front seat frame or right hand side on floor pan or sill. 1937-39—Plate on right side of cowl under hood. 1940-42—Plate on floor before right front seat. 1946-48 —Plate on right front body hinge pillar. 1949-52—Plate on left front door hinge pillar.

Year	Model	
1935	EC	EC-1001
	ED	ED-1001
	EA	EA-1001
1936	FC	FC-1001
	FD	FD-1001
	FA	FA-1001
1937	GB	GB-1001
	GA	GA-1001
1938	HB	HB-1001
	HA	HA-1001
1939	JB	JB-1001
	JA	JA-1001
1940	KB	KB-1001
	KA	KA-1001
	KH	KH-1001
1941	AH	AH-1001
	AG	AG-1001
1942	BG	BG-1001
	BH	BH-1001
1946	DJ	DJ-1001
	DK	DK-1001
1947	EJ	EJ-1001
	EK	EK-1001
1948	FJ	FJ-1001
	FK	FK-1001
1949	GJ	GJ-1001
	GK	GK-1001
1950	HJ	HJ-1001
	HK	HK-1001
1951	JJ	JJ-1001
	JK	JK-1001
1952	KJ	KJ-1001
	KK	KK-1001

FIRST ENGINE NUMBERS

LOCATION—1935-37—Right side of engine near fuel pump. 1938-52—On crankcase to rear of distributor.

Year	Model	
1935	All	4708995
1936	All	5500179
1937	All	1
1938	All	1187822 B-1, Buffalo, N. Y.
1939	All	1915447 B-10503, Buffalo, N. Y.
1940	All	2697268 B-105462, Buffalo, N. Y.
1941	All	AA-1001 AC-1001, Tonawanda, N. Y.
1942	All	2AA-1001 BA-1001 2AC-1001, Tonawanda, N. Y.
1946	All	DA-1001
1947	All	EA-1001
1948	All	FA-1001
1949	All	GA-1001
1950	All	HA-1001
1951	All	JA-1001
1952	All	KA-1001

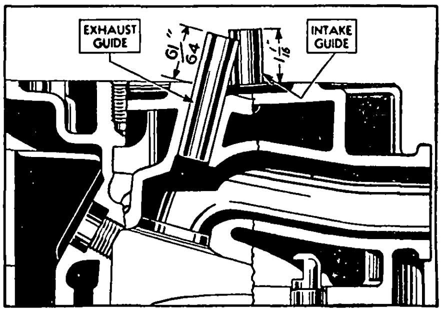


Fig. 1 Install valve guides as shown. 1937-52 standard engine

The initial adjustment must be made only when the lifter is on the camshaft base circle. An easy method of adjustment is to remove the distributor cap and turn the engine over to bring No. 1 cylinder to the top of its compression stroke, which is indicated when the breaker points open for this cylinder. In this position, both lifters for No. 1 cylinder will be on the base circle of the cam and both valves can be adjusted.

After adjusting No. 1 valves, repeat by turning the engine over according to its firing order and adjust the valves of each cylinder in turn.

To make adjustment, turn the adjusting screw down until all lash is removed between the lifter and valve. This can be determined by checking the push rod side play at the adjusting screw and while turning the adjusting screw. At the point where no side play of the push rod can be felt, continue turning the adjusting screw down 1½ turns and tighten the lock nut securely. This places the lifter plunger in the center of its travel and no further adjustment is necessary.

Disassemble Cylinder Head

1. Drain radiator, raise hood and remove air cleaner. Disconnect throttle and choke wires from carburetor.
2. Disconnect throttle rod from carburetor.
3. Disconnect gas and vacuum lines from carburetor.
4. Remove gas and vacuum line retaining clip from water outlet.
5. Remove manifold assembly.
6. Remove water outlet and thermostat from cylinder head.
7. Remove rocker arm cover.
8. Remove all spark plugs.
9. Detach coil and lay it down out of the way.
10. Remove push rod cover.
11. Disconnect oil line from rocker arm connector.
12. Remove temperature indicator element from cylinder head.
13. Remove rocker arm assembly.
14. Remove bolts and lift off cylinder head.
16. With head on the work bench, compress the valve springs with a suitable compressor and remove valve locks, caps and seals.
17. Lift off valve springs.
18. Remove all valves and place them in a board with numbered holes so they can be identified as to the valve port from which they were removed.

Valve Springs—After washing the springs in gasoline or other solvent, examine them for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring pressure on a spring testing fixture if one is available. If not, at least check the free length of each spring by standing it alongside a new one. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10% should be replaced. Likewise, any spring that stands up shorter than the new spring used for comparison should be discarded.

Valve Guides—Clean the valve guides with a wire guide brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the clearance between valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between valve stems and guides will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

Valve stem-to-guide clearance may be checked with special "GO" and "NO-GO" gauges. Lacking these, an alternate method is to take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the guides that are worn as indicated by this test. If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, it is an indication that the old valve stem is worn and a new valve must be installed.

To remove the old guides, place the cylinder head on the table of an arbor press and, with a suitable piece of round stock, press out the guides.

Special drivers having stop collars are available to install the new guides to the correct position. Lacking these tools, install the guides so they are positioned as shown in Figs. 1 and 2. After the guides are installed, they should be

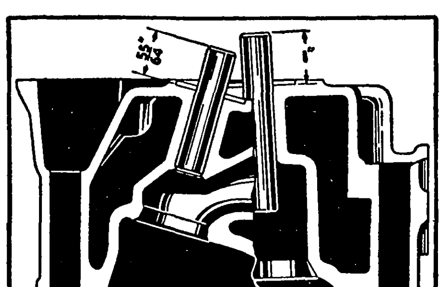


Fig. 2 L cation f valv guides in 1950-52 ngin used with P werglid transmissi n

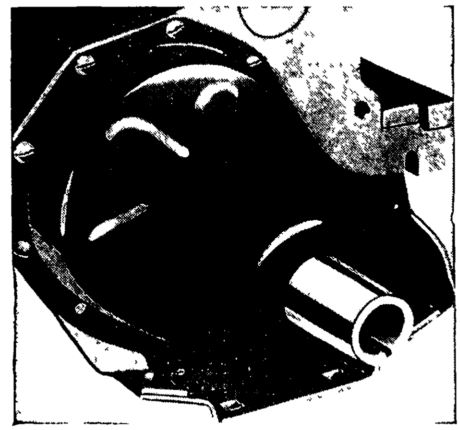


Fig. 5 Timing gear c ver centering sleeve. 1935-52

finish reamed with a .343 in. hand reamer.

Refacing Valves—In refacing valves, take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

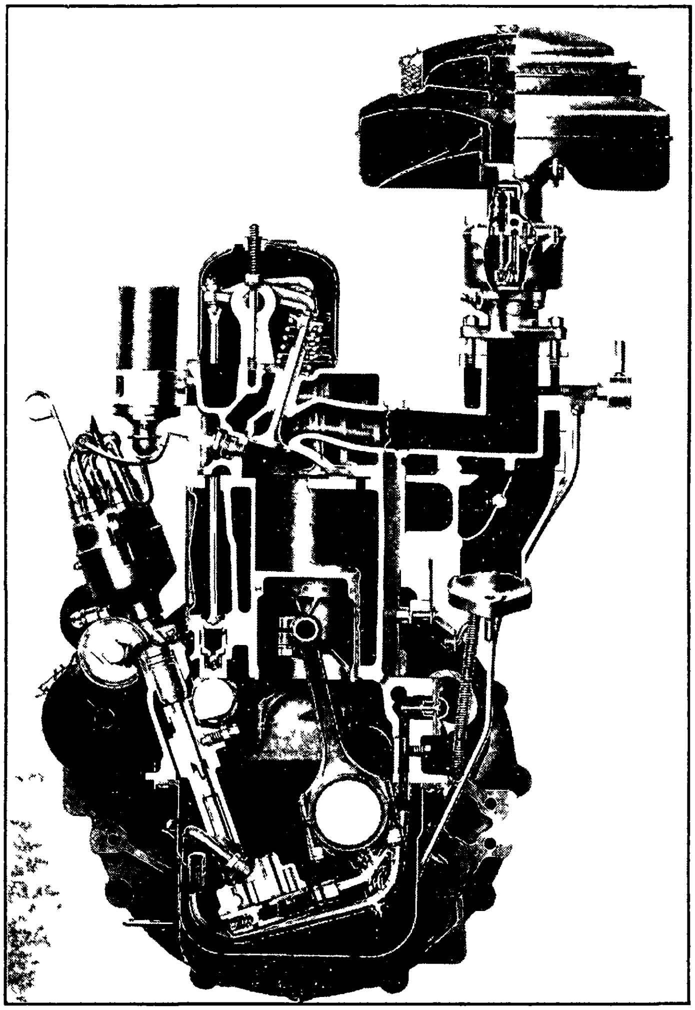
Inspect the valve seats in the head for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul, it is advisable to reface the valves seats regardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

The valve seat width after refacing should not measure more than 1/16 in. for the intake and 3/32 in. for the exhaust. The width may be checked by placing a scale across the face of the valve seat.

A simple check can be made to prove the fit of the valve in the valve seat. Make pencil marks about ¼ in. apart across the valve face, place the valve in its guide and give the valve ½ turn in each direction while exerting firm pressure on the valve head. Remove the valve and, if all pencil marks have not been removed at the point of contact with the valve seat, it will be necessary to repeat the refacing operation and again check for proper seating.

Rocker Arms & Shafts—Sludge and gum formation in the rocker arms and shafts will restrict the normal flow of oil to the rocker arms and valves. Each time the rocker arm and shaft assemblies are removed they should be disassembled and thoroughly cleaned.

1. Remove the support bolts, hairpin locks, springs, rocker arms and supports.
2. Clean all sludge and gum formation from the inside and outside of the shafts and from the oil distributor to valve rocker shaft tube.
3. Clean oil holes and passages in the shafts and rocker arms.
4. Clean the rocker arm shaft oil connector assembly.
5. Inspect the shafts for wear. Check the fit of the rocker arms on the shafts



Secti nal vi w of 1950-52 engine used with Powerglide transmissi n. This engine features hydraulic valve lifters

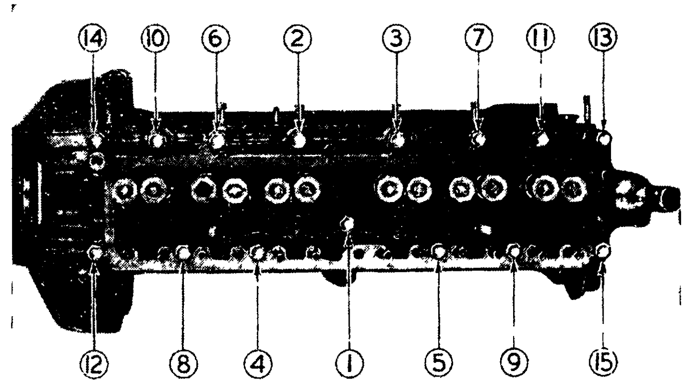


Fig. 4 Cylind r h ad tightening sequenc . 1935-52

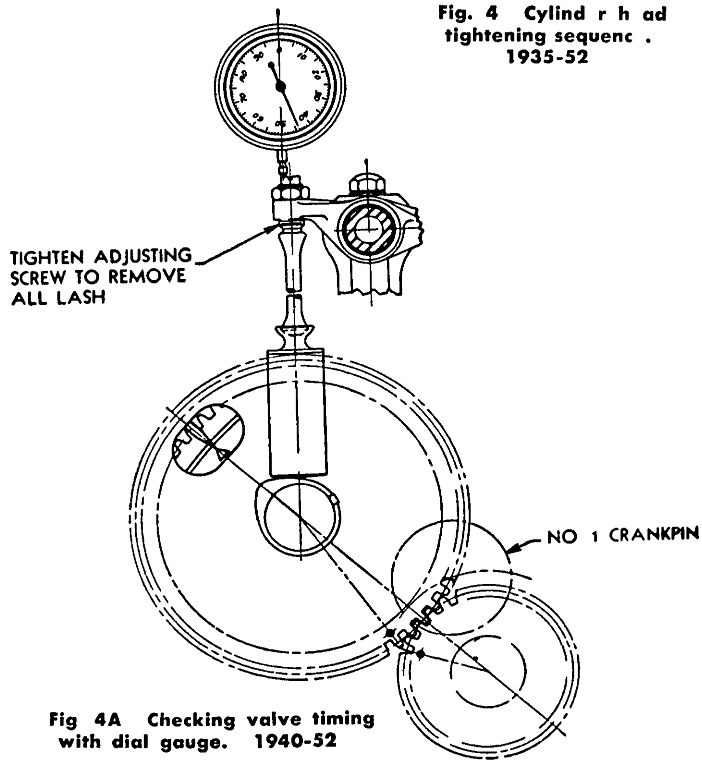


Fig 4A Checking valve timing with dial gauge. 1940-52

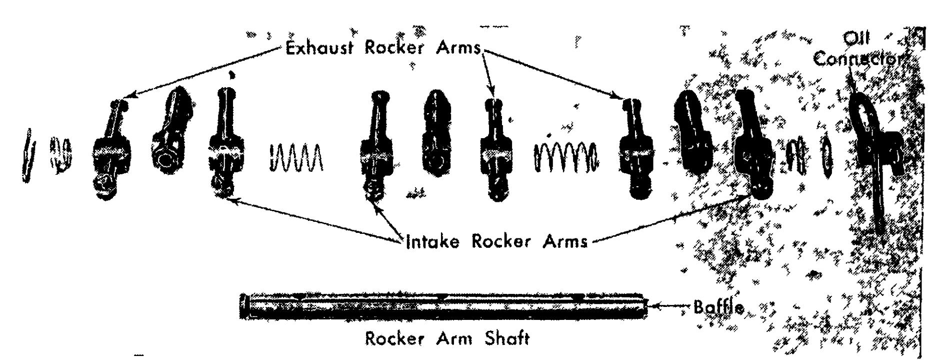


Fig. 3 Layout of rear rocker arm and shaft parts. 1941-52

and the valve end of the rocker arms for excessive wear

6 On 1935-40 engines, there are three types of rocker arms The right inclined arms are for intake valves of cylinders 1, 3 and 5 The left inclined arms are for 2, 4 and 6 Exhaust rocker arms are all alike These rocker arms come with bushings installed and diamond-bored ready for assembly Worn rocker arm bushings necessitate the replacement of rocker arms Worn shafts should be replaced at the same time

7 On 1941-52 models there are three each of four different type rocker arms used—right and left hand exhaust and right and left hand intake, Fig 3 Each rocker arm carries an identification number and is installed in the following manner Rocker arms marked "1" are for cylinders 1, 3 and 5 exhaust; rocker arms marked "2" are for cylinders 2, 4 and 6 exhaust, arms marked "5" are for 2, 4, 6 intake, arms marked '6" are for 1, 3 and 5 intake

8 On all models, one end of each rocker arm shaft is plugged The open end of each shaft must be toward the center

Valve Lifters—Valve lifters should be a free fit in their guides and the end that contacts the camshaft should be smooth If wear is apparent replace with new parts

Hydraulic Valve Lifters — 1950-52 If the operation of a valve lifter becomes faulty due to excessive varnish deposits or presence of dirt, it may be disassembled and cleaned as outlined in the *Hydraulic Valve Lifters* chapter

As long as these lifters operate properly they should be left alone They should not be disassembled and cleaned when removed for other work but should be wrapped in clean paper to avoid entrance of dirt

Cylinder Head, Install—The best practice is to install a new cylinder head gasket each time the head is removed and installed. The gasket must be installed with the side marked "This Side Up" on top so all water passage holes and cylinder head bolt holes will line up properly.

To properly align the head to the cylinder block and keep the gasket in place to prevent damage, two cylinder head guide pins should be used. They screw into the cylinder block at the front and rear holes on the manifold side and guide the head into position.

After the head has been properly aligned, insert and tighten the head bolts, tightening each one evenly a little at a time in the order shown in Fig. 4. The order or sequence in which the bolts are tightened is important, since many water leaks between cylinders are caused by improper tightening of head bolts. A final tightening should be made with a torque wrench to the torque valves listed in the *Tune Up Chart*. After the engine has been warmed up to operating temperature, recheck the bolts and adjust torque as required. Don't forget to check and adjust valve clearance as outlined previously.

VALVE TIMING

1935-39—With No. 1 intake valve set to the clearance given in the *Valve Data* table, crank the engine until No. 1 piston is coming up on its exhaust stroke. Continue cranking until No. 1 intake valve starts to open. In this position, the second flywheel tooth before the steel ball in the flywheel should be in the center of the inspection hole in the flywheel housing.

1940-52—To obtain an increase in peak horsepower, the location of the keyway in the crankshaft timing gear has been changed. This change retards the camshaft 4 degrees relative to the crankshaft, and went into effect with 1947 produced engine number 572254 and all later engines.

If a new crankshaft gear is being installed on 1947 engines built prior to the above serial number and on all 1940-46 engines, this new gear will be furnished and the valve timing will be effected. On engines with the old gear, intake opens three degrees before top dead center, while those with the new gear, intake opens one degree *after* top dead center.

To check the valve timing, crank the engine until No. 1 exhaust valve opens and just starts to close. Continue cranking until the triangular mark on the flywheel lines up with the pointer on the flywheel housing. Mount a dial gauge, Fig. 4A, on the rocker shaft support with the spindle of the indicator on top of the No. 1 cylinder valve adjusting screw.

With the new type gear, set the indicator at .044".

With the old type gear, set the indicator at .036".

Continue to crank the engine until the indicator hand just stops moving. At this point, the indicator should read zero, plus or minus .004".

If the indicator reading is greater or less than .004", it indicates excessive

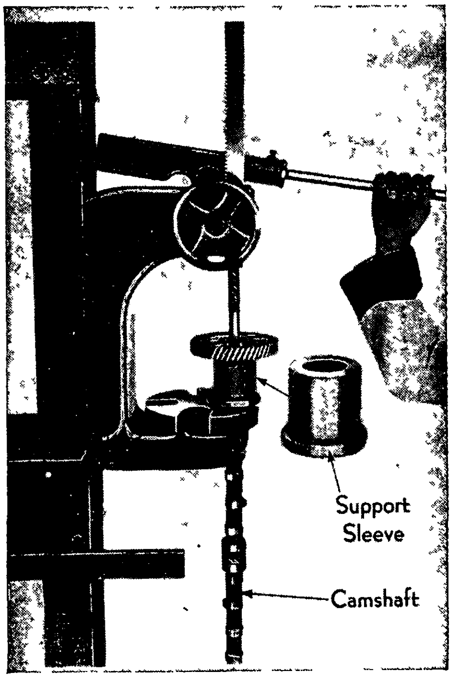


Fig. 6 Removing camshaft gear. 1935-52

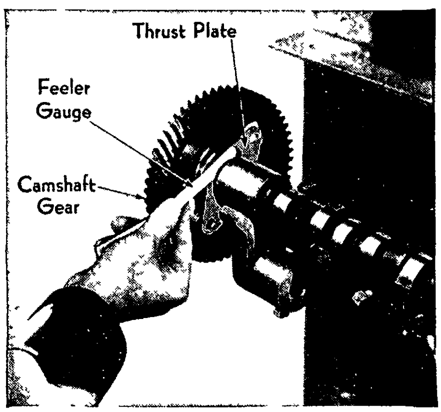


Fig. 7 Checking camshaft end play. 1935-52

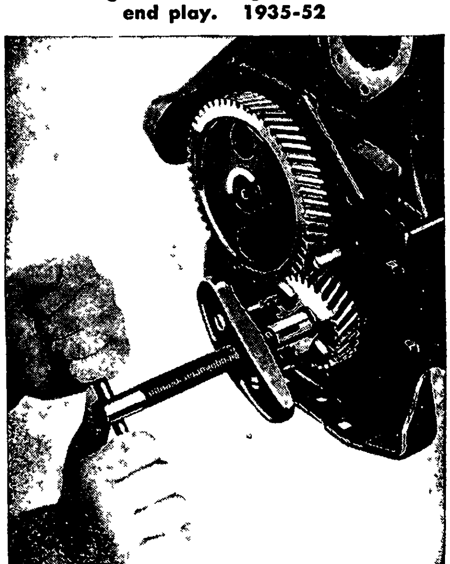


Fig. 8 Using puller t r m v crankshaft g ar. 1935-52

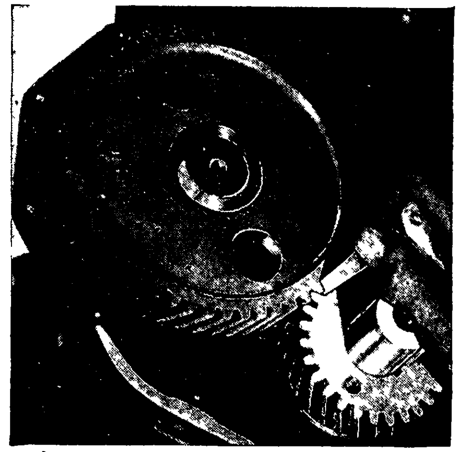


Fig. 9 Checking timing gear backlash. 1935-52

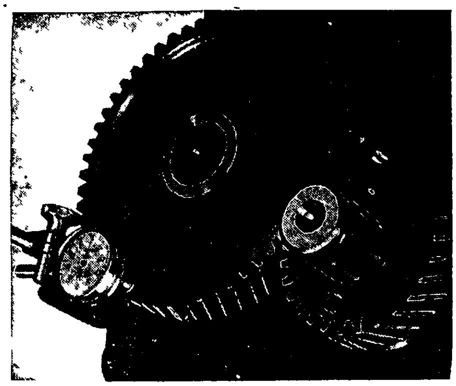


Fig. 10 Checking run ut f timing gears with dial indicat r. 1935-52

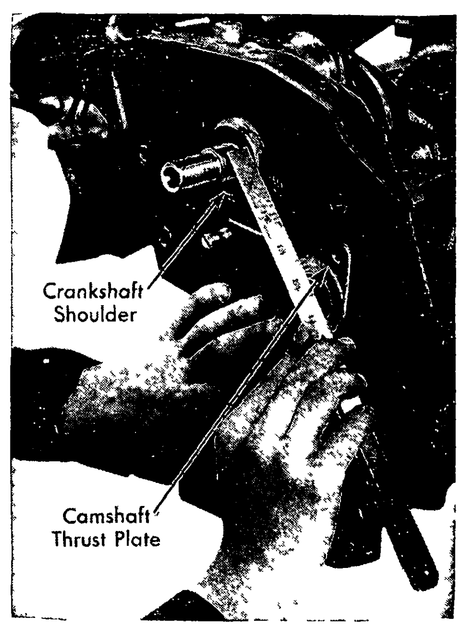


Fig. 11 Checking timing g ar alignm nt. 1935-52

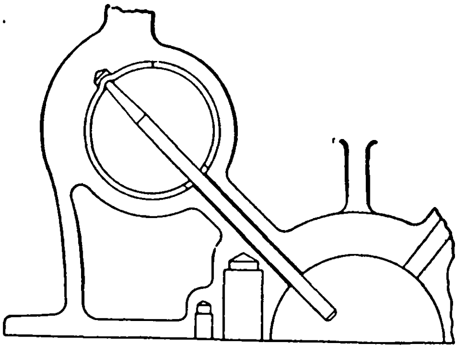


Fig. 12 Using round-nosed punch to stake camshaft bearings in place. 1935-52

Fig. 13 Checking cylinder bore with dial gauge. 1935-52

timing gear wear or improperly installed timing gears.

1950-52 ENGINE WITH HYDRAULIC LIFTERS—To check an engine equipped with hydraulic valve lifters for valve timing according to the method outlined above, the hydraulic lifter and push rod for No. 1 cylinder exhaust valve must first be replaced by a non-hydraulic lifter and push rod, the same as those used for the regular 235 cu. in. truck engine.

TIMING GEAR COVER

1935-52 — Before installing the timing gear cover, be sure that the oil seal is seated properly in its recess in the cover, otherwise premature wear of the seal will result, causing an oil leak.

When replacing the cover, use a sleeve which is the same size as the hub of the vibration damper, Fig. 5, slipping it over the front end of the crankshaft to act as a guide when replacing the cover.

Apply a light film of grease on the inner circumference of the seal to prevent it from being damaged when the vibration damper is being installed.

Fig. 14 Checking piston fit. 1935-52

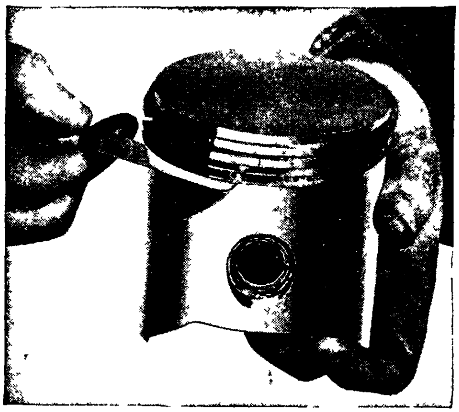


Fig. 15 Checking ring clearance in groove. 1935-52

TIMING GEARS

1935-52—When necessary to install a new camshaft gear, the camshaft will have to be removed as the gear is a pressed fit on the shaft. The camshaft is held in position by a thrust plate which is fastened to the crankcase by two capscrews which are accessible through two holes in the gear web.

Use an arbor press to remove the gear and when doing so, a suitable sleeve, Fig. 6, should be employed to support the gear properly on its steel hub.

Before installing a new gear, assemble a new thrust plate on the shaft and press the gear on just far enough so that the thrust plate has practically no clearance, yet is free to turn. The correct clearance is from a free fit to a maximum of .003", Fig. 7.

The crankshaft gear can be removed by utilizing the two tapped holes in conjunction with a gear puller, Fig. 8.

When the timing gears are installed, be sure the punch-marks on both gears are in mesh. Backlash between the gears should be from .002" to .005", Fig. 9. Check the run-out of the gears, Fig. 10, and if the camshaft gear run-out exceeds .004" or the crank gear run-out is in excess of .003", remove the gear (or gears) and examine for burrs, dirt or some

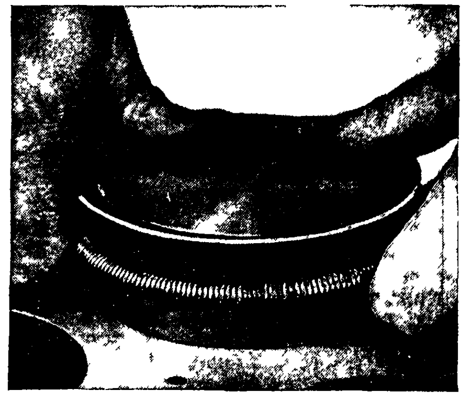


Fig. 16 Using ring compressor to insert piston. 1935-52

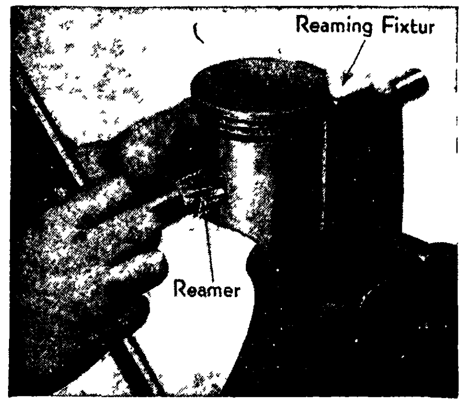


Fig. 17 Reaming piston pin bushings. 1935-52

other fault which may cause the run-out. If these conditions are not the cause, replace the gear (or gears).

CRANKCASE FRONT END PLATE

1935-52—This plate is assembled to the cylinder block with from one to three gaskets which are used for the purpose of aligning the timing gears. To check the alignment of the gears, install the front end plate to the block and use two gaskets, holding them in position with three screws. Then use a new (spare) camshaft thrust plate over the camshaft hole in the end plate and place a steel straight edge, Fig. 11, against the camshaft thrust plate and over the shoulder of the crankshaft to see whether these two surfaces are flush. If the scale strikes the shoulder on the crankshaft, add another gasket. On the other hand, if there is space between the scale and the crankshaft shoulder, remove a gasket. When the desired result is obtained, assemble the screws and bolts, using a center punch to lock the screws.

CAMSHAFT & BEARINGS

1935-52—Camshaft end play should be from a free fit to a maximum of .003" and is controlled by a thrust plate at the front end of the shaft. This clearance can be checked by inserting a feeler ribbon between the front end of the shaft and the thrust plate, Fig. 7.

If necessary to replace bearings, drive

out the expansion plug at the rear of the rear bearing and use suitable equipment to remove and replace the bearings.

CAUTION—Be sure the oil holes in the bearings are lined up with the oil holes in the crankcase. Before reaming the bearings, insert a round-nosed punch, Fig. 12, through the oil passage from the main to the camshaft bearings and stake each bearing in place.

PISTONS & RODS, REMOVE

1935-52 — After removing the cylinder head as outlined previously, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove the connecting rod caps and push the pistons and rods out of the cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so they can be installed in the original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTON & ROD, ASSEMBLE

1935-52—The connecting rod should be assembled to the piston so that when placed in the cylinder bore, the piston pin clamp bolt faces the camshaft side of the engine.

PISTONS

1935-52—Pistons are available in oversizes of .003, .010, .020, .030 and .040 inch. When necessary to replace pistons, due to wear, the cylinder walls should be honed for .003 inch oversize, or rebored and honed for the larger oversize pistons.

In determining the piston size required, use a dial gauge, Fig. 13, or micrometer. In using the dial gauge, insert it in the bore and move it up and down its full length. Then rotate it at as many points as desired, taking readings at each point. In this manner, all variations in the cylinder walls from top to bottom may be determined.

FITTING PISTONS — The piston to be fitted should be checked with a micrometer, measuring just below the lower ring groove and at right angles to the piston pin. The cylinder should then be bored to the same diameter as the piston.

If a micrometer is not available to measure the piston, the cylinder should be bored .002 inch less than the oversize piston to be fitted. After boring the cylinders, they should be finished with a hone until the piston being fitted can be pushed through the cylinder on a .002" feeler, Fig. 14, using light pressure, and will lock on a .003" feeler. The feeler gauge must be placed between the piston and cylinder wall one-quarter of the way around from the piston pin ends, or at right angles to the piston pin.

PISTON RINGS

1935-52—Piston rings are furnished in standard sizes as well as .005, .010, .015, .020, .030 and .040 inch oversizes.

Always use standard size rings in cylinder bores that are *standard at the bottom, regardless of the amount of taper*. Rings may have ample clearance in the upper part of the cylinder but at the bottom of the piston stroke the ends jam, causing the rings to buckle and distort. Always see that the end gap is within specifications at the *bottom of the cylinder*. When fitting rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side when installed in the piston, Fig. 15.

Fig. 18 Checking fit of rod bearing. 1935-52

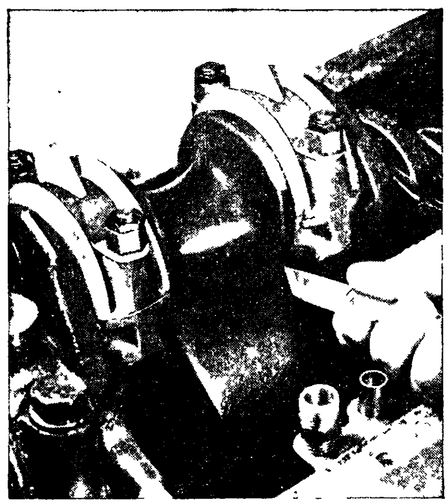


Fig. 19 Checking connecting rod end clearance. 1935-52

Before removing pistons, the ridge at the top of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder wall, never try to remove the last traces of the ridge; this can be done afterward by honing.

New rings should be fitted according to the instructions given with the ring package. Ring grooves must be clean and free from carbon and must show no perceptible wear. Rings should be fitted to limits given in the *Piston & Ring* table. Oversizes ordered must be determined by the measurement of the smallest portion of the bore.

PISTON PINS

1935-52—Chevrolet pistons are furnished with bushings and pins fitted. Should it be necessary to replace a piston pin, three oversizes, .003, .005 and .010 inch are available. The bushings will have to be reamed, however, and this should be done in a fixture designed to keep the reamed hole at right angles to the piston skirt, Fig. 17.

Carefully expand the reamer in reaming the first piston. Once the right size is obtained, reduce the reamer about .0005 inch and rough-ream the rest of the pistons. Always measure all pins with a micrometer before starting the job to be sure they are all the same size.

CONNECTING RODS

1935-52 — The connecting rod bearings are babbitt-lined, bonded directly to the rod and cap. Shims are provided to allow adjustment without filing. If bearings require adjustment, remove the same thickness of shims from each side until the rod cannot be snapped forward and backward on the crankpin by hand, but can be tapped back and forth with a light hammer. Then place one .002 inch shim on one side, being careful to keep the number of shims on each side equal, if possible. When the bearing is properly fitted, it should be possible to snap the rod back and forth by hand, Fig. 18.

If it is not possible to have an equal thickness of shims on each side it is preferable to have the greater number on the camshaft side.

Check connecting rod and clearance between the upper half of the rod and the side of the crankpin with a feeler gauge, Fig. 19. This clearance should not be less than .004 inch nor more than .011 inch.

MAIN BEARINGS

1935-52 — Standard main bearings for 1935-47 engines are babbitt-lined steel half shells. For replacement, however, precision type bearings are furnished. These precision bearings are of the same design as are used as standard for 1948 and later engines.

To replace the old style bearings with the new, it is no longer necessary to remove the engine from the chassis. The procedure is as follows:

1. Remove radiator, vibration damper, fan belt, and spark plugs.
2. Loosen all rocker arm screws to relieve tension on camshaft.
3. Raise front and rear of car about 8" off floor, keeping car level.
4. Remove transmission floor pan and flywheel underpan.
5. Unfasten transmission support from cross member.
6. Uncouple gearshift selector rod from selector lever.
7. Raise rear of engine and support it with a bar across frame braces.
8. Release clutch fork from ball.
9. Unfasten transmission and slide it back about ¾".
10. Remove oil pan and timing gear cover.
11. Remove oil pump and screen assembly.
12. Rotate crankshaft to best possible

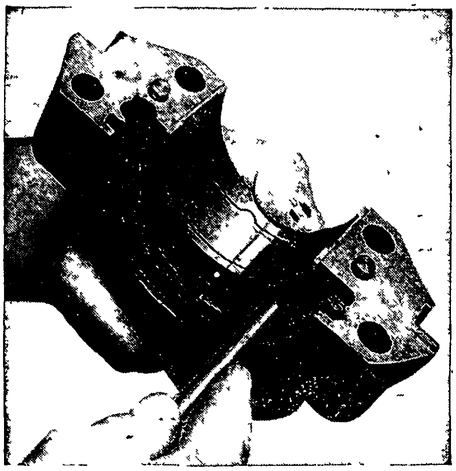


Fig. 20 R lling oil seal in rear main bearing cap. 1940-52

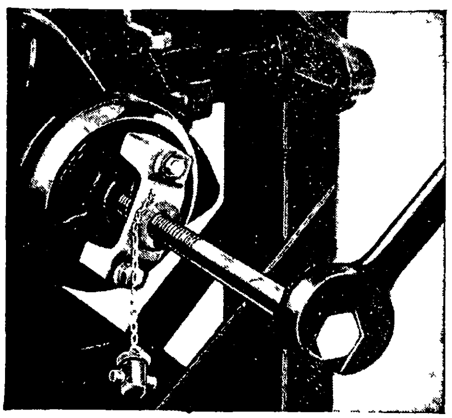


Fig. 21 Using puller to remove vibrati n damper. 1935-52

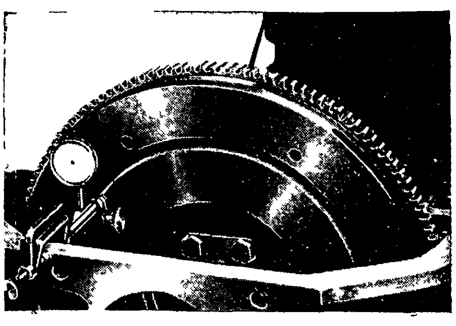


Fig. 22 Checking flywheel runout with dial indicator. 1935-52

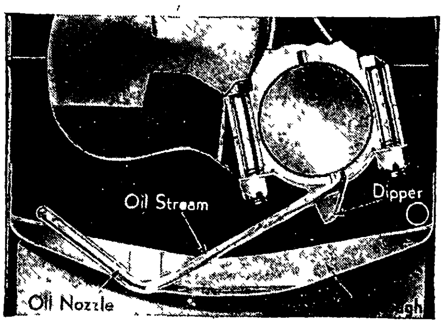


Fig. 23 C nnecting r d bearing lubricati n. 1935-52

position for removal of all bearing caps and mark timing gear position to allow for reassembly in same position.

13. Loosen all main bearing cap bolts, allowing crankshaft to drop about ⅜".

14. Remove No. 2 and 4 bearing caps and take out upper and lower bearing shells.

15. Install new upper bearing shells, locating dowel in hole and pressing bearings in place. If bearing has correct spread, bearing shells should snap into place.

16. Install new lower bearing shells and replace caps, using three .002" shims on each side of bearing. Draw bolts up until cap is snug to crankshaft, but not so tight as to raise crankshaft.

17. Repeat steps 14, 15 and 16 for No. 1 and 3 bearings.

18. Place jack under No. 3 bearing cap to raise crankshaft, keeping shaft horizontal and making sure all upper bearings remain in place. Also see that crankshaft gear meshes with camshaft gear at previously marked tooth position.

19. Draw all bearing caps up snug, then remove jack.

20. Starting with the rear bearing, remove shims evenly until there is a slight drag on crankshaft (when turned by hand) with bolts pulled up snug. Then replace a .002" shim on one side. Again tighten bolts. The shaft should now turn freely. Loosen bolts of this bearing and follow same procedure with other bearings. Shims should be removed evenly, if possible. When they are not even, have the greatest number of shims on the same side of all bearings.

21. Complete the job by replacing the parts that were removed.

CRANKSHAFT END THRUST

1935-52—Crankshaft end thrust is controlled by flanges on the center bearing on 1935-36 engines, and No. 3 bearing on 1937 and later engines.

Through normal wear, this clearance will seldom become excessive, but whenever new bearings are fitted, check the end play carefully and if necessary, the bearing flanges may be dressed down to provide the desired clearance.

When dressing down the bearing flange, first face off the front side of the bearing just enough to give a fresh bearing surface. Then face off the rear side and install the bearing on the crankshaft. Check the clearance with a feeler gauge, and if not enough material has been removed to provide the desired end play, carefully face off a little more.

NOTE—On 1935-39 engines, if the front side of the thrust bearing is faced off too much, the oil slinger at the rear of the crankshaft may strike the back wall of the slinger groove.

The clearance at this point should be from .002" to .032" as measured with a feeler between the back face of the slinger and the groove in the crankcase (bearing cap removed).

REAR MAIN BEARING OIL SEAL

1935-39—Oil sealing at the rear main bearing is controlled by an oil slinger, integral with the crankshaft, running in a groove leading into the oil sump.

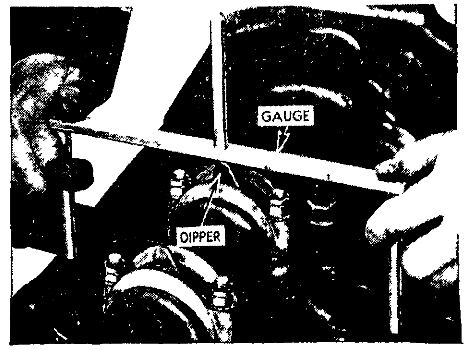


Fig. 24 Checking rod dipper height. 1935-52

1940-52—The rear bearing cap and crankcase have a groove into which a wick-type seal is rolled, Fig. 20. As it would be necessary to remove the engine and crankshaft to install the wick seal in the crankcase, this seal should always be renewed when new bearings are installed.

To install a new seal in the rear main bearing cap, insert the seal in the groove with the fingers. Then using a rounded tool, roll the seal down into the groove Start at one end and roll to the center Start again at the other end and roll to the center. The small portion of the seal which protrudes from the groove at each end should be cut off flush with a sharp knife. To prevent pulling the seal out of the groove, use a round block of wood the same diameter as the crankshaft to hold the seal firmly while cutting it off.

VIBRATION DAMPER

1935-52—To remove the damper, a special puller is available and consists of a puller body, a puller screw and a driver head. In operation, Fig. 21, the puller body is attached to the damper by means of the two cap screws in the puller, which screws into the tapped holes in the damper. This insures the puller body being held firmly against the damper and helps to hold the damper together while being removed.

When installing the damper, the puller body is removed, the driver placed in the starting crank jaws and the puller body reassembled to the damper. Then line up the key in the crankshaft with the keyway in the damper and drive the damper in position, using the puller screw as a driver. If the puller is assembled in any other way, serious damage will be done to the damper.

FLYWHEEL

1935-52—The flywheel ring gear is not furnished separately—the gear and flywheel being sold only as a unit. After the flywheel is assembled to the crankshaft, check the flywheel face and rim for run-out. This can be done with a dial indicator mounted on the clutch housing, Fig. 22, and run-out should not exceed .008".

ENGINE OILING

OIL PAN

1935-52—Due to interference of the steering linkage on 1949-52 models, it will be necessary to remove the intermediate steering arm before the oil pan

can be taken down. On models previous to 1949, the operation is simply a matter of unfastening the oil pan from the engine and taking it down.

On all models, the oil pan should be thoroughly cleaned and the heights of oil troughs and dippers checked. Oil nozzles should be tight and their aim should be checked as described below.

OIL PUMP, OVERHAUL

1935-36 — Before assembling the pump, check for excessive looseness or too much play between the rotor and its bearing surface in the oil pump body. Excessive clearance at this point will seriously reduce pump pressure. The clearance between the oil pump shaft and its bearing should not exceed .009".

When the oil pump is assembled into the body with the two blades and springs, see that the tapered end of the blades are in the direction of pump rotation. Be sure also, that the oil inlet hole in both the pump cover *and gasket* are in line with the oil inlet hole in the pump body. Assemble the oil pump screen cover and connect the oil inlet pipe to the cover to hold it in place.

CAUTION — Be sure the tapered set screw which holds the oil pump in the crankcase is fully seated in the tapered hole in the pump body, otherwise the crankshaft cheeks may strike the pump body. Be sure to tighten the tapered screw lock nut.

1937-52—The pumps used in these engines are of the positive gear type. After disassembling the pump, examine the shaft and gears for excessive wear and replace where necessary, or better still, install a new pump. When assembling the pump, be sure the ground side of the idler gear is toward the cover.

NOTE—The gasket which is used between the pump cover and the body is special in that it controls the clearance in the pump. If the relief valve parts show wear, install new parts. Be sure that the tapered set screw which holds the pump in place is fully seated and locked with its lock nut.

TIMING GEAR LUBRICATION

1935-52—The nozzle in the front end of the crankcase, through which a stream of oil flows to the timing gears, should point somewhere between straight down and 30 degrees to the left.

For 1941-52 engines, the oil nozzle is fitted into the crankcase front end plate by being pressed and flared in place. If the nozzle becomes damaged, it will be necessary to replace the front end plate rather than attempt to replace the nozzle without the use of special equipment.

ROD BEARING LUBRICATION

1935-52—Fig. 23. Every time the oil pan is removed or a new one installed, it is important that the height of the oil troughs and the aim of the oil nozzles be checked. Proper adjustment of the rod dippers is equally important.

At low engine speeds, the connecting rod dippers pick up oil directly from the oil troughs. At higher engine speeds, as the oil pressure increases, the nozzle oil streams rise, being caught by the dippers, forcing oil into the connecting rod bearings under high pressure.

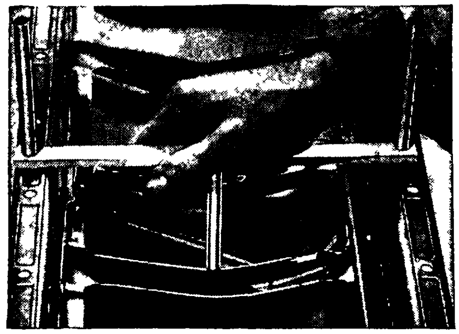


Fig. 25 Checking depth of oil trough. 1935-52

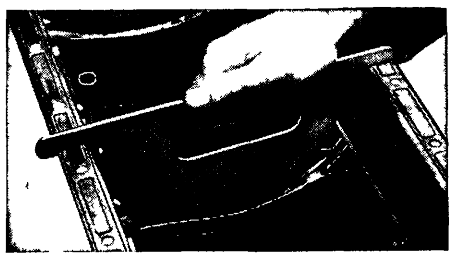


Fig. 26 Checking oil nozzle height. 1935-52

ROD DIPPERS & OIL TROUGHS ADJUST

1935-52—A special gauge is available for checking the height of rod dippers and oil troughs. It consists of a bar having three pins, Fig. 24, the center pin being used to check the oil level in the troughs. When the tool is inverted, with the two outer pins resting on the crankcase flange, the rod dipper should contact the center of the bar when the dipper being checked is at bottom dead center. If the dipper does not contact the cross bar, replace the dipper. If the dipper hits the bar before the rod is at bottom dead center, it may be bent to the correct position.

When checking the height of oil troughs, rest the bar on the oil pan flange (without gasket) with the center pin facing down, Fig. 25. The height of the trough is correct if the gauge pin just touches the top edge of the trough. Raise or lower the trough until the desired result is obtained.

OIL NOZZLES, ADJUST

1935-52—To check the oil nozzle height, a nozzle depth gauge is available, Fig. 26. With the oil pan gasket removed, hook the edge of the gauge over the oil pan flange, with the side of the gauge marked *Front* toward the front of the oil pan. With the gauge resting flat on the pan, move it from one oil trough to another, being sure that the open end of each nozzle is below the gauge.

To check the aim of the nozzles, a special target gauge should be used, Fig. 27. Locate the target gauge on the oil pan with the dowels in the oil pan screw holes, which will bring the target holes in line with the nozzles. Insert a water nozzle in the main oil line and tip the oil pan sideways about 45 degrees so that the tips of the nozzles will not be covered by water in the troughs. When the water is turned on, the streams from

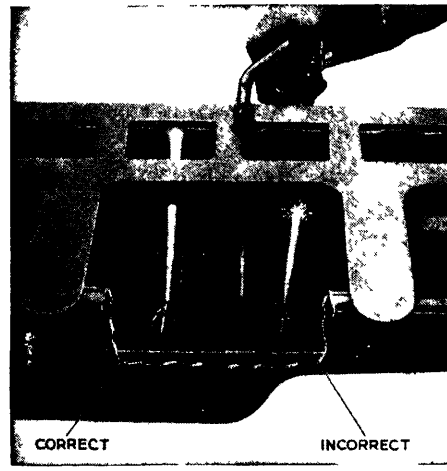


Fig. 27 Checking aim of oil nozzles, using target gauge and water. 1935-52

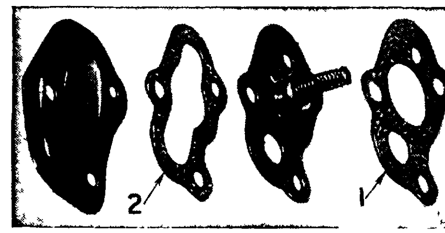


Fig. 28 Oil distributor cover and gaskets. 1940-52

the nozzles should pass through the target holes. If not, a special nozzle adjusting tool is available. After obtaining the desired result, again check the nozzles for correct height.

OIL DISTRIBUTOR VALVE

1935-39—Before replacing the oil distributor body to the cylinder block, be sure that the parts are positioned properly. The oil distributor valve gasket should be in good condition and assembled to the body so that it rests firmly against the valve seat. The valve is then assembled with the spring, copper gasket and the retaining nut.

1940-52—When assembling the oil distributor valve assembly, install a cork gasket between the valve assembly and the cylinder block, and another cork gasket between the valve assembly and the oil distributor cover.

NOTE — Care must be exercised when assembling the gaskets that they are installed properly, Fig. 28. By matching the holes in the gasket which fits against the cover, and the holes in the gasket which is assembled over the valve, assembly will be made correctly.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-36 — Drain the cooling system and hoist the car. Remove the left headlamp assembly. Disconnect front fenders from radiator shell and radiator core from support. Remove grille and upper and lower radiator hose. Disconnect radiator hold down bolts. Remove hydraulic brake

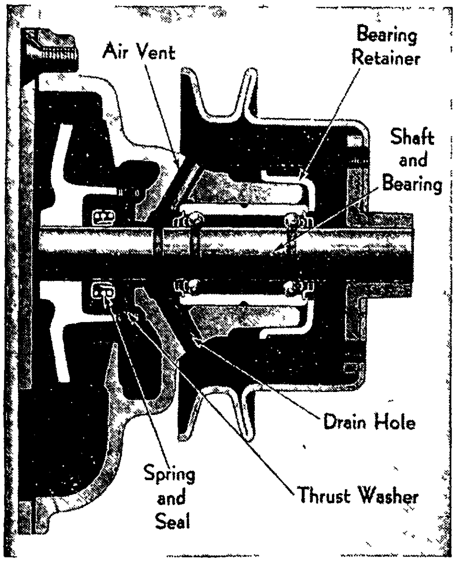


Fig. 29 Water pump. 1937-52

pipe on 1936. Disconnect hood hinge to radiator and remove hood. Disconnect brace rods to radiator and lift out core.

1937—Drain cooling system. Disconnect front fender supports. Disconnect upper and lower hose and radiator hold down bolts. Disconnect hood hinge to radiator and remove hood. Disconnect brace rods and radiator core from support. Remove water pump and lift out core.

1938-41 — Drain cooling system and disconnect upper and lower hose. Disconnect hood hinge to radiator and remove hood. Disconnect brace rods and radiator core from support. Remove water pump on 1939-41 models and lift out the core.

1942-52—To remove the radiator core:

1. Remove drain cock and hose from lower tank.
2. Disconnect upper and lower hose from radiator.
3. Loosen clamps at cylinder head and water pump and twist hose and remove.
4. Unclip wiring harness from radiator support and move out of the way.
5. Unbolt the core band from support.
6. Take off carburetor air cleaner.
7. Lift the core straight up and lay it over the top of the engine and remove.

WATER PUMP REMOVAL

1935-52—Drain cooling system, disconnect pump from engine and lift off.

WATER PUMP, OVERHAUL

1935-36—To overhaul, proceed as follows:

1. Remove pulley and pull impeller and shaft out through rear.
2. Remove packing nut and clean out old packing.
3. Press out old bushings and press new ones in.
4. Slip shaft through internal parts through rear.
5. Push shaft through front bushing until impeller is against thrust washer.
6. Press pulley on far enough to take up all end play without causing a bind.
7. Tighten packing nut firmly, back it off and then turn it up with a light pull on a short wrench.
8. Fill grease cup and make sure grease is reaching shaft.

1937-52—Fig. 29 is a sectional view of the ball bearing pump used on these models. A repair kit, which consists of the seal assembly, seal washer, bearing retainer and plate gasket, is available and should be used when a leak develops. To repair these pumps, proceed as follows:

1. Place pump in vise and remove pump plate attaching screws. Take pump from vise and remove plate and gasket.
2. Assemble pump pulley, Fig. 30, to puller, making sure tool is installed with puller plate square with pulley face.
3. Place puller plate in vise, Fig. 30, and tighten puller screw to remove pulley. Remove tool from pulley.
4. Place pump in vise and with long drift punch, remove bearing retainer from pump body.
5. Support pump on milled shoulder of body in a hand arbor press, or press plate shown in Fig. 30A, and press shaft and bearing out of pump body and impeller.
6. Remove thrust washer and seal from impeller and discard.
7. Wash all parts except pump shaft bearing in cleaning solvent. (Pump shaft bearing is a permanently sealed and lubricated bearing and should not be immersed in cleaning solvent—it may be cleaned with a solvent dampened cloth.)
8. Inspect shaft and bearing for roughness or excessive end play. Remove any rust or scale from shaft with fine emery cloth. The bearing should be wrapped in cloth while this operation is performed to prevent emery dust from entering bearing.
9. Inspect seat for thrust washer in pump body for pit marks or scoring. If thrust washer seat is scored or pitted, the entire pump should be replaced.
10. To assemble, install the shaft and bearing into the body, applying pressure to the outer bearing race until it bottoms.
11. Press shaft and bearing retainer onto pump body by using a short piece of 1½" diameter pipe or the pilot shown in Fig. 30B.
12. Coat end of rubber seal (opposite to the end having the three projections) with sealer, then place seal into impeller bore with the sealer coated end down.
13. Coat both sides of thrust washer with a small amount of water pump grease and install washer on top of seal so that the two lugs index with slots in impeller.
14. Lay impeller and seal on a flat surface on an arbor press and carefully press shaft and housing into impeller, Fig. 30C.
15. Check clearance between face of impeller and pump body, Fig. 30D. This clearance should be between .010" and .035".
16. Place pump in arbor press with end of pump shaft supported on a small flat plate and press pulley onto shaft, Fig.

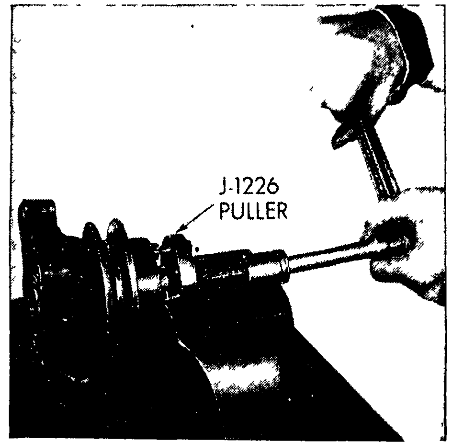


Fig. 30 Removing water pump pulley. 1937-52

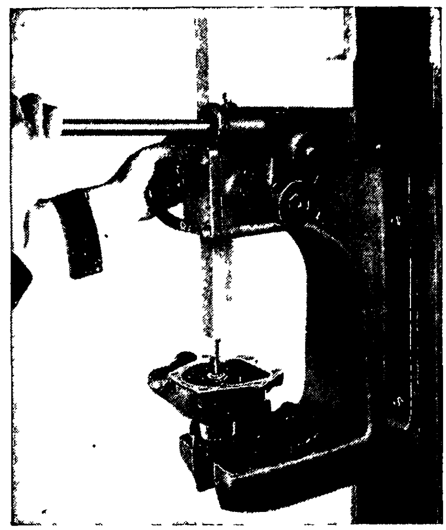


Fig. 30A Pressing water pump shaft and bearing from body. 1937-52

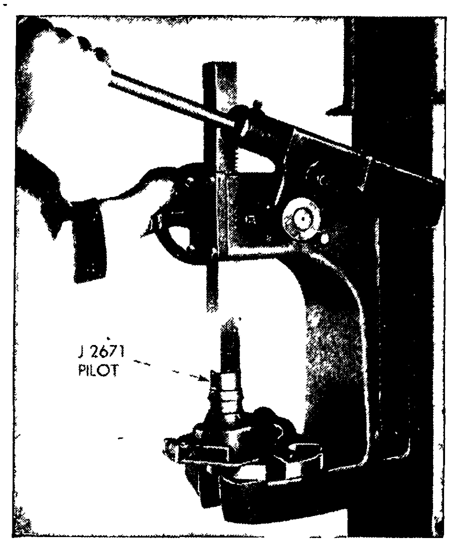


Fig. 30B Use a pi ce of 1½" pipe r th pil t shown t pr ss b aring retain r nt wat r pump b dy. 1937-52

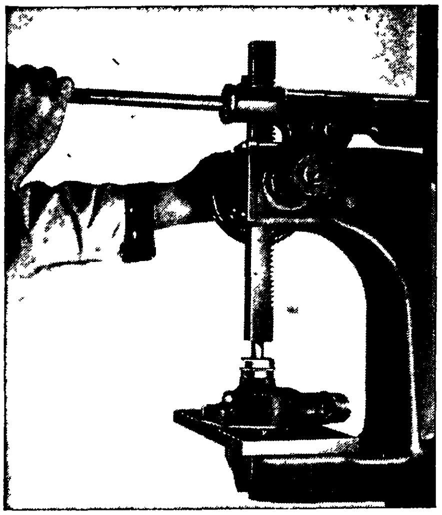


Fig. 30C Pressing water pump shaft and h using into impeller. 1937-52

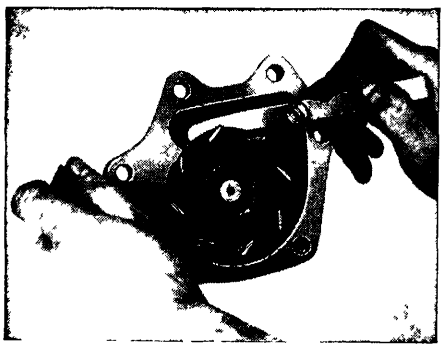


Fig. 30D Checking clearance between face f imp ller and pump body. Clearance sh uld b fr m .010" to .035". 1937-52

30E, until pulley is flush with end of shaft.

17. Install pump plate to body, using a new gasket. Install screws, tighten securely and stake in place.

EXHAUST VALVE COOLING NOZZLES

1935-52—Copper nozzles are installed in the cylinder head in such a manner that the opening near the upper ends directs the flow of water toward the valve seat. If removed, use care to see that the openings are pointed in the right direction. If necessary to replace, be sure that the new nozzles are of the correct length.

ELECTRIC SYSTEM

IGNITION TIMING

1935-52—Set the octane selector at zero. Check to see that the vacuum control operates freely, and is in full retard position. Crank the engine until No. 1 piston is coming up on its compression stroke and the steel ball in the flywheel registers with the line on the inspection hole in the flywheel housing. Loosen the distributor clamp screw and turn the housing until the points just break. Then set the octane selector so that a

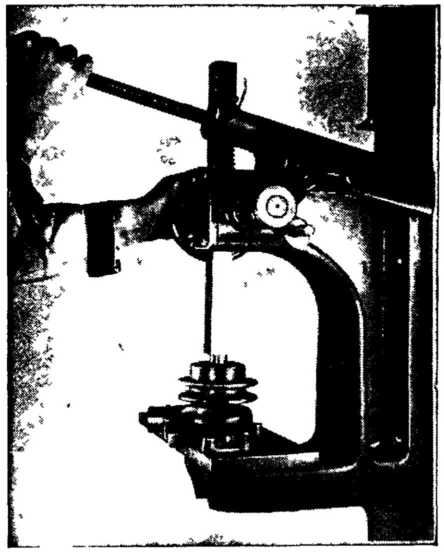


Fig. 30E Pressing water pump pulley onto shaft. 1937-52

slight ping is heard on open throttle at 10 to 15 MPH.

When a Neon timing light is used, the engine should be run at idling speed for if it is turning faster the spark may be advanced by the centrifugal weights on the distributor and the timing will not be correct. The stroboscopic effect of the Neon light makes the ball appear to stand still in relation to the pointer at the flywheel opening. The distributor can then be rotated until the ball appears to remain exactly in line with the pointer, when the timing is correct. The factory recommends using the Neon light in timing the ignition.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-37—With the clutch pedal resting against its stop, adjust the stop so that the pedal shank is ½ inch from the underside of the toe-board. Then adjust the pedal screw until the pedal has 1 inch free travel before the clutch begins to disengage.

1938-52 — Figs. 32 and 33 — With the clutch pedal resting against its stop, adjust the stop so that the pedal shank is ½ inch from the underside of the toe-pan. Then adjust the pedal screw until the pedal has from ¾ to 1 inch free

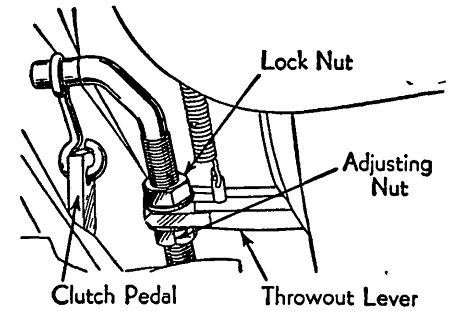


Fig. 32 Clutch pedal adjustm nt. 1939

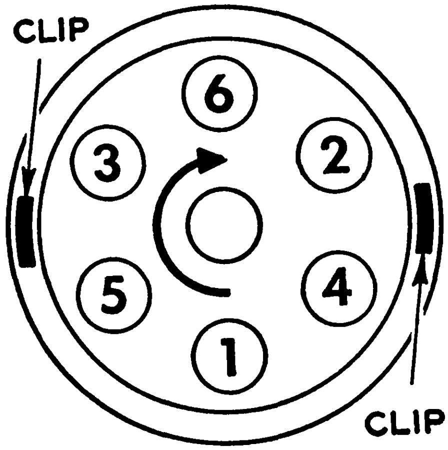


Fig. 31 Diagram of 1941-52 distributor cap showing firing ord r, directi n f rotation and locati n f cap clips

travel before the throwout bearing engages the diaphragm spring.

NOTE—Check this free travel with one finger on the pedal and not with the foot as this adjustment is very sensitive.

CLUTCH, REMOVE & REPLACE

1935-37—Remove the transmission as explained under that heading and unhook pedal pull back spring and clutch pedal lever rod and remove the cap screw holding the throwout fork to the flywheel housing. Two wrenches are necessary, one to hold the swivel on the fork and one to turn the cap screw. Remove the throwout fork and its bearing. Force the springs holding the throwout sleeve against the throwout levers and remove the sleeve. Unscrew, little by little, the cap screws which hold the clutch cover to the flywheel and remove the clutch assembly.

Assembly may be made in the reverse order. Insert a piloting tool in the pilot bearing in the flywheel and replace the clutch disc and pressure plate assembly. The "X" mark on the flywheel should line up as closely as possible with the corresponding "X" mark on the pressure plate in order that the clutch balance be maintained.

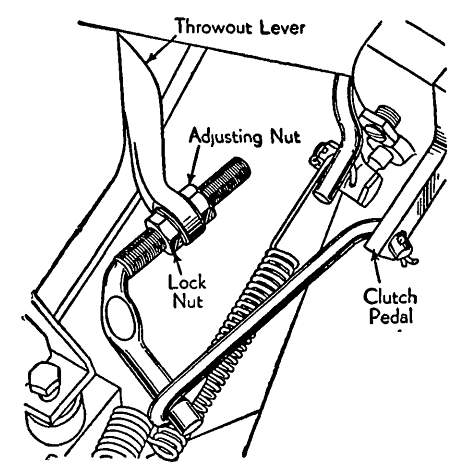


Fig. 33 Clutch p dal adjustm nt. 1940-52

Maximum run-out of the clutch throw-out bearing should not exceed .020". The plate may be trued with connecting rod shims which have had their ends trimmed.

1938-52 — Remove transmission, clutch throwout fork and bearing, and loosen clutch cover from flywheel by turning the six cap screws one turn at a time, relieving spring pressure evenly. Support weight of clutch while removing the cap screws, using the special pilot tool if it is available.

When replacing the clutch, make sure the X-mark on the flywheel registers with the similar mark on the clutch cover. Tighten the cover screws evenly, a turn at a time on each screw, to avoid distorting the cover while taking up spring tension.

TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1935-36 Standard Models — 1. Remove floor boards.

2. Disconnect brake rods from rear axle.
3. Detach hydraulic brake lines (1936).
4. Remove spring U clips and slide axle back until propeller shaft is clear of universal joint.
5. Disconnect hand brake lever.
6. Detach speedometer cable.
7. Uncouple transmission from cross member.
8. Remove two top transmission mounting bolts and insert guide studs in their place.
9. Remove other mounting bolts and slide transmission back and out.

Replace transmission in reverse order, being sure to use the guide studs to guide the transmission in safely.

1935-36 Master Models—1. Remove floor boards.

2. Disconnect speedometer cable.
3. Unfasten hand brake lever from frame.
4. Unfasten and slide universal ball and collar back on propeller shaft.
5. Split universal joint.
6. Remove two top transmission mounting bolts and insert guide studs in their place.
7. Uncouple transmission from frame cross member.
8. Remove other mounting bolts and slide transmission back and out.

Replace in reverse order, being sure to use the guide studs to guide the transmission safely into place.

1937-39 Models — 1. Remove floor pan over transmission.

2. Disconnect pull rods from brake cross shaft.
3. Detach left bracket and remove brake cross shaft.
4. Uncouple speedometer cable.
5. Disconnect vacuum shift controls (1939).
6. Support torque tube with jack and disconnect universal joint.

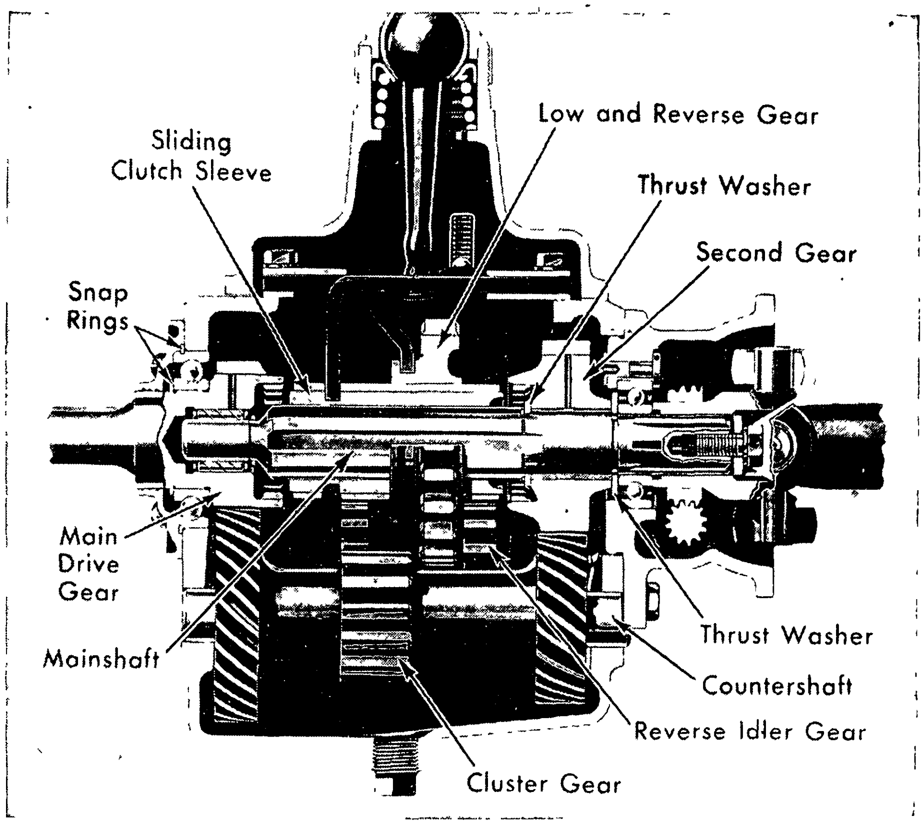


Fig. 34 1935-36 transmission on Standard models

7. Detach and slide universal ball and collar back on propeller shaft.
8. Split universal joint.
9. Relieve pressure on jack under torque tube.
10. Remove two top transmission mounting bolts and insert guide studs in their place.
11. Remove other mounting bolts and slide transmission back and out.

Replace transmission in reverse order, using the guide studs to guide the transmission in place.

1940-52 — 1. Remove metal floor cover.

2. Disconnect vacuum shift controls.
3. Remove brake cross shaft.
4. Remove speedometer cable.
5. Detach and slide universal ball and collar back on propeller shaft.
6. Split universal joint.
7. Detach transmission from cross member.
8. Remove two top transmission mounting bolts and insert guide studs in their place.
9. Remove other mountings bolts and slide transmission back and out.

Replace in the reverse order, using the guide studs to guide the transmission in safely.

TRANSMISSION, OVERHAUL

1935-36 Standard Models—To disassemble, see Fig. 34 and proceed as follows:

1. Remove transmission cover.
2. Lock mainshaft by placing transmission in two gears.
3. Remove universal joint.
4. Slide mainshaft and synchronizer sleeve through rear.
5. Press mainshaft out of rear bearing.
6. Remove second speed gear and thrust washers from mainshaft.
7. Pull main drive gear out through front.
8. Drive countershaft out through rear and lift out cluster.
9. Drive out reverse idler expansion plugs, remove lock screw, drive shaft out and lift out gear.

Assemble in the reverse order.

1935-36 Master Models—To disassemble, see Fig. 35 and proceed as follows:

1. Remove cover and place transmission in two gears to lock mainshaft.
2. Detach universal ball retainer and turn it to unlock countershaft.
3. Drive countershaft out rearward, allowing cluster gear to lie in case.
4. Withdraw universal ball retainer with second speed gear and clutch sleeve as a unit.
5. Remove first speed gear and front synchronizer drum through top.
6. Pull main drive gear out through front.
7. Drive out reverse idler expansion plugs, remove lock screw, drive shaft out rearward and lift out gear.
8. Lift out cluster gear and washers.
9. Press mainshaft out of rear bearing

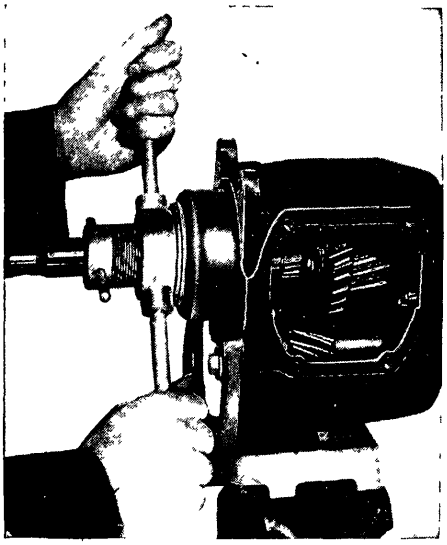


Fig. 37 R moving main drive gear and bearing with puller. 1937-52

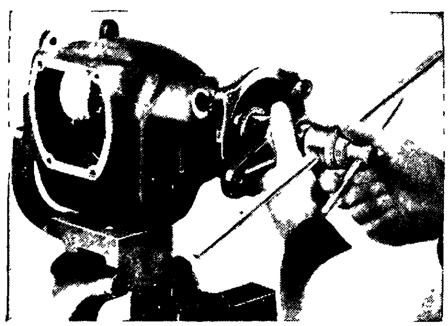


Fig. 38 Rem ving mainshaft. 1937-52

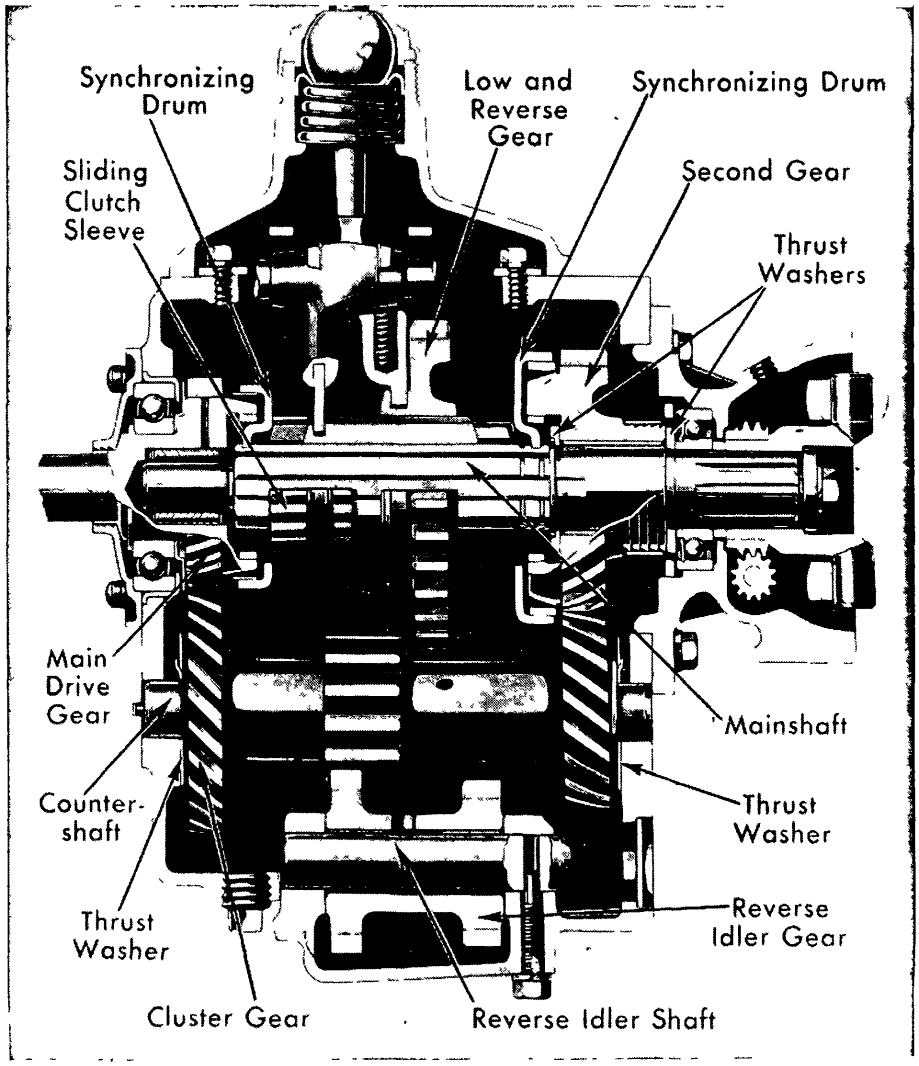


Fig. 35 1935-36 transmission for Master models

retainer, and strip mainshaft.

Reverse the order of the above procedure to assemble.

TRANSMISSION, OVERHAUL

1937-38—To disassemble, see Fig. 36 and proceed as follows:

1. Remove cover, noting that the two front screws also lock shift shafts in case.
2. After removing shifter interlock, drive shafts out through front.
3. Remove shifter yokes, lock balls and springs.
4. Lock transmission in two gears and remove universal joint.
5. Remove main drive gear through front.
6. Pull mainshaft out through front of case.
7. Remove clutch sleeve, sliding gear and second speed gear from case as a unit.
8. Drive countershaft out through front and lift out cluster gear.
9. Drive lock pin in reverse idler shaft, remove shaft and gear.

Assemble in the reverse order, noting the remarks made in the *Assembly Notes* for servicing 1939-51 transmissions.

TRANSMISSION, OVERHAUL

1939-52—To disassemble, see Fig. 36 and proceed as follows:

1. Remove cover and shifter assembly.
2. Lock transmission in two gears and remove universal yoke from mainshaft.
3. Use puller, Fig. 37, to remove main drive gear and bearing.
4. Use pusher, Fig. 38, to force mainshaft forward out of rear bearing.
5. Shift second speed gear into clutch sleeve and remove these parts together with sliding gear. Take second gear thrust washer from case.
6. Expand snap ring and tap mainshaft rear bearing toward inside of case and remove. (This bearing must be removed before attempting to remove the cluster gear.)
7. Drive countershaft out through front, and lift out cluster gear and thrust washers.
8. Drive idler shaft lock pin into shaft and remove shaft, idler gear and thrust washers.
9. Using tool shown in Fig. 39, remove main drive gear retaining nut and oil slinger. Then press shaft out of bearing.
10. Turn synchronizer ring in clutch sleeve until ends of ring retainers can be seen through slot in sleeve. Expand retaining ring, Fig. 40, and slip ring out of sleeve.

ASSEMBLY NOTES—Inspect all gears for wear or damage, and see that the first and reverse sliding gear and the clutch sleeve slide freely on the mainshaft. See that the synchronizing cones are not loose in the clutch sleeve. If the cones are damaged, it will be necessary to replace the clutch sleeve assembly and both synchronizing rings.

See that the synchronizer rings are smooth and that they do not rock in the cones. Excessive rocking affects proper synchronizing of the gears during shifting.

Normally, it should not be necessary to replace the energizing springs. However, should this be necessary, the spring is assembled in its groove with its offset end between the fourth and fifth clutch teeth of either bank of teeth. This will prevent the spring from turning in its groove.

Check the countershaft bushings for excessive wear by using a narrow feel-

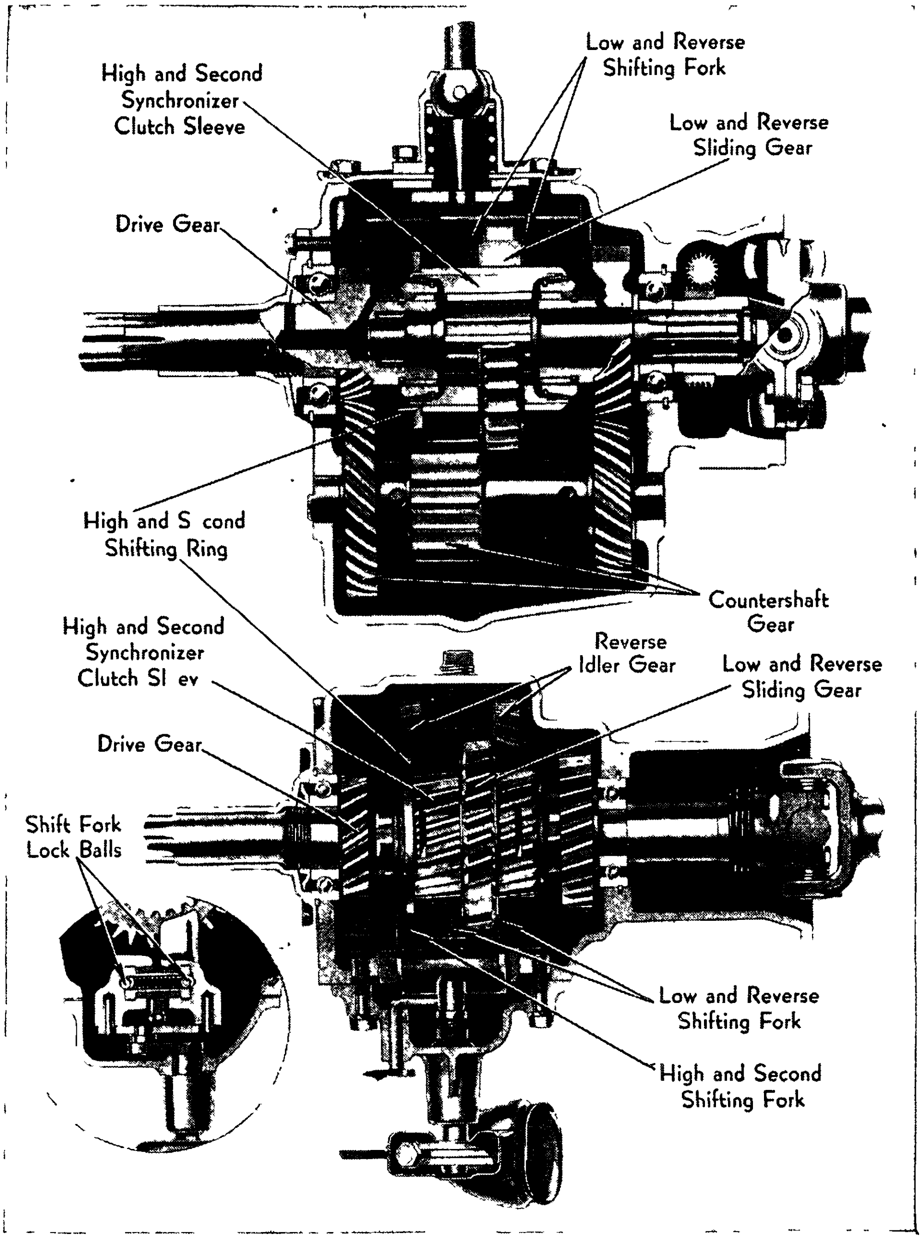


Fig. 36 Transmissions. Upper 1937-38; lower 1939-48. 1949-52 is similar except vacuum shift is not used

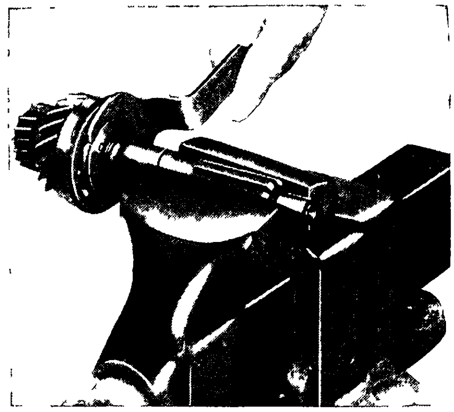


Fig. 39 Removing main drive gear retaining nut and oil slinger. 1937-52

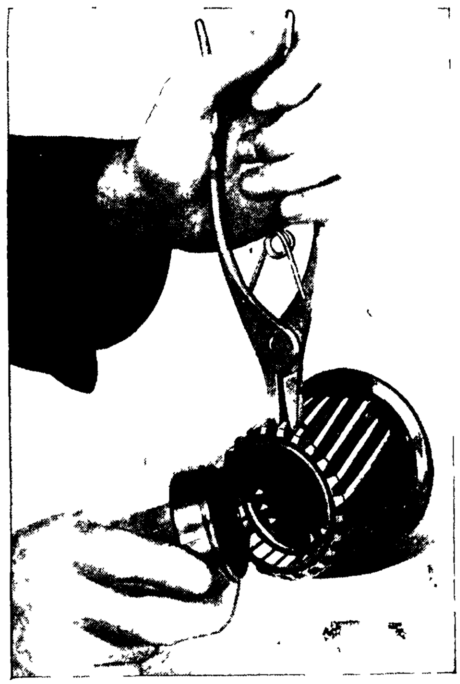


Fig. 40 Removing synchr nizer ring from clutch sleeve. 1937-52

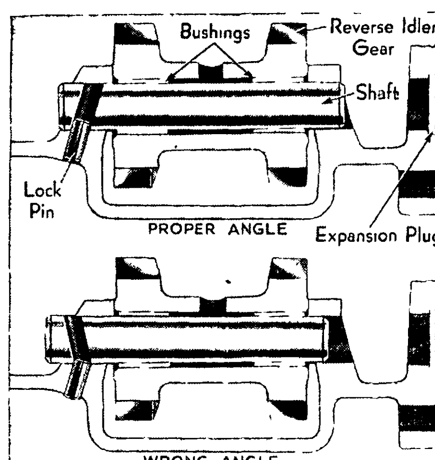


Fig. 41 Reverse idler gear, shaft and l ck pin. 1937-52

er gauge between the shaft and the bushings. The proper clearance should be from .002" to .004".

When installing the reverse idler, the chamfered teeth should be placed to the rear of the case. Install the idler shaft, making sure that the lock pin hole in the shaft lines up with the hole in the case at the same angle, Fig. 41. It is well to line up these holes with a punch before installing the lock pin. Use a new lock pin and drive it in about 1/16" beyond flush with the case, and peen the hole slightly.

When installing the countershaft, the step on the forward end should be flush with the front face of the case, or about 1/32" below the face, to maintain proper transmission alignment.

When installing the mainshaft, the proper seating of the shoulder on the shaft against the inner race of the mainshaft rear bearing should permit .010" end play of the second speed gear.

When the assembly has been completed, check the transmission in all gears to be sure that there is no indication of binding in any position.

GEARSHIFT

GEARSHIFT ADJUSTMENTS, 1939

Gearshift Lever—The relationship of the shift lever to the top of the mast jacket should be as shown in Fig. 42. To obtain this measurement, shift the lower support bracket up or down on the mast jacket.

Control Shaft Lever—Adjust the control

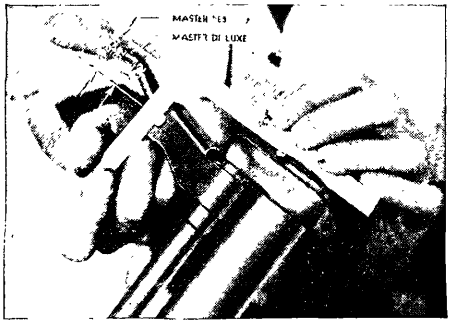


Fig. 42 1939 gearshift lever adjustment

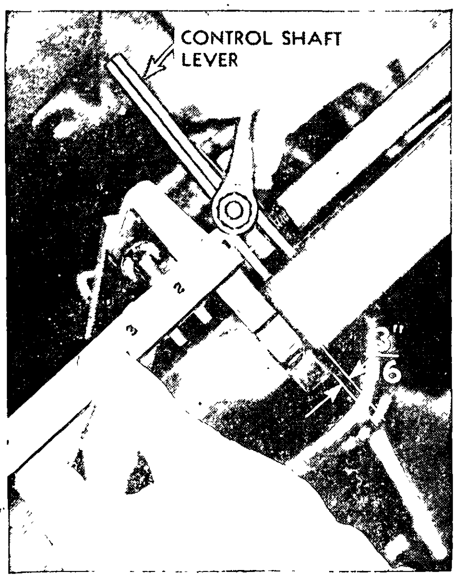


Fig. 43 1939 control shaft lever adjustment

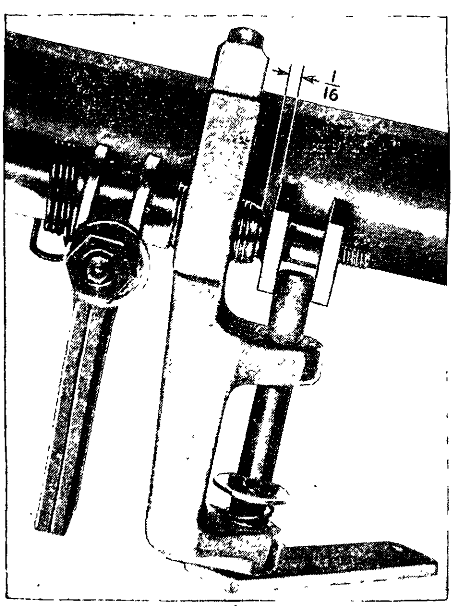


Fig. 44 1939 select r lev r guid adjustm nt

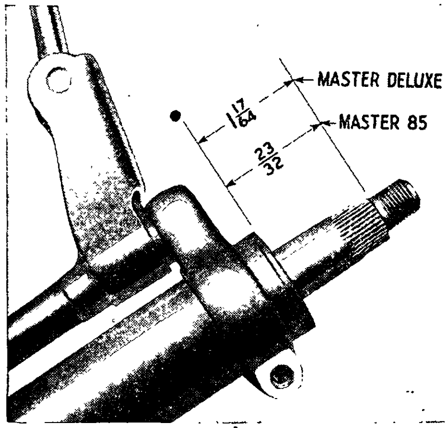


Fig. 45 1939 mast jacket position

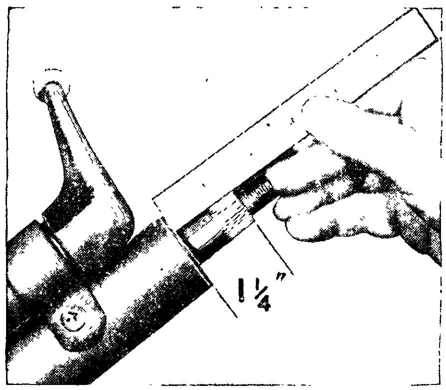


Fig. 46 1940-48 mast jacket position

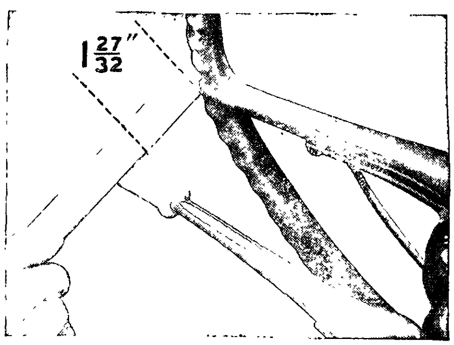


Fig. 47 1940-48 selector rod adjustment

lever up or down to secure $\frac{3}{16}$ inch clearance, Fig. 43.

Selector Lever Guide—With the end of the selector lever bell crank in the groove of the selector lever guide, screw the guide on the selector control rod until there is $\frac{1}{16}$ inch clearance as shown in Fig. 44.

Mast Jacket Position—If the distance between the horn contact ring at the top of the mast jacket and the shoulder at the top of the steering column is not as shown in Fig. 45, loosen the clamp bolt and move the jacket up or down.

Shift Selector Rod—To adjust, pull the rod forward to bottom the transmission interlock firmly against its stop. In this position, adjust the swivel by screwing it up or down on the rod. When the swivel is ⅛ inch to the rear of the hole in the lever tighten the lock nut. Pull the lever rearward and connect the rod.

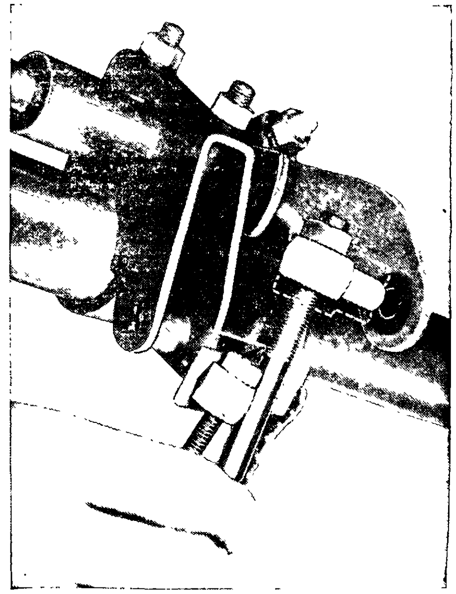


Fig. 48 1940-48 shift c ntrol rod adjustment

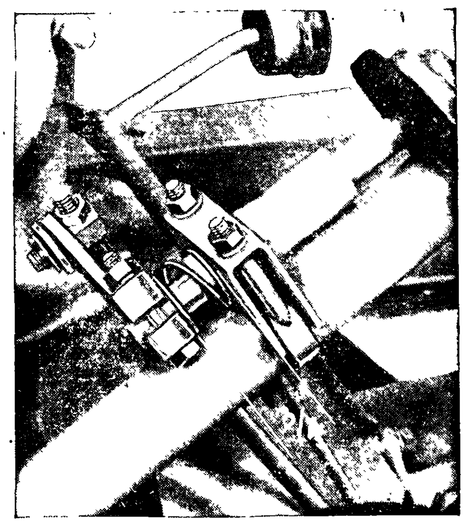


Fig. 49 1940-48 l w r support bracket position

Shift Control Rod—With the gearshift lever in the horizontal position, locate the clevis pin in the end of the shift control rod so that it is in the center of the elongated hole in the transmission operating lever. Adjust the swivel as required until its pivot lines up with the hole in the shift control lever, and install the spring and washer.

GEARSHIFT ADJUSTMENTS, 1940-48

Mast Jacket Position — If the distance between the horn contact ring at the top of the mast jacket and the shoulder at the top of the steering column is not as shown in Fig. 46, move the mast jacket up and down as required.

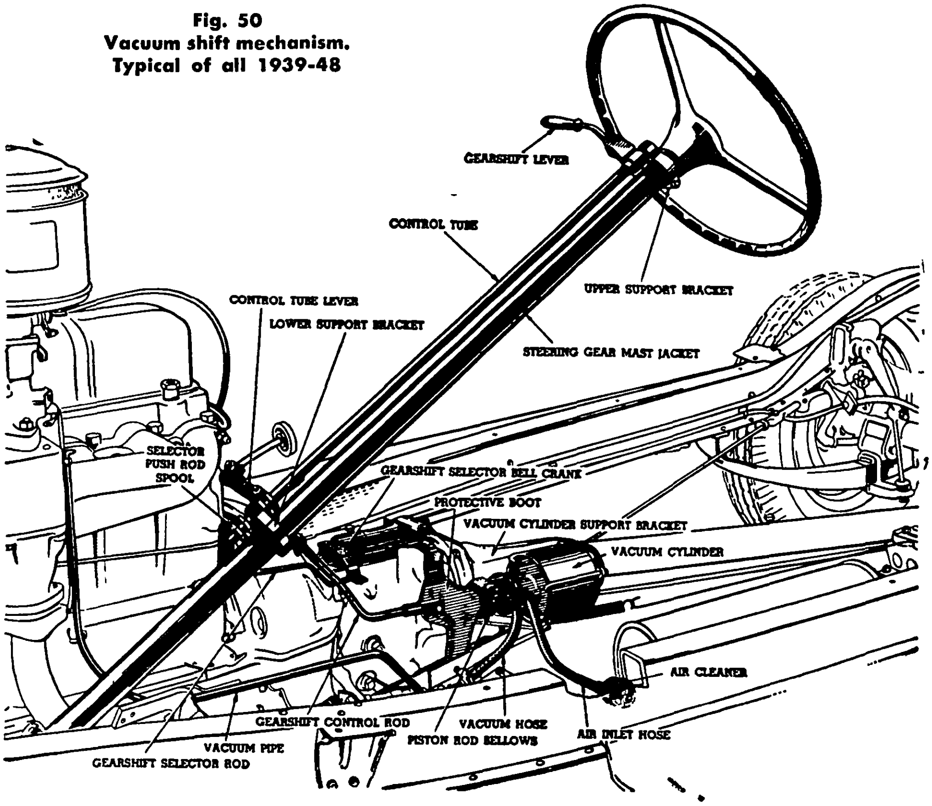


Fig. 50
Vacuum shift mechanism.
Typical of all 1939-48

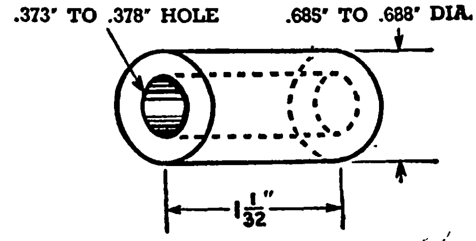


Fig. 51 Dimensions for making vacuum valve adjusting bushing. 1939

Selector Rod—Loosen check nut on rod adjustment and pull rod forward as far as possible. Screw the swivel up or down until the dimension is as shown in Fig. 47 when the rod is connected.

Shift Control Rod—With selector rod in horizontal position, loosen check nut and push control rod back until all clearance is taken up. Note the position of the swivel with reference to the shift control lever, Fig. 48. Pull the rod forward until all clearance is removed and again note the location of the swivel. The neutral position is a point midway between these two positions, Fig. 48. Screw the swivel up or down until the pivot just enters the shift control lever.

Lower Support Bracket—Move the lower support bracket up or down on the mast jacket until the dimension shown in Fig. 49 is obtained.

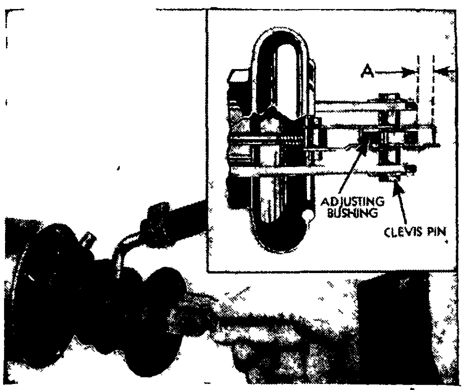


Fig. 52 Sh wing valve links away from cylinder. 1939-48

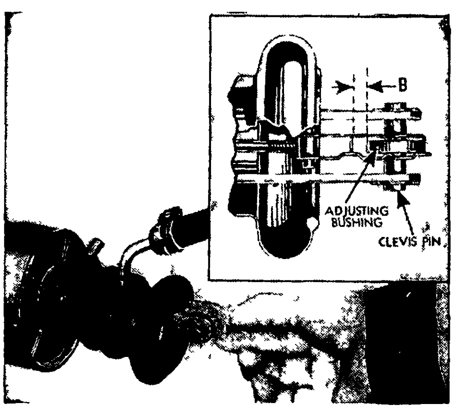


Fig. 53 Sh wing valve links t ward cylinder. 1939-48

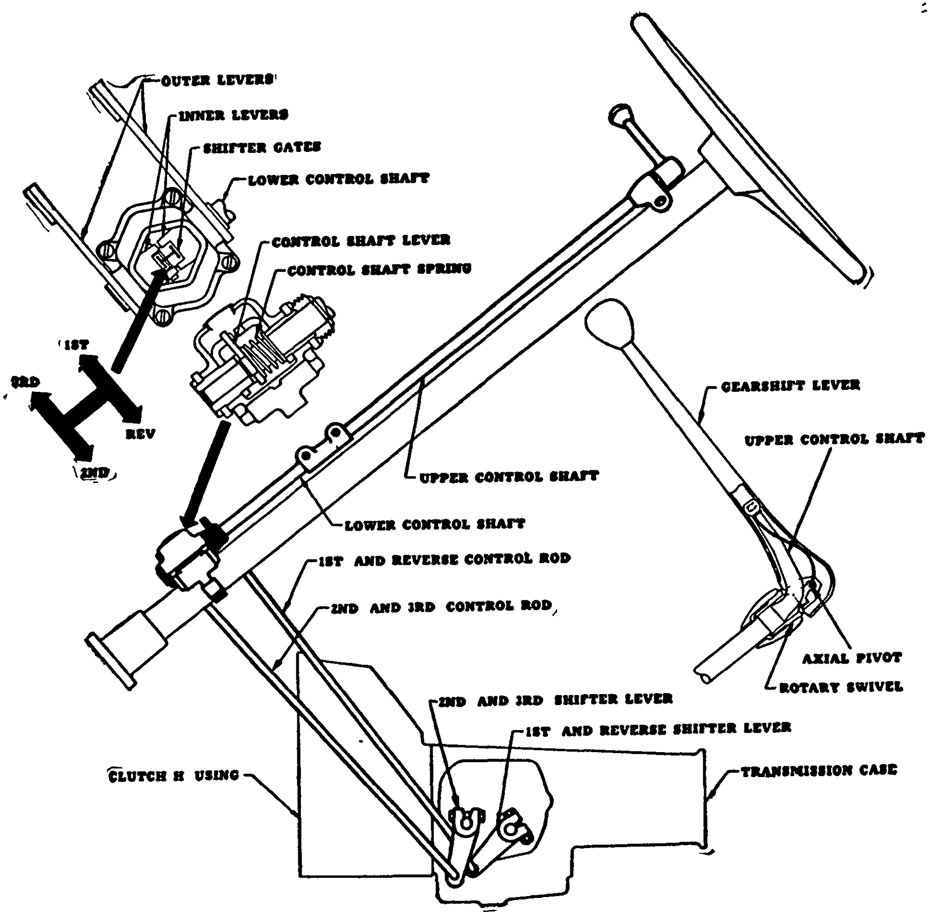


Fig. 53A 1949-52 gearshift linkag

VACUUM SHIFT

1939-48—Fig 50 shows the components of the vacuum gearshift mechanism In this system, both physical and vacuum effort are combined to affect transmission gear changes The majority of the effort, however, is exerted automatically by engine vacuum when the engine is running The gears may be shifted manually, which is the case when the engine is not running.

VACUUM VALVE, ADJUST

1939-48 — A special bushing should be used for making adjustments Make one up to the dimensions shown in Fig 51 for 1939 models, and to the following dimensions for 1940-48 cars $\frac{11}{64}$" by 940" by 315' In lieu of the latter, however, a bushing is available under Tool No J-1452-5 To adjust, proceed as follows

Disconnect piston rod yoke and valve links and push the piston into the cylinder to provide clearance for making adjustments Thread the special bushing through the valve links Raise the bushing with links inside the piston rod yoke and install the clevis pin through the yoke and bushing Fig 52

With the engine running to provide a source of vacuum, move the valve links away from the cylinder until all clearance between the bushing and clevis pin is toward the front as indicated at "A" in Fig 52 In this position, the piston rod should move slowly outward

Now move the links toward the cylinder until all clearance is toward the rear as shown at "B" in Fig 53 In this position, the piston rod should move slowly inward

If the piston will move outward only, the valve links are adjusted too far toward the cylinder If this condition exists, unscrew the links in the valve rod ½ turn at a time until the correct valve action is obtained Similarly, if the piston moves inward only, unscrew the links on the valve rod ½ turn at a time until valve action is correct.

VACUUM CYLINDER, LUBRICATE

1939—Every 6 months, or 6,000 to 10,000 miles of service, the vacuum cylinder should be lubricated as follows Remove clevis pin and shift control rod from reactionary unit Remove leather boot and allow shift control links to drop away from their normal position Remove vacuum hose from vacuum inlet. Exert forward pressure on vacuum inlet stack (keeping valve rod in extreme forward position in the piston) and shift transmission into 2nd gear by pushing forward on transmission operating lever. Move transmission operating lever from 2nd to 3rd gear position slowly, at the same time introducing ½ oz of shock absorber fluid into the cylinder through the vacuum stack Move valve rod to extreme rear position in the piston rod and introduce ½ oz of shock absorber fluid into the cylinder while moving the transmission operating lever from 3rd to 2nd gear position Reassemble vacuum hose, leather boot and shift control rod.

1940-48—It is necessary to remove the vacuum cylinder to lubricate it due to its mounting angle

With the cylinder set up on its mounting end, pull the valve link forward to open the vacuum port on the forward side of the piston, and, while holding the link, introduce ½ ounce of shock absorber fluid into the cylinder through the vacuum inlet stack Allow sufficient time for the oil to flow down into the cylinder Push the valve rod all the way into the piston rod, and introduce another ½ ounce of oil allowing sufficient time to flow into the cylinder

Move the piston rod in and out of the cylinder several times, at the same time turning the cylinder to spread the oil over the cylinder walls and piston leather

Reassemble the cylinder to its bracket, and connect the piston rod yoke and valve link to the reactionary lever system This should be done about every 6,000 to 10,000 miles

VACUUM SHIFT AIR CLEANER LUBRICATE

1939-48—Every 10,000 miles, remove the air cleaner from the frame side member and wash it in gasoline Dip the unit in engine oil and allow excess oil to drain before installing In dusty areas this operation should be performed more frequently

VACUUM SHIFT TROUBLE DIAGNOSIS

1939-48—When correctly assembled and adjusted, the vacuum shift mechanism should require only the periodic lubrication and cleaning to keep it in order. In event of faulty operation, check the following list for cause

Sticky Shift — Disconnect the selector control rod from the selector lever and check the up and down movement of the gearshift lever If the lever does not return freely to the downward position, check these following items (a) Fit of control shaft bracket pivot pins (b) Clearance of gearshift lever in bracket. (c) Roughness or burrs in the bracket. (d) Rubber anti-rattle bushing binding in control shaft (e) Selector lever bell crank binding in lower support assembly (f) Clearance between end of control shaft and upper face of selector control lever guide (g) Selector control rod bent, causing it to bind in the selector control lever (h) Check movement of selector lever on transmission

Hard Shift — If hard shifting is encountered in all gears, check for leaks in the vacuum line and connections If hard shifting is in high gear only, check vacuum hose clamp position at the vacuum cylinder for interference with speedometer cable Make certain that the control shaft lower support screws are tight Use an offset screwdriver

Creeping Out Of Gear — Check for interference of vacuum hose clamp at vacuum cylinder Check reactionary lever and shift linkage for binding or need of lubrication If these items do not correct the trouble, the vacuum cylinder valve should be adjusted.

1949-52 GEARSHIFT ADJUSTMENTS

Fig. 53A—There should be ⅞' clearance between the gearshift lever and the support bracket To adjust, remove the support from the steering column and the upper control shaft from the lower bracket Screw the upper support up or down as required, and replace the parts.

The clearance between the gearshift lever and the lower edge of the steering wheel rim should be $2\frac{1}{16}$" To adjust, loosen the control shaft and housing clamp bolts and move the housing up or down to obtain the desired clearance. Tighten bolts securely

With transmission in neutral, gearshift lever should be horizontal To adjust, loosen second and third speed control rod swivel clamp bolt and adjust swivel as required to bring the gearshift lever to horizontal plane Tighten clamp bolt

Remove the housing cover and make sure shifter gates in inner levers are aligned If alignment is off, loosen first and reverse speed control rod swivel clamp bolt and adjust swivel until shifter gates are aligned Tighten clamp bolt.

POWERGLIDE TRANSMISSION

1950-52—The unit consists of two major assemblies—a five-member torque converter and a planetary gearset, the latter used only for reverse and emergency low For normal operation the car is driven by the torque converter at all speeds, from start to maximum At no point does the transmission go into mechanical direct drive, although 'direct" is approached as the torque converter becomes, in effect, a fluid coupling at about 30 mph

The transmission is controlled by a lever and quadrant mounted on the steering post Positions on the quadrant are Park, Neutral, Drive, Low, Reverse The engine can be started only when the indicator is at Park or Neutral

The five elements of the torque converter are the primary pump, driven by the engine, the turbine, connected to the rear wheels and driven by the force of oil thrown from the primary pump, the secondary pump and the primary and secondary stators, all three of which are located between the primary pump and the turbine, Figs 54 and 55

These members are installed within a doughnut shaped housing, or torus The primary pump and turbine vanes line the outer curve of the torus, the turbine being located toward the front of the car An additional set of vanes resembling paddlewheel "buckets" are mounted inside the pump and turbine These make up what is called on overrun coupling and are designed to retard the movement of oil when the throttle is released, thus preventing "coasting" The two stators — primary and secondary, and the secondary pump are mounted along the inner diameter of the torus and are arranged to freewheel in one direction only

In operation, the primary pump, which is connected to the crankshaft, starts to turn when the engine is started Its

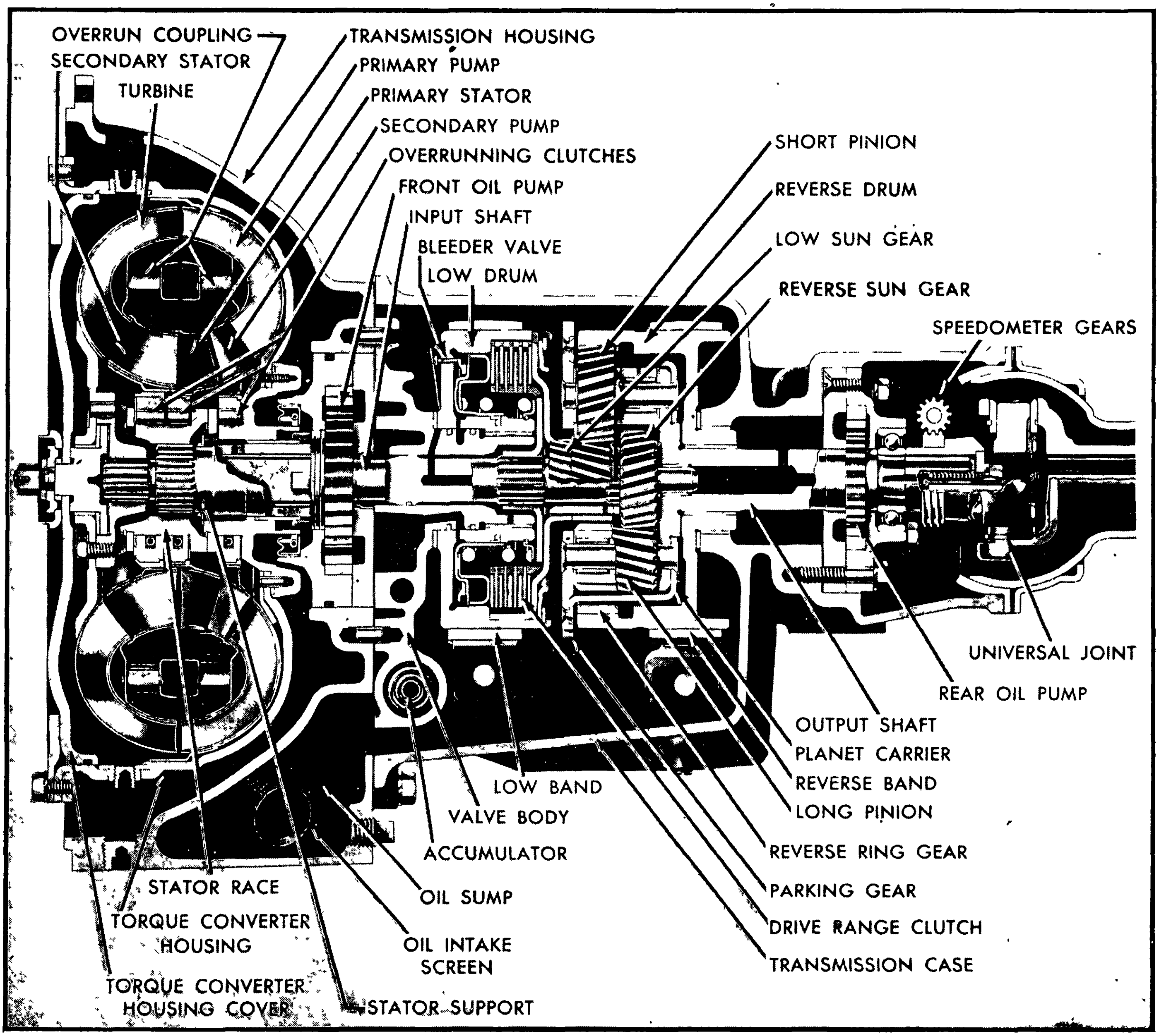


Fig. 54 Cross section of Powerglide transmission

vanes develop a rotary movement of the oil and, by means of centrifugal force, throw it out near the rim. The oil then enters the turbine blades which are connected to the rear wheels of the car. The turbine vanes are so shaped that they cause the oil to return, through the two stators, and the secondary pump, to the primary pump.

When the engine is speeded up, the flow of oil is accelerated by the primary pump. This speeds up the turbine. The oil is now flowing in a backward direction—through the exit spaces between the turbine vanes which are closer together than the entrances, thus increasing the force. Chevrolet compares this effect to increasing the force of a stream of water by partially stoppering the end of a hose with the thumb.

The stators (which can rotate in only one direction) now come into play. Their vanes are so designed that they receive the stream of oil from the turbine vane exits and convert it from a backward flow to a forward flow before they direct it into the vanes of the primary pump. The primary pump, in turn, picks up the oil and adds more velocity to it before starting it through the cycle again.

SERVICE ADJUSTMENTS

1950-52—The design of the Powerglide transmission requires only two service adjustments; a linkage adjustment and a neutral safety switch adjustment.

LINKAGE ADJUSTMENT—

1. Check clearance between control lever and upper support cover, which should be as shown in Fig. 56.
2. To correct this clearance, remove screws holding upper support to mast jacket and screw upper support up or down as required to gain the required clearance. Replace upper support screws.
3. Place selector lever in reverse and check clearance between control lever and steering wheel rim which should be 1½" (plus or minus 5/16"), Fig. 57. To adjust, loosen lower support clamp bolts and move up or down as necessary.
4. With selector lever in reverse, check clearance between reverse stop on control shaft lower support and lower lever, Fig. 58. The clearance should be 3/64".
5. To adjust, loosen transmission control rod swivel, move selector lever as necessary to obtain 3/64" clearance and retighten swivel. When making this adjustment, make sure transmission manual valve lever is raised to top detent position and selector lever is in Reverse position.

NEUTRAL SAFETY SWITCH — This switch prevents operation of the starter except when the transmission control lever is in Neutral or Park positions To adjust, proceed as follows:

1 Loosen two switch mounting screws.
2 Place selector lever in neutral and, with clips over flats on end of shifter shaft, insert pin into switch mounting bracket and locating plate, Fig. 59.

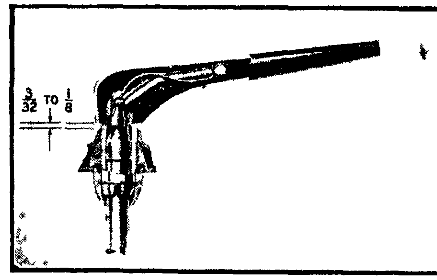


Fig. 56 Steering c lumn upp r support-to-control lever cl arance. Powerglide transmissi n

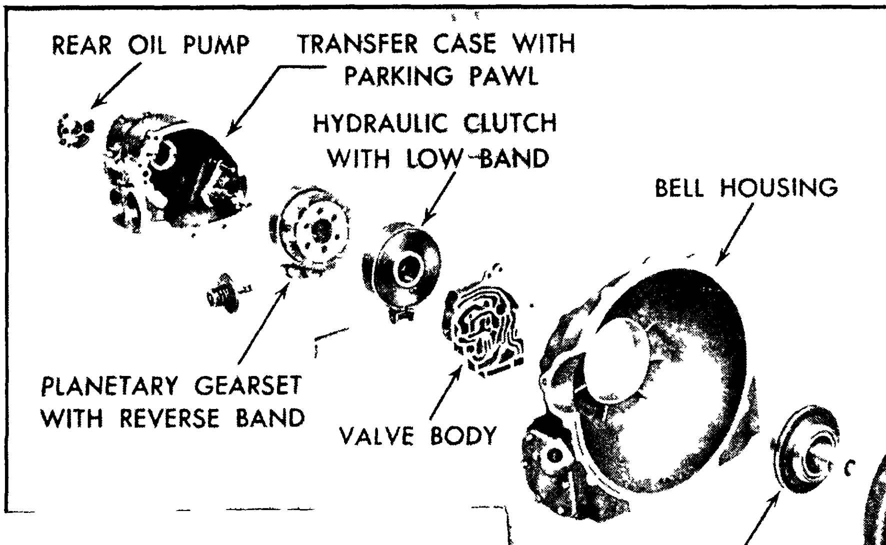
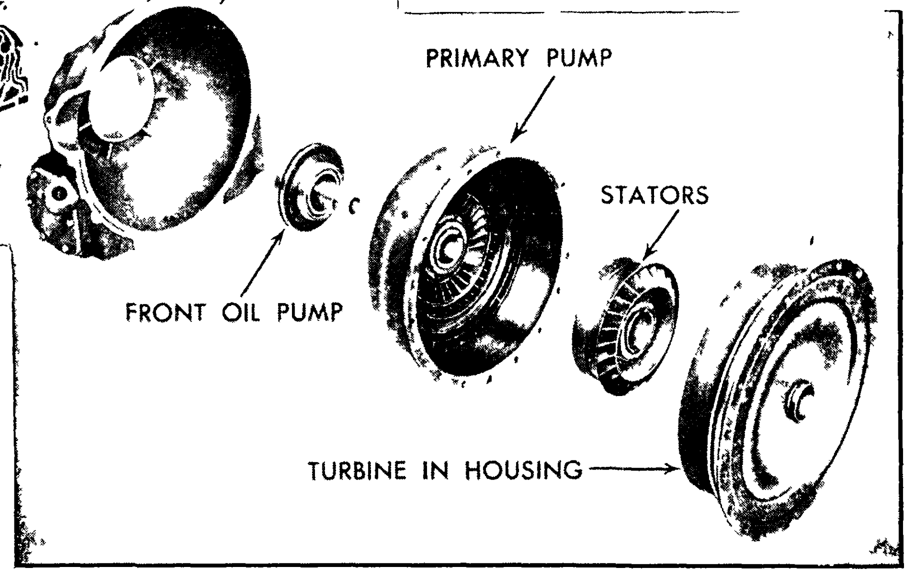



Fig. 55 Layout of Powerglide transmission components

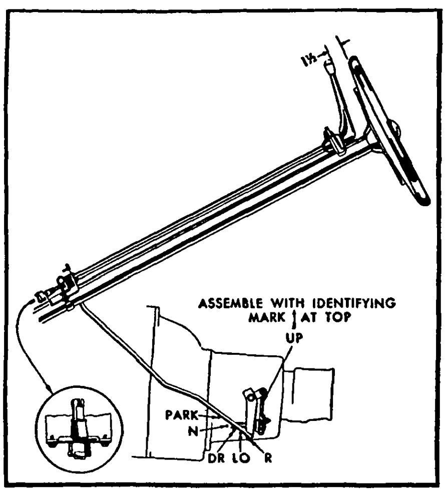


Fig. 57 Control lever to steering wheel clearance. Powerglide transmission

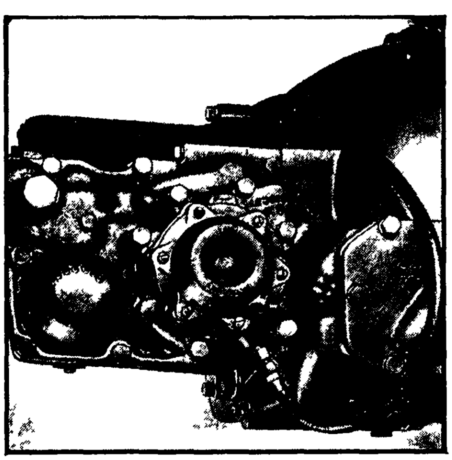


Fig. 60 Pressur gaug c nn ct d t l w servo apply line

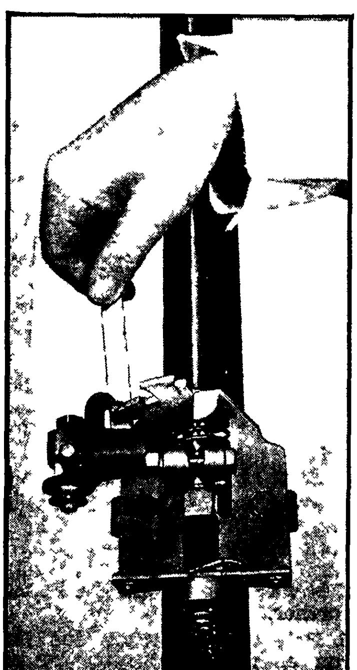


Fig. 58 R v rse stop to l w r lever clearance. Pow rglide transmissi n

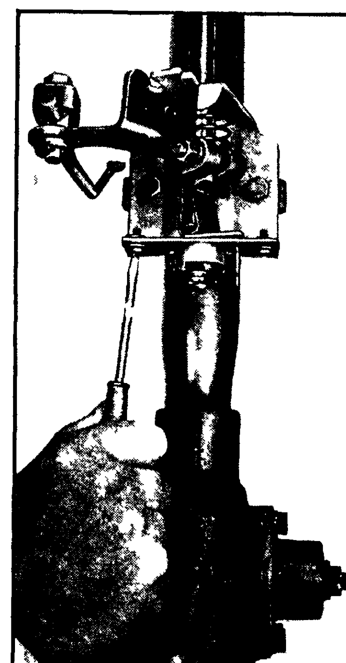


Fig. 59 Adjusting saf ty switch. P werglide transmissi n

3. Tighten screws to secure switch in this position and remove location pin.

TROUBLE SHOOTING

Before attempting to check for and correct any complaints on the Powerglide transmission, it is absolutely essential that the oil level be checked and corrected if necessary. Low oil level can be the cause of a number of things from excessive noise to slippage in all ranges. Partially low oil level may only be noticed by transmission slippage and tendency of engine to run away on shifts. Always idle the engine with the selector lever in Drive range with parking brake applied and with transmission warm when checking oil level.

Because of the above mentioned reasons, before any overhaul work is done, a road test should be made to be sure the complaint still exists after oil has been checked and brought to the proper level.

WARMING UP TRANSMISSION — When making checks for oil leaks and when checking minor complaints on functioning of the transmission, it should be remembered that cold oil can slow up the action of practically all of the hydraulic controls of the transmission. For this reason, a trouble or oil leak diagnosis should not be attempted until the transmission has been warmed up by either of the following procedures.

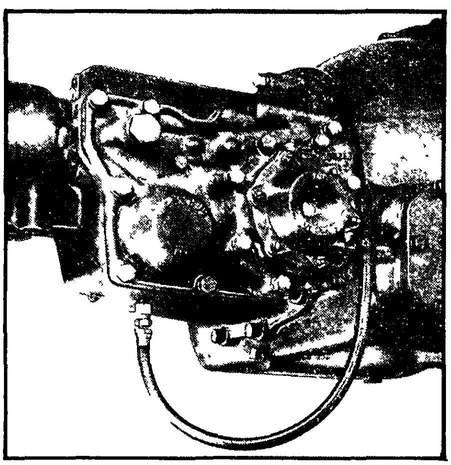


Fig. 61 Pressure gauge connected t revers servo apply line

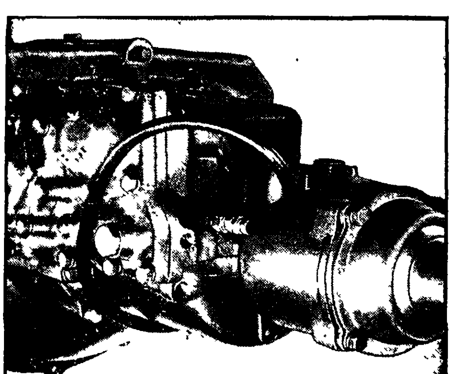


Fig. 62 Pr ssur gaug c nn ct d t rear pump

Important—Before any Trouble Diagnosis checks are made.

1. Carefully Warm Up Transmission.
2. Check Transmission Oil Level.
3. Install Tachometer.
4. Check Radiator Water Level.
5. Check Pressures.

Idle (400-425 RPM)

Drive__________

Low__________

Reverse__________

Stall Speed (1560-1610 RPM)

Drive__________

Low__________

Reverse__________

Road Speed (30 MPH)

Drive__________

Low__________

Condition	Possible Causes
Excessive Slip (All Ranges)	a, b, f, i, m
Excessive Slip, Drive Only	b, o
Excessive Slip, Low Only	b, g, j, l, n, t
Excessive Slip, Reverse Only	b, h, i, p, u, l, j
Creeps Forward in Neutral	b, o
Creeps Forward in Reverse	b
Creeps Backward in Low	b
Car Won't Move—Wheels Locked	c, v
Car Won't Move—Drive Only—Wheels Free	d, e, n, o
Car Won't Move—Wheels Free	a, s, v
Rough Shift, Low to Drive	g, n, o, l

Condition	Possible Causes
Engine Runaway, Low to Drive	g,
Rough Shift, Drive to Low	g, l, j
Rough Shift, Neutral to Reverse	l, p, j
Chatter in Low	h, o
Chatter in Drive	g, h, n
Chatter in Reverse	h, p, w
Buzzing (All Ranges)	a, r, s
Excessive Fuel Consumption	y, z, o
Converter Ringing Noise	a, f, m, i
Drag in Reverse	o, x
Jerky Reverse	o, x

POSSIBLE CAUSES CODE

a. Oil Level
b. Linkage
c. Parking Pawl
d. Radiator Coolant Level
e. Oil Cooler
f. Oil Suction Pipe
g. Low Band Adjustment
h. Reverse Band Adjustment
i. Oil Pressure—Front Pump
j. Modulator
k. Oil Pressure—Rear Pump
l. Accumulator
m. Pressure Regulator Valve
n. Low Band
o. Clutch
p. Reverse Band
r. Front Pump
s. Rear Pump
t. Low Servo
u. Reverse Servo
v. Internal Parts Broken
w. Planetary Unit
x. Clutch Relief Valve
y. Secondary Pump
z. Free Wheeeling Cams

Fig. 63 Powerglide transmission trouble diagnosis chart

To warm up the transmission on the road, drive the car approximately ten miles with frequent starts and stops as might be encountered in heavy traffic.

To warm up the transmission in the shop, it must be done according to the following method:

1. Jack up the rear end of car.
2. Start engine and run in Drive range at 20 mph for five minutes to warm up engine.
3. Apply brakes to lock rear wheels.
4. Press accelerator to floor with selector lever in Drive range and hold for approximately 15 seconds. **CAUTION**—If engine runs away, clutch is slipping and this warm up should not be carried any further.
5. Release accelerator and brakes and run engine at 20 mph for about two minutes.
6. If car was at room temperature when warm up was begun, repeat the above cycle (steps 3, 4 and 5) eight times. If car was driven into garage and is warm repeat cycle six times. If car has been standing outdoors and is extremely cold, warm up engine for ten minutes and repeat cycle twelve times.

NOTE—In diagnosing complaints it will be necessary in almost all cases to have an accurate knowledge of the oil pressures in the various circuits in the transmission. Pressure gauge J-4268 has been designed for this purpose. A systematic check of the transmission by using the gauge will aid materially in running down the cause of the complaint and save a lot of time and trouble.

Another method of quickly determining source of trouble is through the use of a tachometer. Using a tachometer gives a quick check on operation of the clutch, low band and reverse band.

TACHOMETER CHECKING PROCEDURE—

1. Connect tachometer to engine.
2. Apply brakes to lock rear wheels.

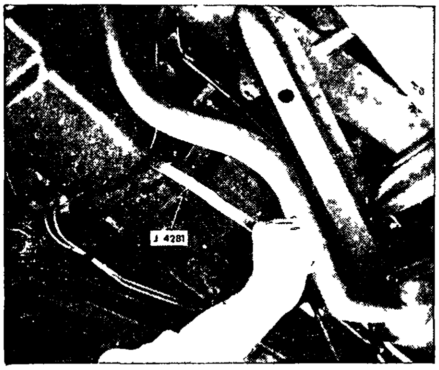


Fig. 64 Engine turning tool

3. Place selector lever in Drive range and run engine speed up as high as it will go. If engine speed rises above 1560-1610 rpm, which is stall speed, clutch slippage is indicated.
4. Place selector lever in Low range and if engine speed rises above the stall speed, low band is slipping.
5. Place selector lever in Reverse and if engine speed rises above the stall speed, reverse band is slipping.

CAUTION — When making checks at stall speed, excessive heat is built up in the converter. Check in various ranges should not exceed 20 seconds in each range.

OIL PRESSURE CHECKING PROCEDURE—Before checking any oil pressures, warm up transmission as outlined above.

There are five checking points provided on the transmission which allow checking by means of the pressure gauge. These are the front pump, rear pump, reverse servo, clutch, and low servo. All of these checking points except the front pump are accessible without dismantling the transmission.

1. Remove floor mat and transmission hole cover.
2. Clean off any dirt around pressure point check hole plugs.
3. Connect gauge to low servo apply outlet provided on lower front of servo cover, Fig. 60.
4. With tachometer, set engine at idle of 400-425 rpm and take idle pressure reading, which should be 40-45 lbs. with selector lever in Drive range and 125-150 lbs. with selector lever in Low range.
5. Apply brakes to lock rear wheels and increase engine speed to stall speed (1560-1610 rpm). With selector lever in Drive range, pressure should be 75-100 lbs. and may be as low as 70 lbs. without causing trouble.
6. With selector lever in Low range, pressure should be 160-200 lbs.
7. Shut off engine, remove gauge from low servo apply outlet and install in reverse servo apply outlet, Fig. 61.
8. Start engine and at idle of 400-425 rpm, take idle pressure reading, which should be 125-150-lbs. with selector lever in Reverse.
9. Apply brakes to lock rear wheels and increase engine speed to stall speed (1560-1610 rpm). With selector lever in Reverse, pressure should be 160-200 lbs.

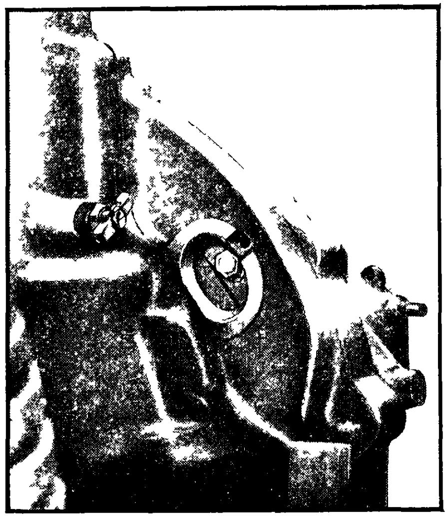


Fig. 65 Bolt access hole in bell housing

10. Shut off engine and raise rear wheels clear of floor.
11. Remove pressure gauge from reverse servo outlet and install it to rear pump outlet, Fig. 62.
12. Start engine, and with lever in Drive range, speed up to attain 30 mph road speed. Pressure of rear pump should be 50-75 lbs. Place lever in Low range, road speed 30 mph and rear pump pressure should be 140-180 lbs.

NOTE—In road testing car for operation when down shifting from Drive to Low range at 40 mph and foot off accelerator, a definite tire chirp should be evident at time of shift down. If chirp is not evident, or if engine runs away, it indicates trouble in the low accumulator or modulator lines. Fig. 63 is a diagnosis chart which may be used as a guide in checking complaints.

TRANSMISSION REMOVAL

1. Raise car and place on stand jacks.
2. Remove floor mat and transmission hole cover.
3. Remove toe pan plate.
4. Remove three top turbine housing attaching bolts through toe pan hole.
5. Disconnect speedometer cable from driven gear.
6. Disconnect emergency brake rod from cross shaft and drop cross shaft, cables and spring.
7. Remove capscrews holding universal joint collar to rear of transmission case, slide universal ball and collar back on propeller shaft housing.
8. Place jack under propeller shaft, remove capscrews which retain front trunnion bearings to front yoke, split the joint and lower front end of propeller shaft.
9. Remove two upper right transmission-to-converter housing bolts and install a lift sling (tool J-4262).
10. Place lifting device J-4279 in position over transmission and attach lift cable to sling.
11. Attach lift chain to two top transmission universal collar attaching holes.

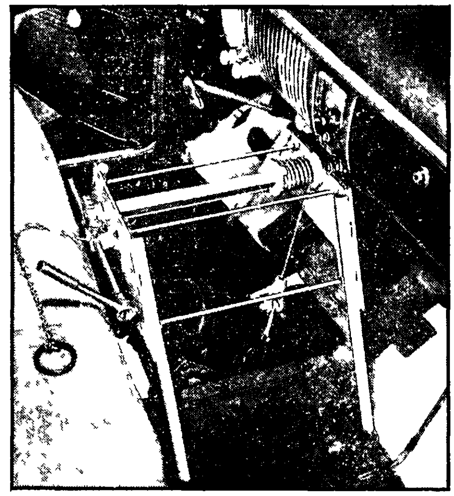


Fig. 66 Removing transmissi n with lifting h ist

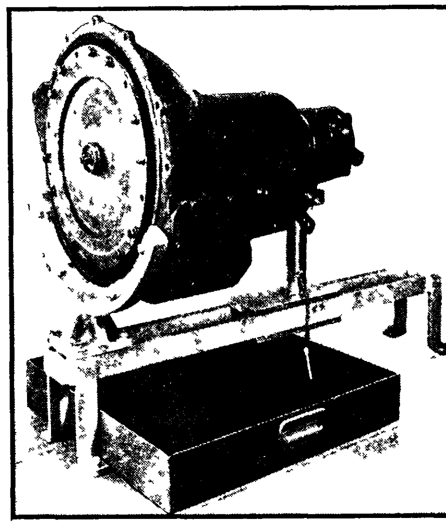


Fig. 67 Transmission in assembly fixture

12. Remove transmission and turbine drain plugs and drain transmission and turbine.
13. Disconnect transmission oil cooler lines and vacuum line from transmission.
14. Remove two lower turbine housing attaching bolts, flywheel cover and flywheel underpan extension.
15. Remove spark plugs.
16. Disconnect exhaust pipe from manifold and disconnect muffler support. Tie exhaust pipe and muffler to left frame side member.
17. Disconnect transmission short shift rod from parking lock lever and long shift rod from bell crank. Tie long shift rod up out of the way.
18. Remove bell crank lever and stud from transmission case.
19. Using tool J-4281, Fig. 64, to turn engine over, remove six flywheel-to-converter bolts, working through opening in housing on left side of engine, Fig. 65.
20. Clean dirt from around filler tube, dip stick and transmission side cover and remove turbine housing bolt which

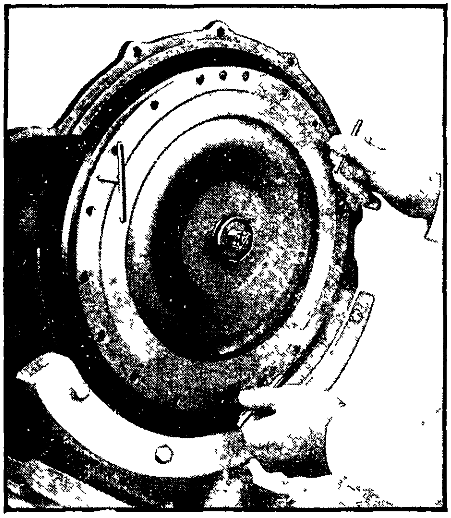


Fig. 68 Removing turbine and cover assembly

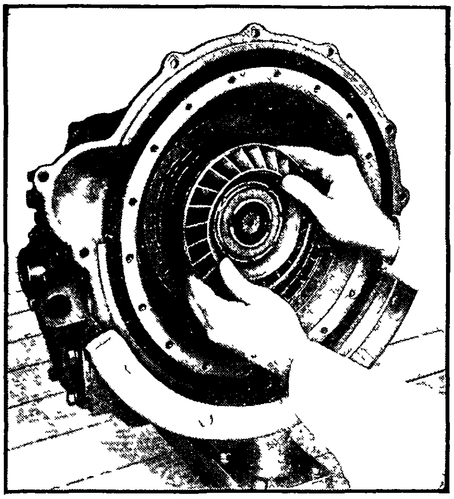


Fig. 69 Removing stator assembly

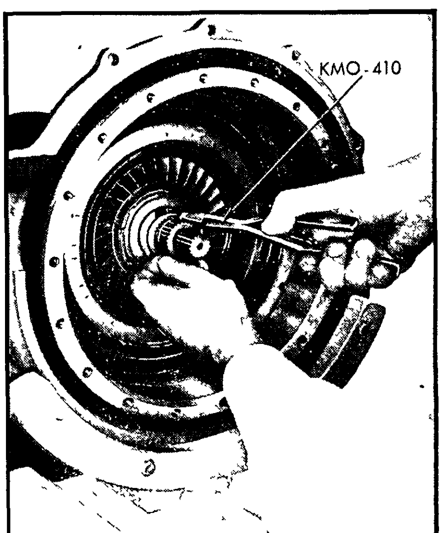


Fig. 70 Rem ving c nv rter r taining ring and wash r

holds filler tube in position. Remove filler tube and dip stick. **NOTE**—Use masking tape or a rubber stopper to cover filler tube hole in side cover.

21. Place jack under engine oil pan.

22. Remove bolts from transmission support and remove support.

23. Remove remaining turbine housing retaining bolts on each side, lifting or lowering engine and transmission as required to gain necessary clearance to bolts.

24. Move transmission back to clear flywheel pilot from flywheel, being very careful not to damage the pilot.

25. Lower transmission a little, then lift up on its back end as far as it will come and hook chain in notch in back of hoist, Fig. 66.

26. Use a pry bar between transmission and floor opening on right side to clear servo cover bolts.

27. Lower transmission a little more and again pull up on back end of transmission as far as possible. Then use pry bar between transmission and floor opening until the lubrication by-pass plug clears opening.

28. Lower transmission onto a dolly or creeper, being careful the transmission does not strike against flywheel.

TRANSMISSION INSTALLATION

NOTE—The torque converter is balanced as a unit and an "X" mark is stamped at the lightest point of the assembly. This "X" appears on the front face of the torque converter cover facing the flywheel.

The flywheel is also balanced and an "X" mark is stamped on the heaviest side of the flywheel. This "X" appears on the back side of the flywheel facing the converter.

When assembling the transmission to the engine, the "X" mark on the torque converter should be lined up with the "X" mark on the flywheel to the nearest bolt hole.

1. Place transmission on dolly or creeper and roll into position under car.
2. Attach lift sling to transmission and hoist cable to lift sling.
3. Lubricate flywheel pilot with Lubri-Plate.
4. Raise transmission and at same time lift up its rear end. Move up through opening, using pry bar as necessary to gain clearance at servo cover.
5. Continue to raise transmission until turbine housing is in its approximately correct position. Use care not to bump or damage the flywheel pilot during this operation.
6. Align bolt hole in flywheel with bell housing opening and with one $\frac{5}{16}$" guide pin installed in turbine cover, carefully enter guide pin in flywheel hole, raising or lowering transmission as required to align flywheel pilot. Transmission must not be forced forward but should be guided by hand until flywheel pilot enters flywheel and housings come together.
7. Install turbine housing-to-bell housing bolts.
8. Remove guide pin and install six flywheel-to-turbine bolts, rotating flywheel as necessary with flywheel indexing tool J-4281, Fig. 64.
9. Install filler tube and dip stick.
10. Install bell crank lever and stud to transmission case.
11. Connect short shift rod to parking lock lever, making sure identification arrow points up, Fig. 57, and connect long shift rod to bell crank.
12. Connect exhaust pipe to manifold and connect muffler support.
13. Replace spark plugs.
14. Replace oil cooler and vacuum lines to transmission, flywheel underpan extension and rear transmission support.
15. Remove jack from beneath engine oil pan and make sure transmission and converter drain plugs are tight.
16. Remove transmission lifting device.
17. Install new "O" ring seal on universal ball seat and insert in rear of transmission case. Connect universal joint and, using shims determined during transmission assembly, slide universal ball and collar forward on propeller shaft and fasten securely.
18. Replace emergency brake cross shaft, cables and spring and connect emergency brake rod to cross shaft.
19. Connect speedometer cable to driven gear.
20. Install top turbine housing attaching bolts, replace toe pan plate, transmission hole cover and floor mat.
21. Remove car from stand jacks.

LUBRICATION

DRAINING CONVERTER—As a result of an engineering change, it has been found that only one drain plug is required to drain the converter. This change, which eliminates the need for the lubrication check valve, allows for venting of the converter during draining through the lubrication oil passage, where the check valve was originally installed, directly into the case. Previously, venting of the converter was accomplished through the removal of both plugs from the converter housing.

Powerglide transmissions installed in late production 1950 cars have only one drain plug in the converter housing and it should be rotated to the bottom and removed to drain the converter.

CHECKING OIL LEVEL — The Chevrolet Service Department, after conducting a series of oil level checks, has found that the oil level may be adequately checked with the transmission selector lever in the "N" position.

Heretofore (prior to June 1950) recommendations have been to check oil level with the selector lever in the "D' position, as in this position, oil is being supplied to the hydraulic clutch and to the low servo.

However, as a result of the tests, it was found that the variations in oil level between these two positions, "N" and "D", are inconsequential when checked with the transmission dipstick.

Recommendations for checking oil level, therefore, have been changed and when making an oil level check the selector lever should be placed in the neutral "N" position. This recommenda-

tion supercedes all other checking procedures issued prior to June, 1950.

OIL REQUIREMENTS—The transmission requires an oil known as Automatic Transmission Fluid, "Type A", bearing a "AQ-ATF" number. The oil is available through Chevrolet dealers and oil company filling stations in sealed containers.

The transmission oil level should be checked every 1,000 miles. Oil should be added only when the oil level gets down to the "Add One Quart" mark on the dipstick. In order to check the oil level accurately, the engine should be idled and with transmission warm and selector lever in neutral "N".

DRAINING & REFILLING — Every 15,000 miles, the transmission should be drained and refilled and the oil suction screen removed and cleaned. Transmission should be warmed up before draining. Complete draining is accomplished as follows:

1. Remove transmission oil drain plug.
2. Turn engine over until converter drain plug is at the bottom and remove the plug to drain the converter.
3. Carefully clean dirt from right transmission housing side cover and remove.
4. Remove and clean oil suction screen and replace screen and cover.
5. Replace drain plugs in converter and transmission.
6. Put in three quarts of fluid, start the engine and while idling in neutral, complete the refilling by adding six quarts of oil.

TRANSMISSION DISASSEMBLY

IMPORTANT — Before attempting any disassembly operation, the exterior of the case should be thoroughly cleaned to prevent the possibility of any dirt getting into the transmission. During disassembly, all parts should be thoroughly cleaned with cleaning solvent or gasoline and air dried. Wiping cloths or rags should not be used to dry parts as lint may be deposited on them and cause trouble later.

In addition to the usual mechanic's hand tools, a number of special tools are absolutely essential for the various service operations described for the Powerglide transmission. These special tools are identified and illustrated where used and are available through the Kent-Moore Organization, Inc., General Motors Building, Detroit 2, Michigan.

To disassemble the transmission, proceed as follows:

1. Place transmission in fixture, Fig. 67.
2. Remove right side cover and oil sump suction screen.
3. Install turbine locking strap to turbine, attaching by means of bolt to one of flywheel attaching holes. This is necssary to hold unit stationary while loosening turbine cover retaining bolts.
4. After all retaining bolts have been removed, screw three 10-32x2" "T" screws into three tapped holes in turbine cover to loosen and remove cover and turbine assembly, Fig. 68.
5. Remove primary and secondary stators as a unit, Fig. 69, and test rollers for slippage, rotating by hand. The

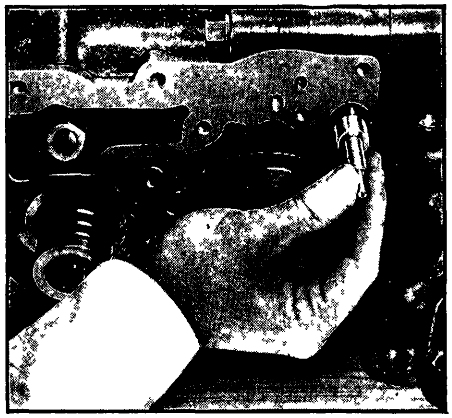


Fig. 71 Removing pressure regulator valve

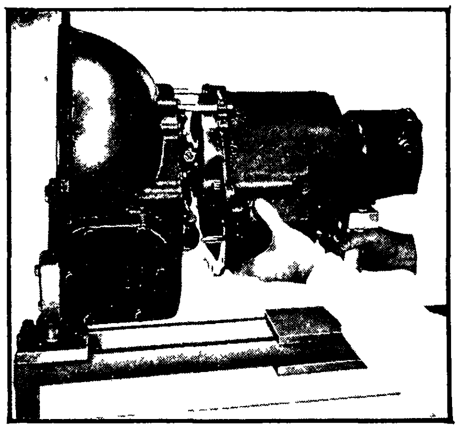


Fig. 72 Separating transmission and turbine

overrunning clutch mechanism should allow rotation in one direction only.

6. Check secondary pump free wheeling clutch as in Step 5.
7. Remove converter retaining ring and washer, Fig. 70.
8. Slide primary pump from stator support and remove. Examine pump hub for possible damage to bearing surface.
9. Remove modulator. When removing modulator cover, be careful that hydraulic plunger and body does not fall out and become damaged.
10. Remove servo cover and gasket. **CAUTION** — Reverse servo spring and pressure regulator springs exert pressure against this cover. Care should be taken when cover is removed to maintain pressure against cover to eliminate possible cover breakage.
11. Remove reverse servo spring and pressure regulator springs and valve, Fig. 71. Handle this valve carefully and lay aside to prevent damage.
12. Loosen low band adjusting screw lock nut and tighten low band adjusting screw to hold clutch in place.
13. Unfasten transmission from turbine housing and carefully separate these parts, Fig. 72.
14. Remove manual valve from valve body, Fig. 73, and manual valve lever from turbine housing. Remove bronze

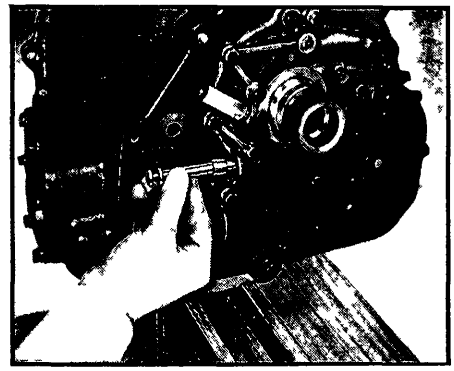


Fig. 73 Removing manual valv

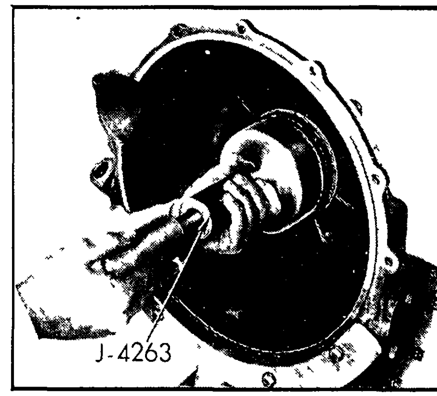


Fig. 74 Removing fr nt oil pump

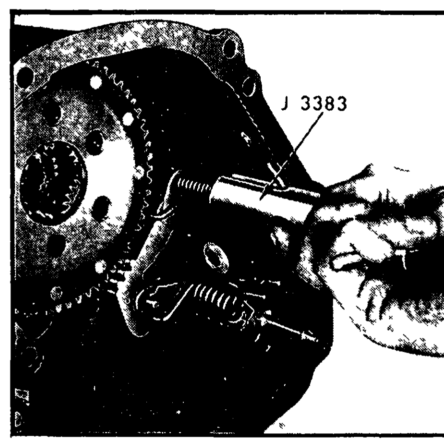


Fig. 75 Removing parking lock pawl spring

thrust washer from valve body delivery sleeve. Then remove body and gasket.

15. Install front pump driver tool, Fig. 74, and remove pump from turbine housing.
16. Loosen low servo adjusting screw and remove transmission input shaft and clutch from transmission.
17. Back off adjusting screw and remove low servo band and strut assembly, low servo piston and release spring.
18. Remove retainer bolt, lockwasher and universal joint yoke washer and slide universal front yoke off end of shaft.

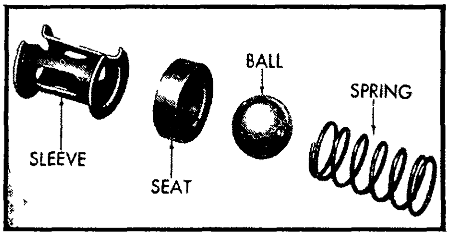


Fig. 76 Lubrication check valve parts

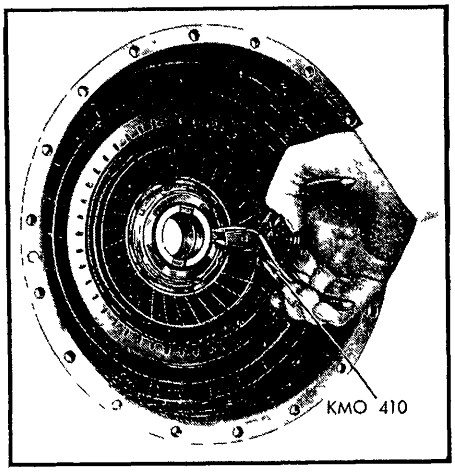


Fig. 77 Removing stator race thrust snap ring

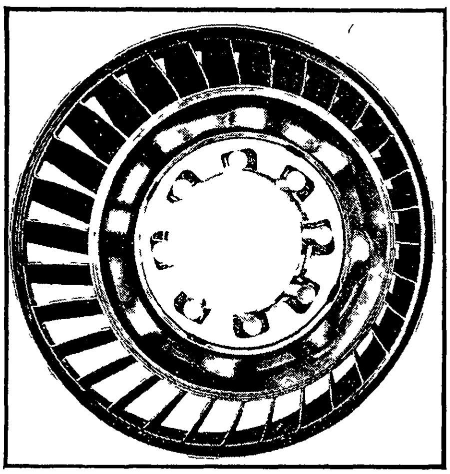


Fig. 78 Curvature of spring retainers

19. Using soft hammer, tap on end of output shaft to remove planet carrier from case and remove reverse brake drum.

20. Loosen reverse servo lock nut, back off adjusting screw and remove reverse servo band and piston.

21. Take off rear pump and gasket.

22. Using tool J-3383, Fig. 75, engage parking lock pawl spring and rotate spring to unhook end from case. Remove spring and parking lock pawl.

23. Remove transmission parking lock lever and steel washer. Then remove parking lock lever shaft and apply spring from case.

24. Remove lubrication check valve, parts of which are shown in Fig. 76.

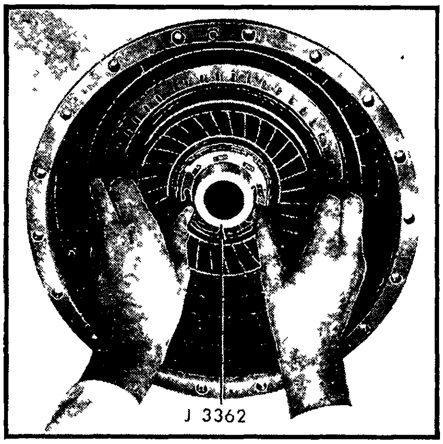


Fig. 79 Installing secondary pump to primary pump hub

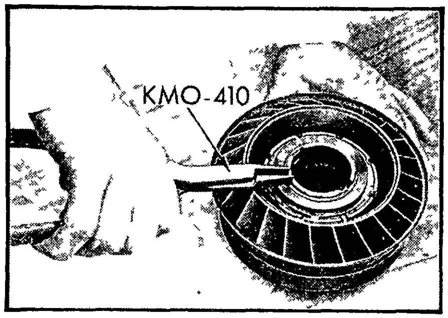


Fig. 80 Removing stator race thrust snap ring

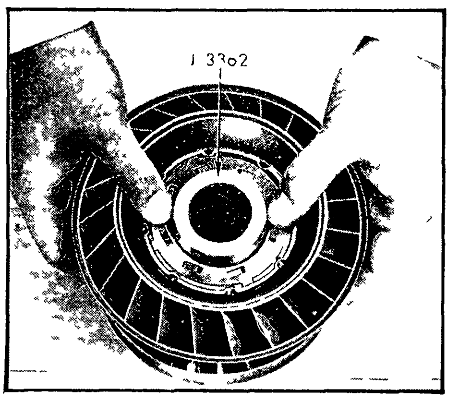


Fig. 81 Use of loading tool to asemble stators

OVERHAULING TRANSMISSION PRIMARY PUMP

DISASSEMBLY—

1. Remove stator race thrust snap ring and thrust washer, Fig. 77.

2. Rotate secondary pump in clockwise direction and withdraw from primary pump.

3. Remove overrun cam roller and spring retainer and remove cam rollers, spring retainers, springs and overrun cam thrust washer.

INSPECTION—

1. Wash all parts in cleaning solvent (air dry).

2. Inspect cam rollers for scoring or galling.

3. Inspect cam roller springs for distortion, and spring retainers for excessive wear or damage.

4. Inspect inner and outer primary pump hubs for galling or scoring and inspect pump bushing for excessive wear.

5. Check primary and secondary pump vanes for looseness or damage.

ASSEMBLY—

1. Assemble overrun cam roller and spring retainer so that prongs on retainer are to the rear.

2. Assemble cam rollers, spring retainers and springs in cam pockets.

CAUTION—Spring retainers are curved and this curvature should fit the curvature of the unit, Fig. 78.

3. Install overrun cam thrust washer, holding retainer on opposite side so that it is not pushed out of position.

4. Using loading tool J-3362, install secondary pump to primary pump hub, Fig. 79, and rotate secondary pump, making sure that pump rotates freely in a clockwise direction and locks when rotated in a counterclockwise direction.

5. Remove loading tool and install stator race thrust washer and snap ring.

STATORS

DISASSEMBLY—

1. Remove stator race thrust snap ring and thrust washer, Fig. 80.

2. Rotate secondary stator clockwise and remove from stator race. Then carefully rotate stator race and remove from primary stator. **CAUTION**—Exercise care when separating parts so that cam rollers and springs may not become lost.

3. Remove cam roller and spring retainer from secondary and primary stator and remove cam rollers, springs and retainers. **NOTE**—Cam thrust washers, springs and spring retainers only are interchangeable.

INSPECTION—Inspect these parts for same conditions as outlined for primary pump.

ASSEMBLY—

1. Install cam roller and spring retainer to secondary stator. **NOTE**—Secondary stator roller and spring retainer has long tabs to accomodate long rollers.

2. Install cam rollers, springs and spring retainers. In assembly of spring retainers, curvature of retainers must follow curvature of hub.

3. Install overrun cam thrust washer.

4. Install cam roller and spring retainer to primary stator.

5. Install cam rollers, springs and spring retainers, being sure that curvature of retainers follow curvature of hub.

6. Install overrun cam thrust washer.

7. Carefully install stator loading tool J-3362, Fig. 81, on stator race and install primary stator over tool and onto stator race with thrust washer down. **NOTE**—Carefully rotate stator in free wheel direction (clockwise) to eliminate

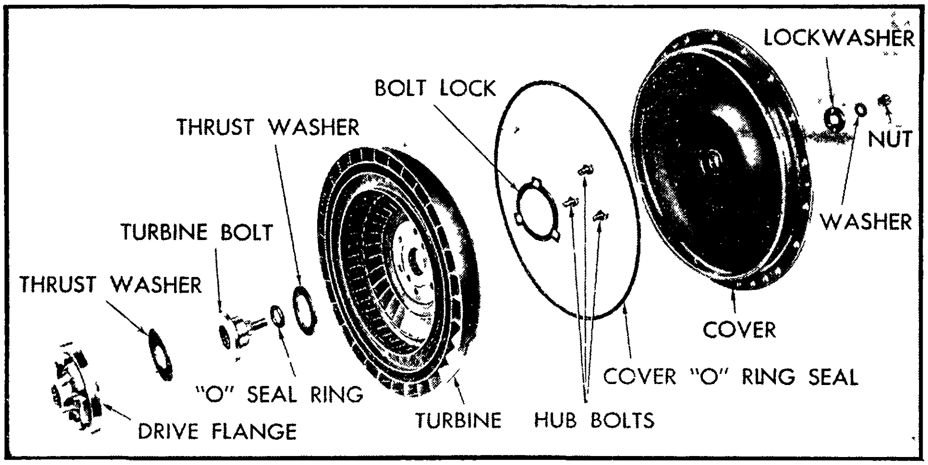


Fig. 82 Layout of turbine parts

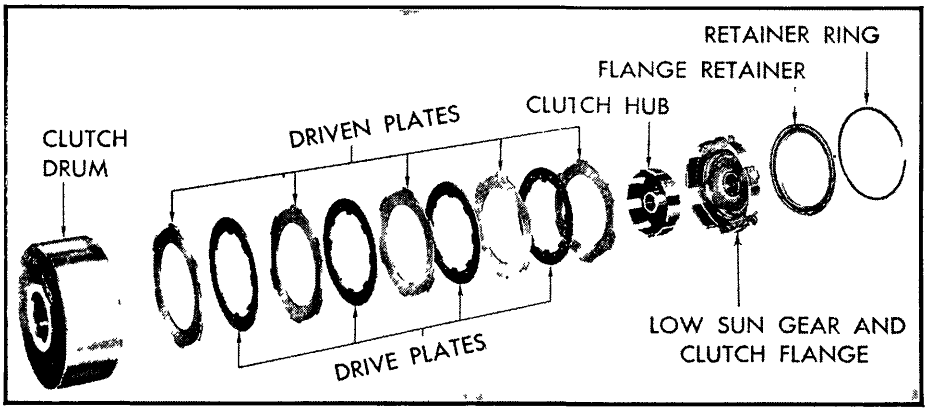


Fig. 83 Layout of clutch parts

possibility of pushing cam rollers out of position.

8. Carefully rotate secondary stator over loading tool with thrust washer down and onto stator race, being careful not to dislodge cam rollers, Fig. 81.

9. Install bronze thrust washer and snap ring.

10. Check operation of stators. They should free wheel in clockwise direction and lock to stator race in other direction.

TURBINE

DISASSEMBLY—Fig. 82.

1. Remove "O" ring from turbine cover.
2. Remove turbine bolt cotter key, nut, flat washer and slotted washer.
3. Lift turbine cover from turbine bolt.
4. Bend down ears of lock plate and remove three turbine hub-to-turbine capscrews.
5. Remove turbine hub and bolt from turbine.
6. Remove turbine bolt and two thrust washers from hub.
7. Remove "O" ring from turbine bolt.

INSPECTION—

1. Clean all parts in solvent and air dry.
2. Inspect turbine bolt, hub and thrust washers for excessive wear or scoring.
3. Inspect turbine blades for looseness or damage.

ASSEMBLY—Fig. 82.

1. Install new "O" ring on turbine bolt.
2. Install thick thrust washer to turbine, indexing lugs with locating holes in turbine.
3. Install turbine bolt.
4. Install thin thrust washer to turbine hub and install hub over bolt, indexing three dowels with locating holes in turbine.
5. Install lock plate and three turbine hub-to-turbine capscrews, tighten securely and lock.
6. Install turbine cover over turbine bolt.
7. Install slotted washer over turbine bolt, indexing pimples with locating hole in pilot. Then install flat washer and nut, tighten securely and lock with cotter key.
8. Install new "O" ring on turbine cover.

CLUTCH

DISASSEMBLY—Fig. 83.

1. Remove clutch flange retainer ring and retainer.
2. Remove low sun gear and clutch flange from clutch drum.

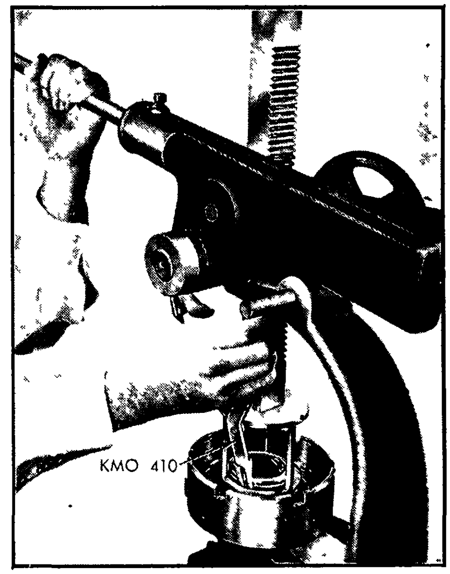


Fig. 84 Removing clutch spring snap ring

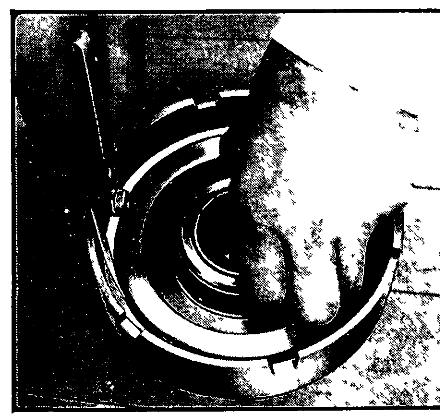


Fig. 85 Checking seating ot clutch piston ut r seal

3. Remove hub and plates from clutch drum.
4. Place clutch drum in press and install piston spring compression tool J-3364 to compress clutch release spring, Fig. 84. **CAUTION** — When handling clutch drum, care should be taken to prevent damage to clutch pressure relief valve.
5. Remove clutch spring snap ring, using snap ring pliers KMO-410. Release spring slowly and remove clutch spring seat and spring.
6. Forcibly rap clutch drum, face down, on a wood surface to remove clutch piston.
7. Remove piston outer ring seal from clutch piston.
8. Remove piston inner ring seal from hub of clutch drum.

INSPECION—

1. Wash all parts in cleaning solvent and air dry.
2. Inspect drum brake band surface for excessive scoring or burning. Also check drum bushing for scoring.
3. Check clutch drum piston relief

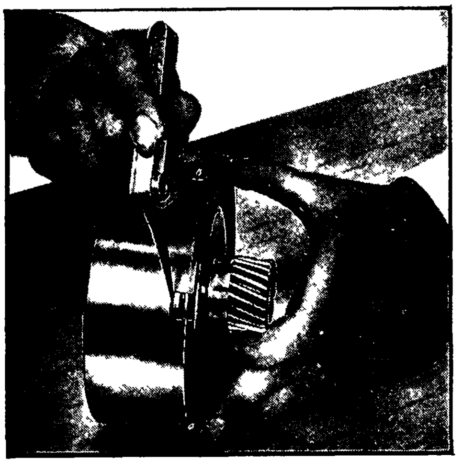


Fig. 86 Checking nd play of clutch flange

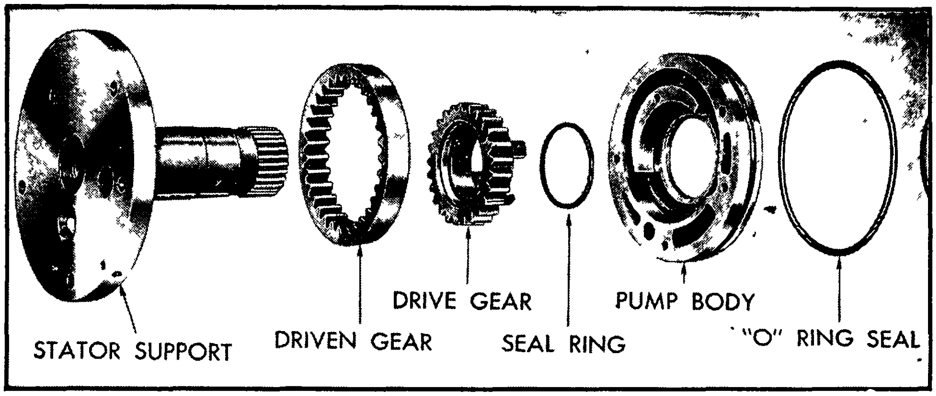


Fig. 90 Layout of front oil pump

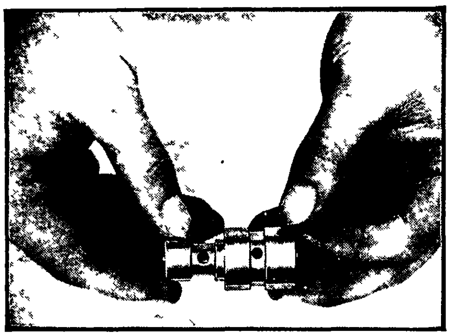


Fig. 87 Hydraulic plunger and body

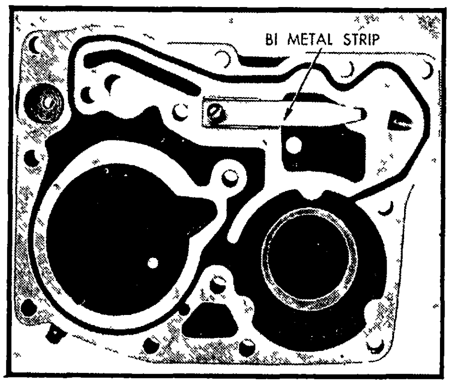


Fig. 89 Lubrication thermostatic valve

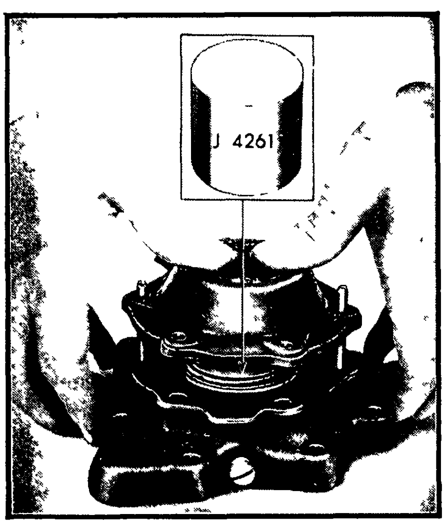


Fig. 88 Installing modulator cover

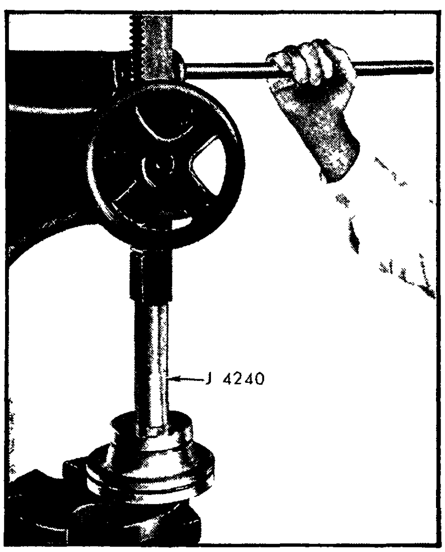


Fig. 91 Installing pump body oil seal

valve for free operation and see that valve is not bent or damaged in any way.

4. Check fit of clutch flange in drum slots. There should be no perceptible radial play between these two parts. Also check low sun gear for nicks or burrs.

5. Check clutch plates for burning or metal pickup. Also check to see that composition plates are a free fit over clutch hub and that steel plates are a free fit in clutch flange.

CLUTCH RELIEF VALVE, REPLACE—

1. With a sharp chisel, cut heads from relief valve spring retainer rivets.

2. With a small punch, drive rivets out of drum and remove valve spring and valve.

3. Install new relief valve, spring and two new rivets.

4. Carefully support drum and peen over ends of rivets securely.

ASSEMBLY—

1. Install new piston outer seal ring on clutch piston, being careful not to stretch seal. Lip of seal should be installed so that it is toward oil pressure side of piston.

2. Install new piston inner ring seal on inner hub of clutch drum with lip of seal toward bottom of piston pocket.

3. Place small amount of transmission oil on inner diameter of clutch drum and on seals. Then carefully install piston into clutch drum, using a piece of feeler stock to insure seating of outer ring seal in clutch drum, Fig. 85.

4. Install clutch spring and spring seat. Place unit in press and, using tool J-3364, compress spring and install snap ring. **CAUTION**—When compressing spring, be careful spring seat does not hang up in snap ring groove which will cause damage to groove.

5. Place clutch hub in clutch flange with open side of hub up and install five steel and four composition plates alternately, starting with a steel plate Steel plates are dished and must be installed with the dished side toward the low sun gear and clutch flange.

6. Assemble clutch drum over clutch flange, invert, and install clutch flange retainer and flange retainer ring.

7. Check end play with feeler gauge between clutch flange drive lug and drive slot in drum, Fig. 86. Maximum allowable end play is 013". **NOTE**—Retainer rings are available in three thicknesses (055", .064" and .073") to control end play of sun gear and clutch flange in drum.

MODULATOR

DISASSEMBLY—

1. Remove hydraulic plunger and body and carefully lay aside to prevent damage. **NOTE** — Hydraulic plunger and body consists of an internal plunger and external body, Fig 87 Care must be taken not to drop plunger from body.

2. Remove modulator outer cover attaching screws, holding cover down against diaphragm spring pressure.

3. Remove diaphragm and spring.

4. Wash all parts in cleaning solvent and blow out all oil passages.

INSPECTION—

1. Check diaphragm spring for distortion or loss of tension.

2. Check diaphragm for wear or cracks that would cause leaks.

3. Inspect modulator outer cover for cracks.

4. Inspect hydraulic plunger and body for nicks and make sure body operates freely in modulator bore and plunger operates freely in body.

ASSEMBLY—

1. Place assembly tool J-4261 in hydraulic plunger and body bore of modulator. Place diaphragm in position and place spring on diaphragm.

2. Install two 10-24 x 3″ guide pins and install modulator cover, Fig. 88. Install attaching screws and tighten securely.

3. Install hydraulic plunger and body with plunger up so plunger will engage modulator lever when assembly is completed.

SERVO COVER

DISASSEMBLY—

1. Remove bi-metal strip retaining screw, strip and retainer from cover, Fig. 89.

2. Remove lubrication by-pass ball plug and copper gasket. Remove spring and ball from cover.

3. Wash all parts in cleaning solvent and blow out all oil passages.

INSPECTION—

1. Inspect cover for nicks or cracks which would result in oil leaks.

2. Inspect by-pass ball spring for distortion.

3. Inspect modulator control lever for free operation. It is important that this lever does not bind on guide pin.

ASSEMBLY—

1. Install by-pass ball in servo cover.

2. Install by-pass ball spring.

3. Using new plug gasket, install plug and tighten securely.

4. Install bi-metal strip retainer, strip and retaining screw and tighten securely.

FRONT OIL PUMP

DISASSEMBLY—Fig. 90.

1. Remove stator support from pump body.

2. Remove pump gears from body.

CAUTION—Use care not to drop these gears or nick them as they are not heat treated.

3. Remove front oil pump seal ring.

4. Remove "O" ring from pump body.

INSPECTION—

1. Wash all parts in cleaning solvent and blow out all oil passages.

2. Inspect pump gears for nicks or damage.

3. Inspect drive gear oil ring and oil ring groove, making sure ring is free of burrs and is free in ring groove. Also install ring in pump body bore and make sure hooked ring ends have clearance.

4. Inspect stator support pump face for nicks or scoring.

5. Inspect pump body for nicks or scoring.

6. Inspect pump body oil seal for excessive wear or damage or evidence of leakage.

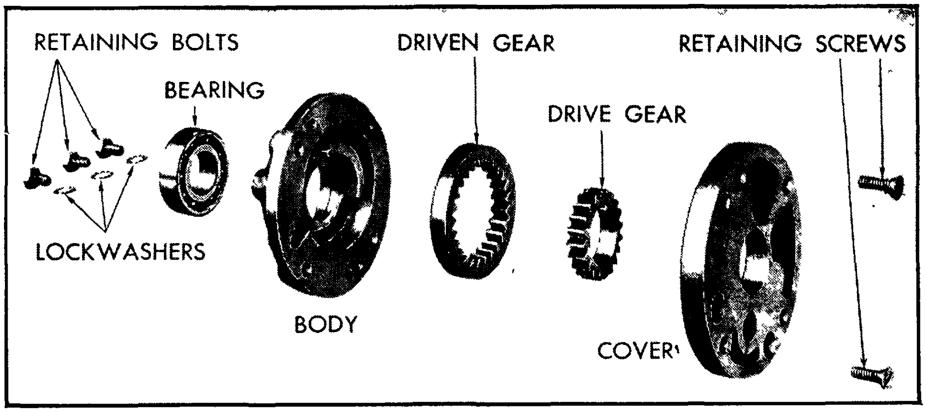


Fig. 92 Layout of rear oil pump

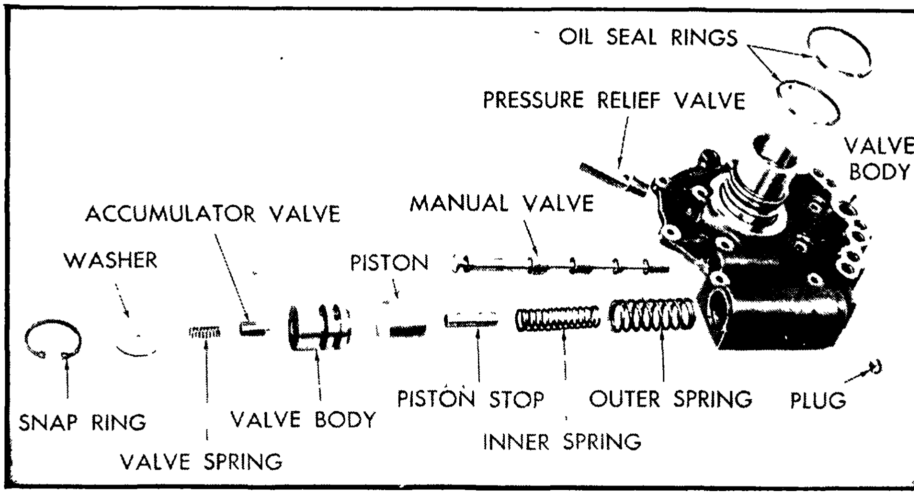


Fig. 93 Layout of accumulator valve body

7. If oil seal is damaged or is leaking, pry out and install new seal, using seal driver J-4240, Fig. 91.

8. Wash parts clean and dry, install pump gears and check: (A) Clearance between outside diameter of gear and body should be .001-.002″. (B) Backlash of gears should be .003-.005″. (C) Clearance of gears to crescent: internal gear .002-.005″, external gear .005-.006″. (D) With scale and feeler gauge check gear end clearance, which should be .0005-.0015″.

ASSEMBLY—

1. Install new "O" ring in pump body.

2. Remove gears from body, install oil pump seal ring, oil gears generously with transmission oil before assembly into body. **NOTE**—Drive lugs on drive gear protrude through oil seal.

3. Assemble stator support through drive gear aligning attaching holes.

REAR OIL PUMP

DISASSEMBLY—Fig. 92.

1. Remove two flat slotted head screws and remove pump body plate.

2. Remove pump gears, wash all parts in cleaning solvent and blow out all oil delivery holes.

INSPECTION—

1. Inspect rear bearing for roughness by rotating by hand.

2. If bearing is rough, remove three retaining capscrews and drive out old bearing.

3. Press new bearing into place and install capscrews.

4. With parts clean and dry, install pump gears and check clearances in same manner as outlined in Step 8 for front oil pump.

ASSEMBLY—

1. Remove gears from body and oil generously with automatic transmission oil.

2. Assemble gears to body.

3. Install pump body plate and secure with two flat slotted head screws.

ACCUMULATOR VALVE BODY

DISASSEMBLY—Fig. 93.

1. Using pliers J-4245, Fig. 94, remove accumulator special snap ring.

2. Remove accumulator valve spring washer, valve spring and valve.

3. Remove accumulator valve body and piston from its bore.

4. Remove accumulator inner and outer springs and piston stop from piston bore.

5. Remove two clutch drum oil seal rings.

6. Remove pressure relief valve.

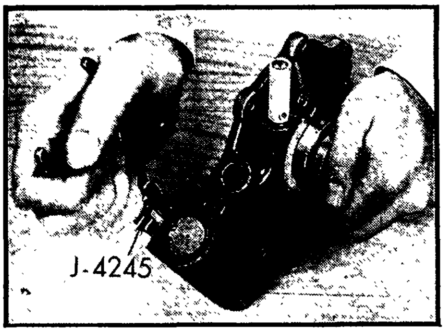


Fig. 94 Removing accumulator sp cial snap ring

Fig. 95 Installing oil seal rings

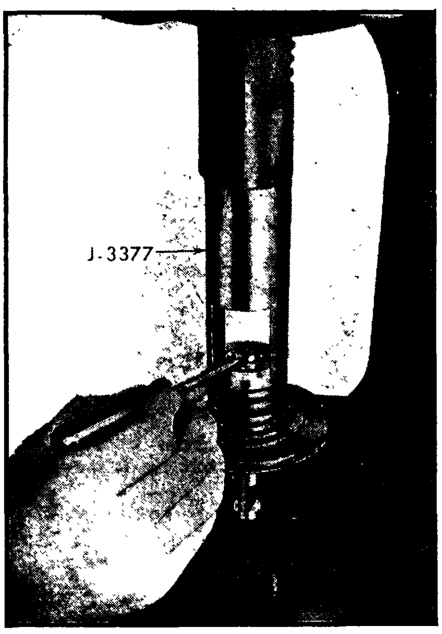


Fig. 96 Removing reverse s rv piston keeper

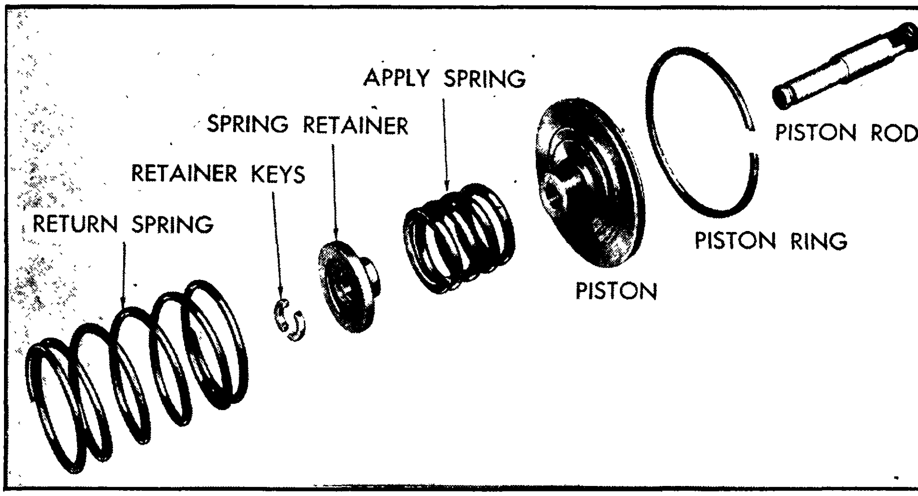


Fig. 97 Layout of reverse servo piston

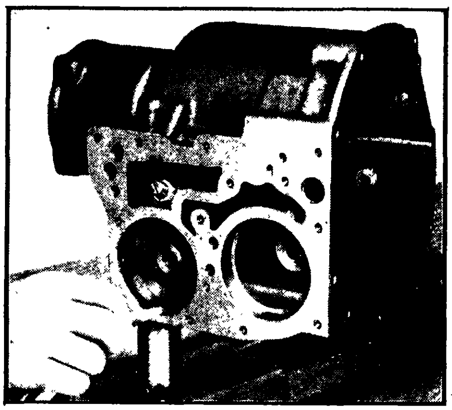


Fig. 98 Checking servo piston ring gap

Fig. 99 Checking planet gear end clearance

INSPECTION—

1. Wash all parts in cleaning solvent, air dry and blow out all oil passages.
2. Inspect valve body for scoring and make sure fibre valve operates freely.
3. Check body in bore to see that it operates freely.
4. Check piston for scoring and see that it operates freely in valve body bore.
5. Check valve for scoring and see that it operates freely in accumulator body bore.
6. Check rings for distortion.
7. Check oil seal rings for nicks or burrs and make sure they are free in ring grooves. Also install rings in clutch drum bore and make sure hooked ring ends have clearance.

ASSEMBLY—

1. Install piston inner and outer springs and piston stop in valve body bore.
2. Install accumulator piston, making sure that it seats over inner and outer springs.
3. Install valve body into its bore.
4. Install accumulator valve into accumulator valve body bore and install accumulator valve spring.
5. Install accumulator valve spring washer, compress spring and install special snap ring, making sure it seats in groove.
6. Install pressure relief valve assembly.
7. Install two clutch drum oil seal rings, Fig. 95.

REVERSE & LOW SERVO PISTONS

1. Place reverse servo piston in press and, with tool J-3377, Fig. 96, compress piston spring and remove spring retainer key and retainer. Remove piston from piston shaft. Fig. 97 shows a layout of reverse servo piston parts.
2. Install piston on shaft and install servo piston apply spring.
3. Install spring retainer over spring and shaft and compress spring with tool J-3377. Install retainer key.
4. Remove piston ring from reverse and low servo pistons and install in piston bore. Check ring gap which should be .005-.010", Fig. 98.
5. Install rings to reverse and low servo pistons.

PLANET UNIT & INPUT SHAFT

INSPECTION—

1. Wash in cleaning solvent, blow out all oil passages and air dry.
2. Inspect reverse brake drum outside diameter for scoring or burning. Also check internal gear for tooth damage and drum hub bushing for scoring or damage.
3. Inspect planet pinions for nicks or other tooth damage.
4. Check end clearance of planet gears, which should be .006-.030", Fig. 99.

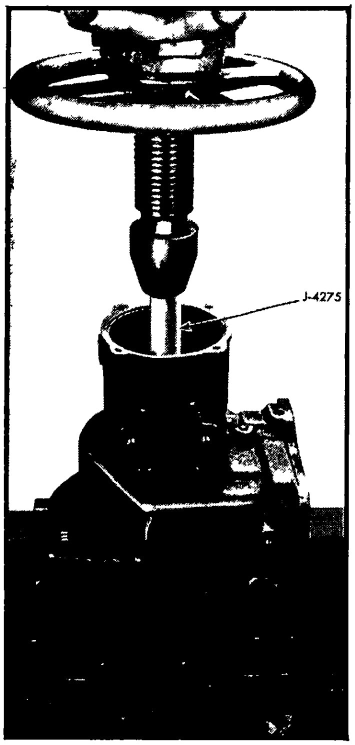


Fig. 100 R moving transmission r ar bushing

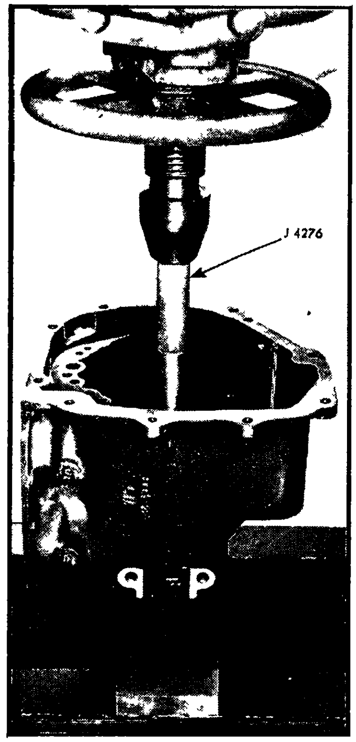


Fig. 101 Installing transmission rear bushing

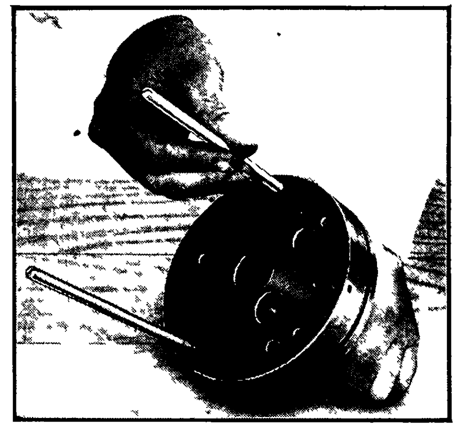


Fig. 104 Guide pins in fr nt pump

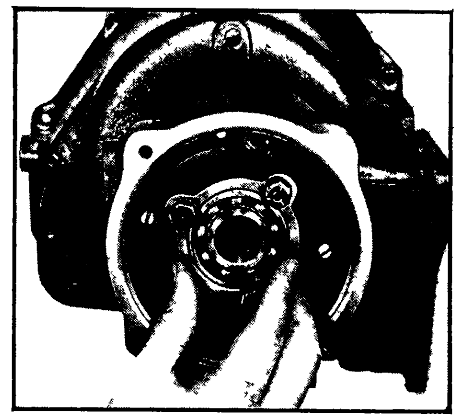


Fig. 105 Installing rear pump

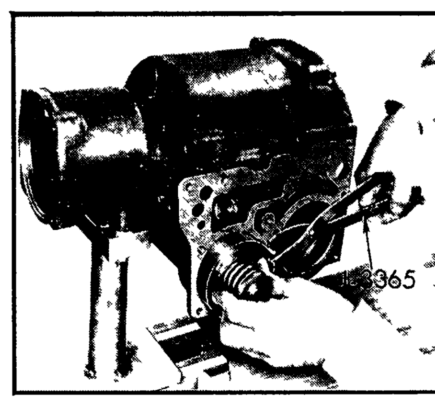


Fig. 106 Installing reverse servo pist n

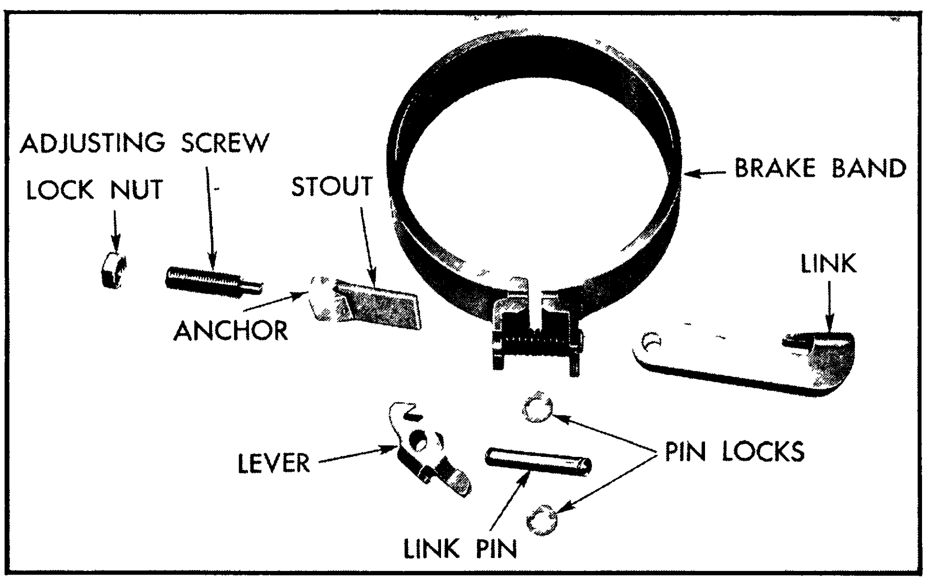


Fig. 102 Reverse brake band

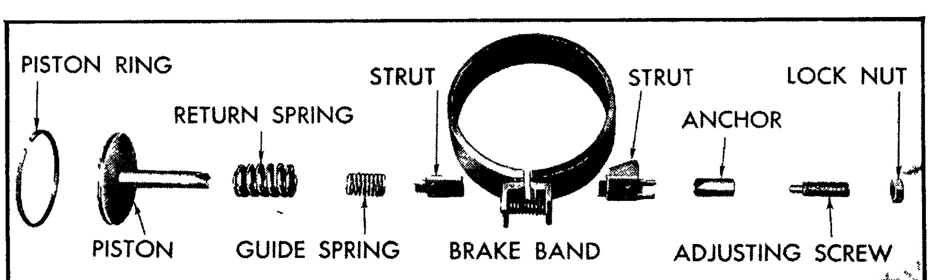


Fig. 103 L w brake band

5. Check reverse sun gear for tooth damage, and sun gear rear thrust washer for damage.

6. Inspect output shaft bearing surface for nicks or scoring and inspect input pilot bushing.

7. Inspect input shaft splines for nicks or damage and check fit in clutch hub and reverse sun gear. Inspect fit of spline in turbine hub.

8. Check oil seal ring for clearance; ring must be free in shaft groove Remove ring and insert in valve body bore and check to see that hooked ring ends have clearance. Replace ring on shaft.

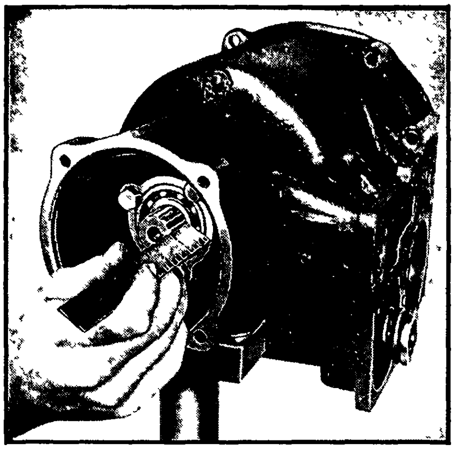


Fig. 107 Checking seating f utput shaft

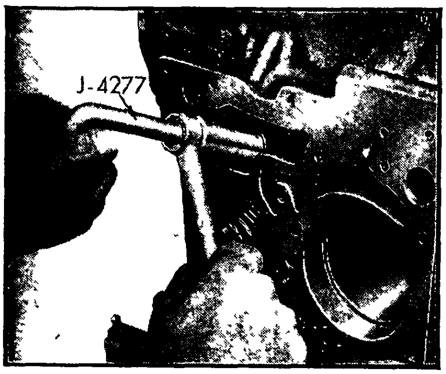


Fig. 108 Adjusting reverse servo

TRANSMISSION CASE

INSPECTION—

1. Wash case thoroughly in solvent, air dry and blow out all oil passages.
2. Inspect case for cracks which may contribute to leakage.
3. Inspect case rear bushing for damage or excessive wear.

REAR BUSHING, REPLACE—

1. Place case in press with rear end up.
2. Install bushing remover tool J-4275, Fig. 100, and press old bushing from case.
3. To install new bushing install rear oil pump so that rear bearing may be used as a pilot when new bushing is pressed in case.
4. Place case in press with front end up.
5. Place new bushing on bushing installer J-4276, Fig. 101, with square end of bushing against shoulder of installer. Insert in case, entering pilot of tool into rear bearing and press bushing in place. This bushing requires no reaming.

BRAKE BANDS

Brake bands have bonded lining which, due to the transmission characteristics and band usage should require very little attention. However, whenever the transmission is disassembled, the bands should be cleaned in solvent, air dried and inspected, Figs. 102 and 103.

1. Check linings for evidence of scoring or burning.

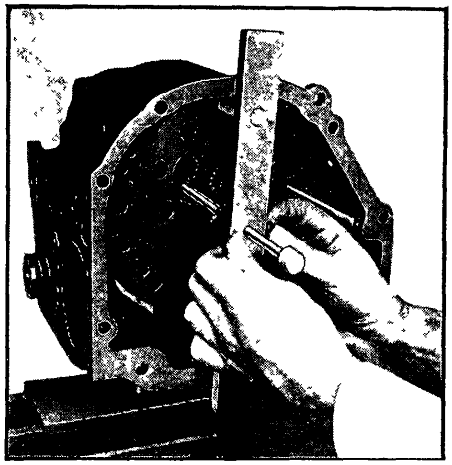


Fig. 109 Measuring sun gear depth

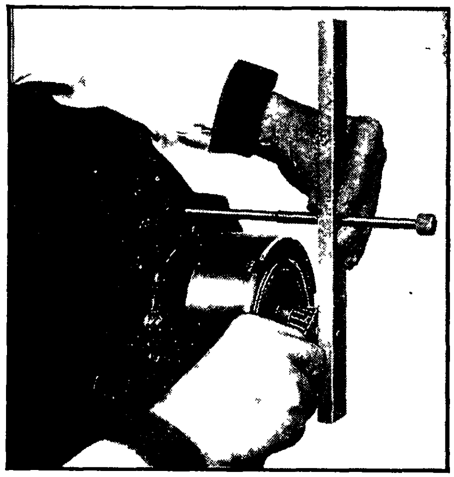


Fig. 110 Checking for proper low to reverse sun gear clearance

2. Check bands and linings for cracks.
3. Check all band linkage for excessive wear.

ASSEMBLING TRANSMISSION CONVERTER—

1. After thoroughly cleaning suction screen, install in oil sump, making sure sealing ring is in position.
2. Place two ¼-20x3½" guide pins in valve body attaching holes in converter housing.
3. Install new valve body gasket to turbine housing.
4. Install valve body over guide pins and install attaching bolts, tightening them to 10 lbs. ft. torque with the exception of the bolt over the pressure regulator valve. This bolt should be torque tightened to 8 lbs. ft. Tighten bolts in a criss-cross manner and after bolts are installed, check to make sure manual valve and pressure regulator valve operate freely.
5. Align holes in stator support with holes in front oil pump body and install two ¼-20x3½" guide pins in front pump, Fig. 104. Install pump to turbine housing, using pump driver J-4263. **NOTE**—When installing pump, line up suction and delivery holes on left side of pump.
6. Install five self-locking bolts through valve body and into pump. Torque tighten two bolts over regulator valve to 8 lbs. ft. and remaining bolts to 10 lbs. ft. **CAUTION**—After tightening two bolts over pressure regulator valve bore, check valve to make sure it operates freely.
7. Check to be sure front pump operates freely.

TRANSMISSION UNIT—

1. Install two $\frac{5}{16}$-18x3" guide pins in rear pump attaching holes. Install new gasket and pump, Fig. 105, aligning suction and delivery holes. Install bolts and tighten securely.
2. Install reverse servo piston, using ring compressor J-3365, Fig. 106. Notch on shaft should be positioned toward front of transmission case.
3. Install reverse brake band and strut with thin end of band away from piston. Thread adjusting screw in until it indexes with hole in anchor.
4. Install bronze thrust washer on hub of reverse drum and install drum into case and brake band.
5. Rotate rear pump drive gear lug to top of pump, then install planet carrier in drum, aligning slot on carrier shaft with lug of pump drive gear. Check amount end of shaft protrudes out of bearing, Fig. 107. This should be a minimum of ⅞" and indicates proper seating of pump drive gear lug in carrier shaft slot.
6. While holding planet carrier in, install universal joint front yoke, universal joint washer, lockwasher and bolt and tighten securely. This pulls planet carrier into its seat.
7. Tighten reverse servo adjusting screw, using tool J-4277, as tight as it will go, then back off 2¾ turns and lock the lock nut, Fig. 108.
8. To determine thickness of low sun gear-to-reverse sun gear thrust washer, proceed as follows: (A) Install bronze thrust washer and clutch on oil delivery sleeve. (B) To measure distance from case flange to reverse sun gear, loosen set screw of tool J-4260, Fig. 109, and place bar of tool against case flange with stem of tool against face of reverse sun gear. While holding tool in this position, tighten thumb screw. (C) There are three hardened and ground steel washers furnished with this tool which are .070", .095" and .120". These washers are the same thickness as bronze thrust washers available for service. (D) Select the .095" steel washer furnished with the tool and place it over the tool pilot. Insert pilot into bore of low sun gear and, while holding tool securely, check clearance between end of low sun gear and steel washer with feeler gauge, Fig. 110; clearance should be .007-.035". (E) If clearance is not within above limits, remove tool and recheck, using either the .070" or .120" steel washer furnished with the tool until the proper clearance is obtained. (F) When proper clearance is obtained, the thickness of the steel washer used is the thickness of the bronze washer required for transmission assembly.
9. After above checks are completed,

Fig. 112 Alignment of thrust washer oil slot with shaft oil hole

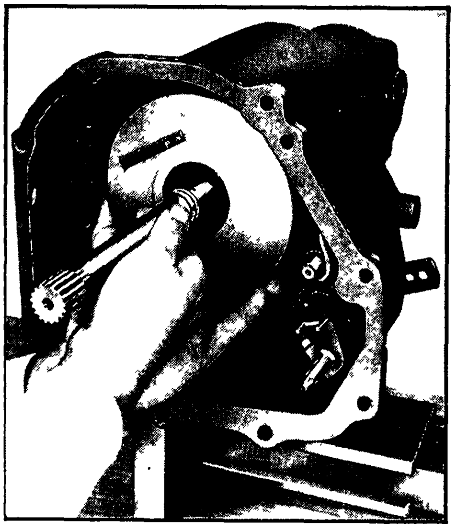


Fig. 113 Installing clutch and shaft into case

remove clutch and thrust washer from oil delivery sleeve.

10. Install parking lock lever and apply spring in case. Install small lip seal over end of parking lock lever shaft and into counterbore of case with lip of seal toward inside of case.

11. Install flat washer and parking lock lever on end of lever shaft, pushing lever onto shaft to obtain .000" to .010" clearance between lever and washer. Then tighten clamp screw.

12. Install parking lock pawl over pawl support rod and install parking pawl spring.

13. Wind up pawl spring, using tool J-3383, so that spring catches on inside of case (see Fig. 75).

14. Install input shaft to clutch unit. Install thrust washer previously selected on reverse sun gear splines of input shaft, aligning missing spline opening with oil hole in reverse sun gear splines of input shaft, Fig. 112.

15. Install unit assembly into case, indexing input shaft pilot with pilot in output shaft and low sun gear with short pinions in planet carrier, Fig. 113.

16. Install low servo piston release spring on servo piston shaft and install piston and spring in case, using ring compressor J-3365.

17. Install low brake band over clutch drum with thin end of band toward piston.

18. Place strut guide spring over piston and anchor strut in piston slot with other end of anchor strut engaging brake band.

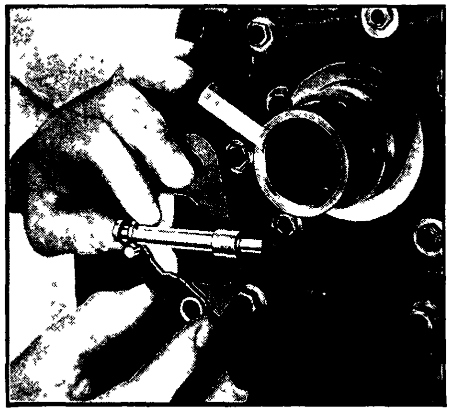


Fig. 114 Indexing manual valve with lever

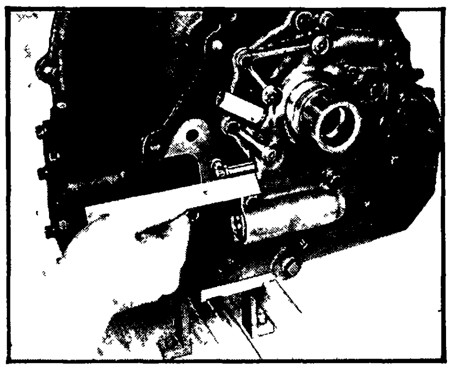


Fig. 115 Setting manual valve in reverse position

19. Place brake band strut assembly in brake band groove, then engage slotted end of anchor over strut and locate over adjusting screw.

20. Install speedometer driven gear.

TRANSMISSION & TURBINE HOUSING ASSEMBLY—

1. Install manual valve in valve body and manual valve inner lever in turbine housing. Index lever pin with pickup slot in valve, Fig. 114.

2. Set manual valve so end of valve protrudes 1½" from face of valve body, Fig. 115. This places valve in reverse position.

3. Install new servo body to case gasket.

4. Raise transmission manual valve lever to top detent position, which is reverse. This aligns reaction lever so that it will index with manual valve inner lever.

5. Place clutch drum thrust washer over oil delivery sleeve.

6. Install two ⅜-16x3¾" guide pins in turbine housing, then push case and turbine housing together, checking to see that reaction lever indexes properly with manual valve inner lever. Then install case-to-housing bolts and tighten securely. **NOTE** — Remove left hand sump cover to observe mating of manual

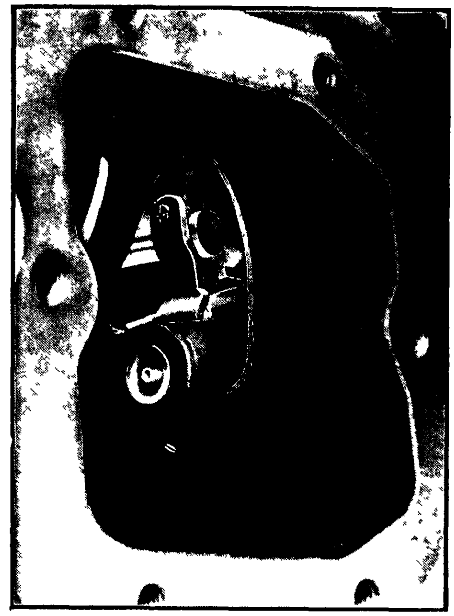


Fig. 116 Indexing manual valve inner lever and reaction lever

Fig. 117 Installing servo cover

valve inner lever and reaction lever, Fig. 116.

7. Install lubrication check valve parts into case in the following order: Spring, ball, ball seat and lubrication sleeve.

NOTE—Install ball seat with radius toward ball.

8. Install two 7/16-18x3" guide pins as guides for servo cover and install new servo cover gasket.

9. Install pressure regulator valve and inner and outer valve springs. Install reverse servo return spring.

10. Install servo cover, applying pressure to cover to compress springs and secure with cover bolts, Fig. 117. Tighten securely. **NOTE**—Be sure pressure regulator springs and reverse servo spring seat properly in seat pockets of servo cover.

11. Install new modulator cover gasket and cover, Fig. 118, and tighten bolts securely.

12. Tighten low servo adjusting screw, using tool J-4277, Fig. 119, down tight.

Fig. 118 Installing modulator

Fig. 119 Adjusting low servo

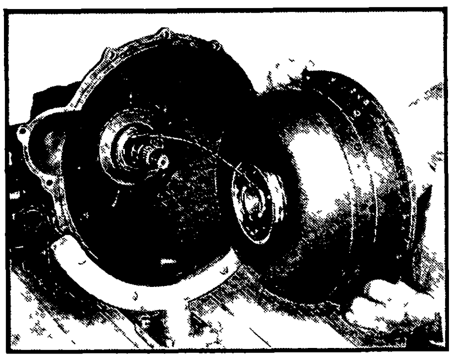


Fig. 120 Aligning primary pump with fr nt pump drive lugs

Then back off three complete turns and tighten lock nut.

13. Assemble primary pump, aligning front pump drive gear tangs with drive slots in pump hub, Fig. 120. Face of pump must be flush with face of bell housing.

14. Install converter retaining washer and snap ring.

15. Install stator assembly to stator support, with small (primary) stator to rear.

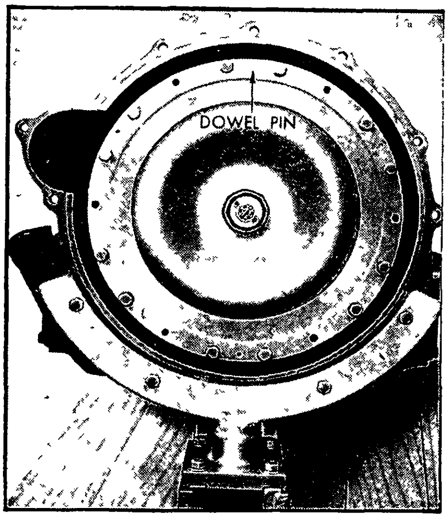


Fig. 121 Positioning of turbine capscrews

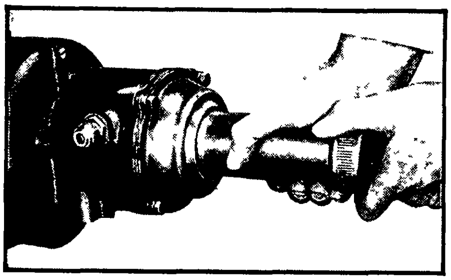


Fig. 122 Adjusting universal joint ball

16. Install two $\frac{5}{16}$-24x1½" guide pins in primary pump bolts holes, align dowel pin hole of turbine cover and dowel pin in primary pump and install turbine cover. Remove guide pins and secure with 12 capscrews, Fig. 121. **NOTE**—Install one bolt on each side of dowel pin, skip one hole and then install two bolts alternately around assembly.

17. Install right hand sump cover and new gasket. Secure with capscrews and tighten securely.

18. Install universal joint and "O" ring, ball and collar and add or remove shims to allow a snug fit. If ball cannot be moved by hand, Fig. 122, add a shim until a smooth firm adjustment is obtained. If ball moves freely by hand, remove shims until proper adjustment is obtained.

19. After number of shims for proper adjustment have been determined, remove universal joint ball and collar and ball seat. Note number of shims used for later assembly and replace universal ball and collar on end of propeller shaft.

REAR AXLE

REAR AXLE REMOVAL

1935-52 — 1. Remove rear wheels and brake drums.

2. Hook clamps on brake wheel cylinders.

3. Disconnect hand brake cables.

4. Uncouple hydraulic brake line from axle housing.

5. Disconnect shock absorber links.

6. Remove spring U bolts and rear shackles.

7. Remove axle from under car.

REAR AXLE SERVICE

1935-52—Fig. 123 is a sectional view of the differential driving unit used on 1935-36 models, while Fig. 124 is employed on 1937-52 cars. In Fig. 123, the pinion is adjusted by a thick spacer and shims between the front double-row bearing and the differential carrier shoulder. The differential side bearings are of the ball type.

Fig. 124 is quite similar, the chief difference being that taper roller bearings are used at the sides of the differential and only shims are used to adjust the drive pinion.

In both types, the drive pinion is splined and pressed in the propeller shaft, and end movement is prevented by a pin riveted through the shaft coupling and the propeller shaft.

The double-row bearing is built with no looseness or end play, nor is it adjustable for end play. If there is any looseness between the race and cone, it is probably caused by abrasive matter in the lubricant which wore down the balls.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, riveting or bolting on the ring gear, checking ring gear and pinion backlash and other differential case operations, is given in the *Rear Axle Chapter*. Service standards are listed in the *Rear Axle* table.

To replace the drive pinion and bearings, it is necessary to take out rear axle assembly, unbolt the differential carrier from the axle housing, remove the axle shafts and, after taking off the differential bearing caps and adjusting nuts, lift the differential from the carrier.

PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, take out the three tapered screws from the side of the housing. Jar the carrier so that the splined end of the propeller shaft will strike on a wooden block or wooden floor and the pinion will slide out. Remove the bearing adjusting shims from the inside of the torque tube, noting their number and total thickness.

To disassemble the pinion from the propeller shaft, file off one head of the straight pin which fastens these parts together, and drive out the pin. Pull the pinion shaft from the propeller shaft. Remove the pinion bearing lock nut and press the bearing from the pinion. Take out the bearing lock sleeve and, after releasing the rear bearing lock ring, remove this bearing.

To assemble, install the rear bearing on the pinion shaft and fit the lock ring in its groove in the shaft. Place the lock sleeve with its beveled side toward the pinion. Press the double-row bearing on the pinion shaft and install the lock nut.

The pinion assembly may now be assembled to the propeller shaft by pressing the splined end into the coupling on the end of the propeller shaft so that the rivet hole in the pinion shaft lines up with the hole in the propeller shaft. Insert a new rivet in this hole and rivet over both ends. Tighten the bearing lock

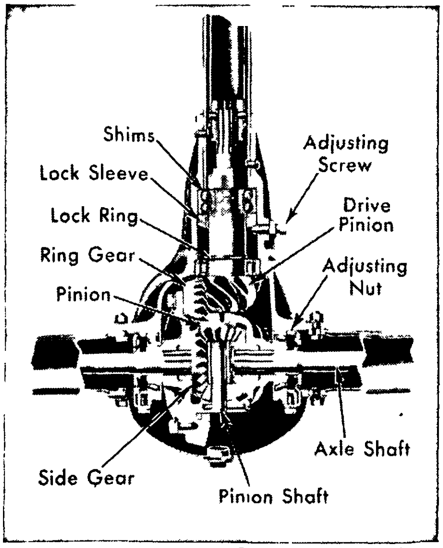


Fig. 124 Rear axle. 1937-52

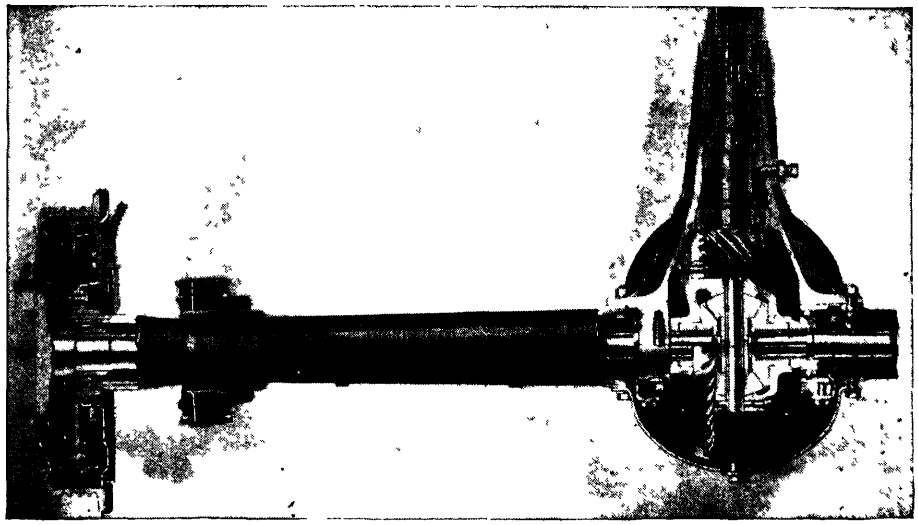


Fig. 123 Rear axle. 1935-36

nut and lock it in the milled slot in the pinion shaft.

PINION & PROPELLER SHAFT, ASSEMBLE—Install the same thickness of shims in the counterbore of the torque tube that were removed when the assembly was dismantled. Make sure the shims are flat in the counterbore and are not cocked. Shims are available in several thicknesses so that a suitable combination may be selected to replace the original ones if they are damaged, or if another combination is needed to secure proper location of the pinion if a new gear set is installed. If a new Chevrolet gear set is to be used, one .015 and one .018 inch shim should be used as this is the standard set-up. On 1936 units, a .188-inch spacer is employed in conjunction with the shims.

Lubricate the bearings thoroughly and coat the bearing surface of the lock sleeve with rear axle lubricant. Install the propeller shaft, driving it down until the bearings are seated in the housing.

Check through the lock screw holes in the side of the housing to see if the lock sleeve is in the correct position up against the back of the double-row bearing. Install the three tapered screws and draw them down evenly and tightly, then tighten the lock nuts.

If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the parts and, if the pinion is to be moved toward the center of the axle, add shims; if it is to be moved away from the center of the axle, remove shims.

If no pinion setting gauge is available, assemble the differential unit and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*.

When the adjustment is correct, set it securely with the lock screws and nuts as stated above.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-52—To remove on axle shaft, take

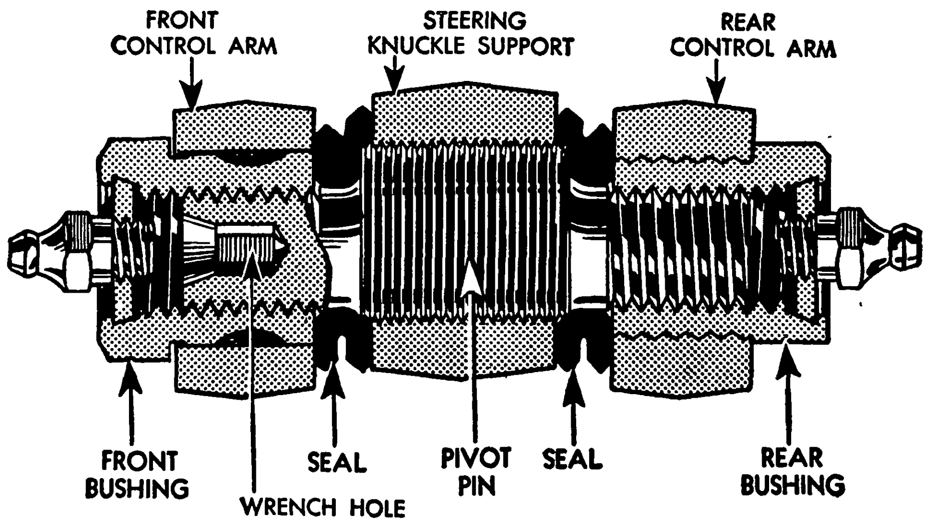


Fig. 125 Upper control arm pivot. 1939-48

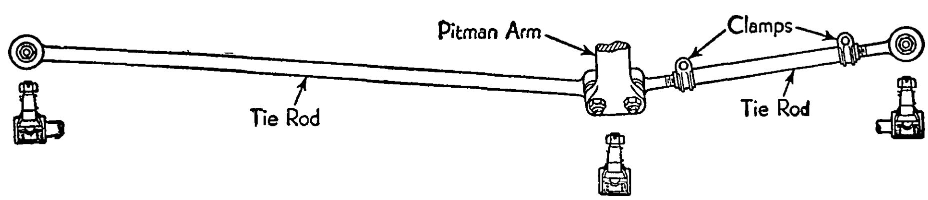


Fig. 126 Steering linkage. 1939-48

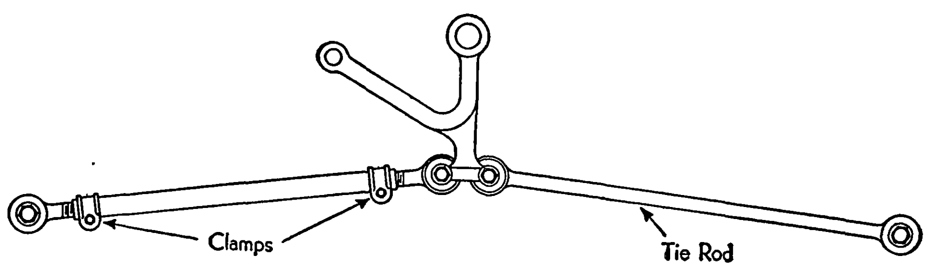


Fig. 127 Steering linkage. 1949-52

off the rear wheel, rear axle cover, differential pinion shaft screw, differential pinion shaft and the spacer block between the two shafts. Push inward on the outer end of the axle shaft and remove the C-shaped spacer on the inner end of the shaft. The axle shaft and brake drum may now be withdrawn.

To remove the bearing and oil seal, a special puller is recommended which removes not only the bearing but the bearing retainer and oil seal. A special tool is also available to install the bearing. With the bearing, inside bearing retainer and oil seal assembled in the tool, start the bearing in the axle housing and give the end of the tool a few light blows with a hammer. The oil seal should be staked in place with a prick-punch.

NOTE — Clearance between the spacer block and the axle shafts should be from a free fit to .014". If the clearance is in excess of this limit, install a new block. These spacer blocks are available in two sizes for each model, providing three different thicknesses for making this adjustment.

WHEEL ALIGNMENT

CASTER & CAMBER, ADJUST

1935-38 Knee Action—Special bending equipment is required for adjusting camber and caster on these models, without which the job cannot be successfully accomplished.

1939-52 — Caster and camber adjustments are both performed by turning the upper control arm pivot pin, Fig. 125. The pivot pin has a $\frac{3}{32}$ in. eccentric. To make the adjustment, proceed as follows:

1. Loosen the clamp bolt at the upper end of the steering knuckle support.
2. Remove grease fitting from the front bushing on 1939-48 or rear bushing on 1949-52.
3. Insert an Allen set screw wrench through the hole from which the grease fitting was removed.
4. Turn the pivot pin in the direction to obtain an exact caster setting. The camber may remain practically the same or it may move in a positive or negative direction, depending on the location of the eccentric on the pivot pin.
5. After making a slight turn of the pivot pin, both caster and camber must be rechecked and adjustments made that will bring both angles within the proper limits.
6. After completing the adjustment, tighten the clamp bolt and install the grease fitting.

TOE-IN, ADJUST

1935-40 I-Beam Axle — Lengthen or shorten the tie rod to obtain the toe-in specified in the *Wheel Alignment Data* chart.

1939-48—Loosen the clamp bolt at each end of the left tie rod, Fig. 126, and turn the rod as required to bring toe-in within specifications.

1949-52—Toe-in is adjusted by loosening the clamp bolts at each end of the left-hand tie rod and turn this rod as required to obtain correct toe-in, Fig. 127.

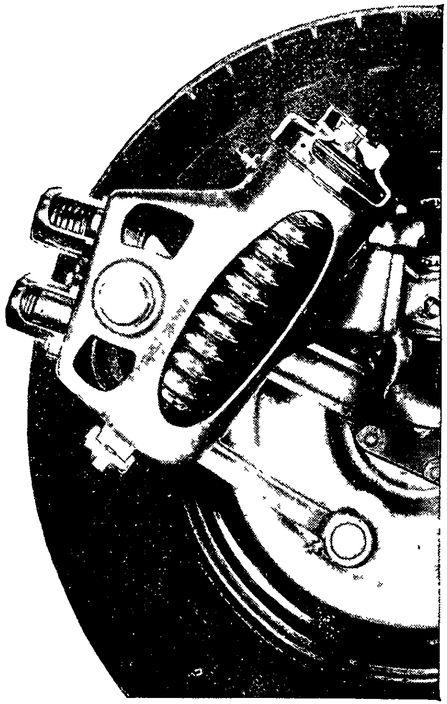


Fig. 128 Cutaway view of knee action unit. 1935-38

FRONT END SERVICE

1935-38 KNEE ACTION

Repair Operations—Except for the operations discussed below, no major repair operations are to be performed on the Knee Action Unit. Any other repairs necessitate the replacement of the entire unit. When new units are obtained from Chevrolet, they will have to be filled to the proper level with shock absorber fluid when they are installed on the car.

Knee Action Unit, Remove—Fig. 128.

1. Jack up car and remove front wheel.
2. Remove two bolts and lock plate at bottom of spring housing.
3. Turn unit outward and lift off brake assembly, holding the radius rod to prevent it from falling and striking the floor.
4. Remove steering arm nut and drive out the steering arm with a brass drift.
5. Remove kingpin lock pin.
6. Remove dust caps and lock rings from kingpin support yokes.
7. Drill a $\frac{1}{4}$ in. hole in the center of the upper kingpin plug and, using a punch through the hole, drive the lower plug out with the kingpin. Then use a soft steel drift on the bottom of the kingpin to force the upper plug out.
8. After plugs have been removed, remove kingpins. During this operation, the lower kingpin bushings will fall out of the lower support boss.
9. When the kingpin has been removed, take off the Knee Action Unit. Then remove the upper kingpin bushing from the upper support boss.

Assembly Notes—Reverse the order of the above operations to assemble the

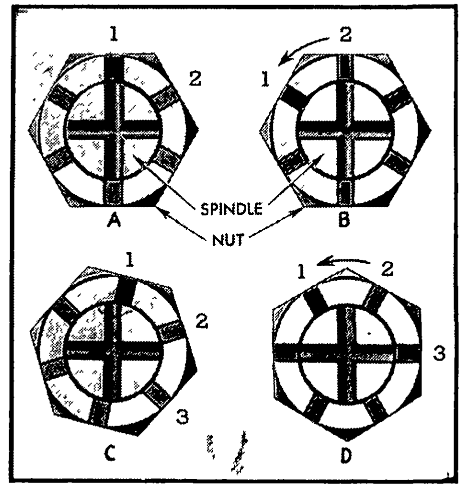


Fig. 128A Method f adjusting front wheel bearings, 1935-52

unit, noting the following:

1. Check end play between spring housing and steering knuckle with a feeler gauge. If this is over .006 in., insert a steel shim at this point.
2. Be sure kingpin bushings are installed with oil grooves in line with the grease fittings on the knuckles.
3. When connecting the radius rod, first screw the radius rod bracket up tight on the radius rod. Then bring the radius rod straight up without moving it to either side. Loosen the bracket just enough to line it up with the boss on the front spring housing. Then place it in position on the boss, assemble the lock plate and tighten the two radius rod brackets to housing bolts securely.
4. Fill the Knee Action Unit with shock absorber fluid to the level of the filler hole. Remove the plug at the back of the spindle and fill the reservoir with vaseline.

FRONT END SERVICE, 1939-48

Front Wheel Bearings, Adjust—

1. Tighten spindle nut to 33 lbs. ft. torque.
2. Check location of a slot in nut with reference to a hole in the spindle. If a slot in the nut lines up with either the vertical or horizontal holes in the spindle, "A" Fig. 128A, back off the nut until the next slot in the nut lines up with the same hole in the spindle and insert the cotter pin, "B" Fig. 128A.
3. If, when the spindle nut is tightened to 33 lbs. ft. torque, the slot in the nut has passed beyond the vertical or horizontal holes in the spindle, "C" Fig. 128A, back off the nut a sufficient amount to line up the second next slot in the nut and the other hole in the spindle.
4. To illustrate this point, the slots in the nut are indicated 1, 2 and 3 (see "D" Fig. 128A. If the slot marked "1" on the nut is slightly beyond the vertical hole in the spindle, the nut should be backed off until the slot marked "3" is in line with the horizontal hole in the spindle. It will be noted that the nut has been backed off slightly less than 1/6 turn.
5. Install hub grease cap and wheel. Lower car to floor, retighten wheel hub nuts and install hub caps.

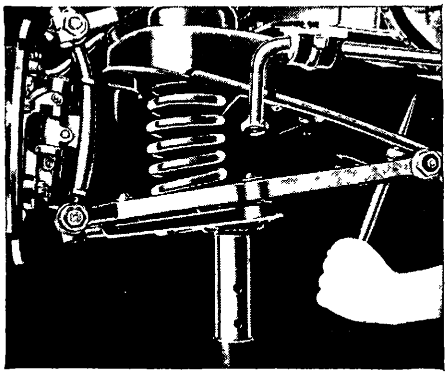


Fig. 129 Aligning lower control arm shaft bracket and frame. 1939-48

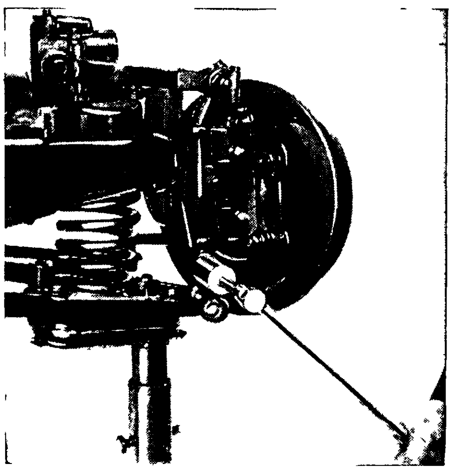


Fig. 130 Removing lower pivot pin bushing. 1939-48

Front Spring, Remove—

1. Disconnect stabilizer link from lower spring seat.
2. Lift front end of car off floor with hoist.
3. Place a jack under the inner side of the lower spring seat of the spring to be removed. Lower car until its weight is supported on jack.
4. Remove nuts from lower control arm shaft bracket bolts. Drive out the bolts and insert a long drift punch to maintain alignment, Fig. 129.
5. Raise car slowly with hoist to remove spring pressure. Then remove the stand jack. This allows lower control arm spring seat to drop down, releasing the spring.

Front Spring, Install—

1. When installing a front spring, make sure the ground end of the spring is up and that the lower end coil of the spring seats in the recess in the lower spring seat.
2. Raise the lower control arm and spring seat and place a stand jack under the inner end.
3. While lowering the car to compress the spring, use a long drift punch through the shaft bracket and bolt hole in frame to maintain alignment, Fig. 129.
4. Bolt pivot shaft bracket securely to frame and install cotter pins.

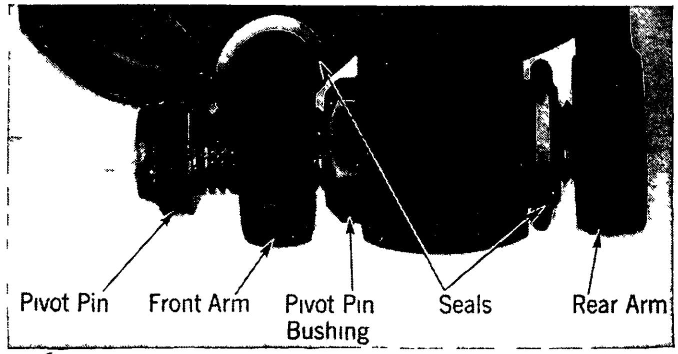


Fig. 131 Position of seals before installing lower pivot pin. 1939-48

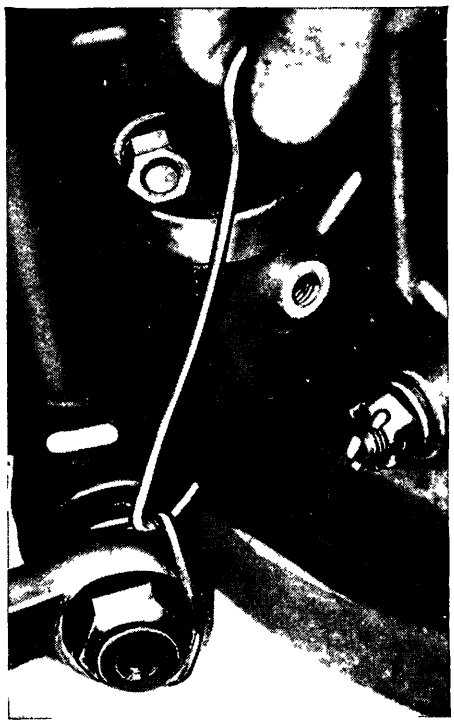


Fig. 133 Positioning seal at lower pivot pin. 1939-48

5. Raise car and remove stand jack. Lower car to floor and connect stabilizer link to spring seat.

Lower Control Arm Pivot, Remove—

1. Raise car and place stand jack under inner side of lower spring seat.
2. Remove wheel and tire assembly.
3. Unscrew lower pivot pin from support arm and knuckle support.
4. Turn wheel being worked on to extreme outward position. This locks knuckle support so that it cannot move outward at the bottom when removing the bushing.
5. Unscrew bushing from knuckle support, Fig. 130.

Lower Control Arm Pivot, Install—

1. Install pivot bushing and tighten it firmly in knuckle support.
2. Before starting lower pivot pin, place a new seal around the front lower control arm and another new seal over the exposed end of the pivot pin bushing in the knuckle support at the rear, Fig. 131. This prevents damaging the seals during assembly.

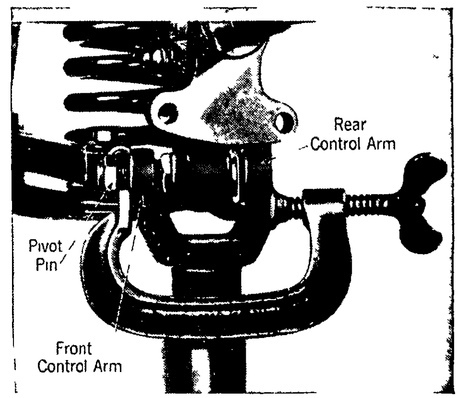


Fig. 132 Using "C" clamp to line up threads on lower pivot pin and rear control arm. 1939-48

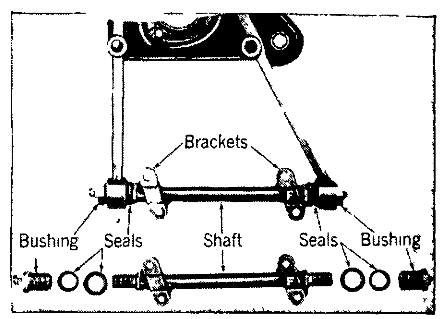


Fig. 134 Layout of lower control arm parts. 1939-48

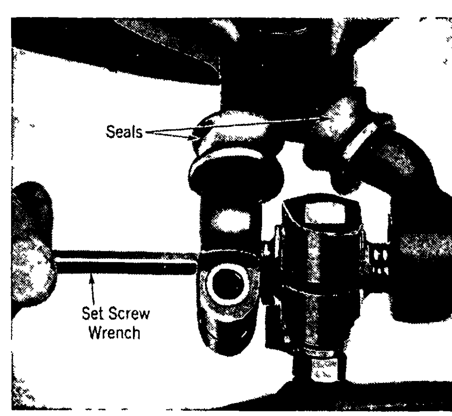


Fig. 135 Centering upper pivot pin in knuckle support. 1939-48

3. Now start the new pivot pin into the front lower control arm. Hold the knuckle support in the center of the yoke formed by the lower control arms and thread the pivot pin into the bushing in the knuckle support, being very careful to keep it centered in the yoke.

4. Continue to screw the pivot pin until it contacts the rear lower control arm. Proceed carefully at this point. If the threads on the pin and in the control arm index properly, continue to screw the pin into the control arm until its head seats firmly against the front lower control arm. However, if the threads do not index, and the control arms are being spread by the pivot pin, place a "C" clamp on the control arms and compress the arms slightly, trying the threads as you proceed, Fig. 132. It will be found that very little compression will allow the threads to index properly without spreading the arms or binding the pivot pin.

5. With a hook made of stiff wire, slip the front seal around the end of the control arm and into its seat, Fig. 133. The rear seal may be slipped off the rear end of the bushing with the fingers. This method of installing the seals prevents any possibility of damaging them during installation.

Lower Control Arm Shaft, Remove—

1. Disconnect the stabilizer link from the lower spring seat and perform the operations for removing the front spring as outlined previously. As a matter of safety, it is good policy to place a stand jack under the frame cross member while proceeding with this operation.

2. Remove the lower control arm pivot pin. This frees the entire lower control arm assembly from the car so it may be taken to the bench for further work.

3. Fasten the assembly in a vise and remove the front and rear bushings.

4. Then shift the shaft as far as possible toward the bushing hole in either arm, which will allow the opposite end of the shaft to clear the hole in the other arm. The shaft can now be removed from the assembly.

5. While the shaft and bracket is removed, it is good policy to check the rivets holding the arms to the spring seat for looseness.

Lower Control Arm Shaft, Install—

1. Make sure that the shaft bracket with the letter W forged in it is installed toward the front of the car, Fig. 134. If this is not done the bolt holes will not line up properly.

2. Install a new seal at each end of the shaft, which has a recess in the shoulder conforming to the shape of the seal. Then install the shaft in the control arm by reversing the procedure outlined under Step 4 of removal procedure.

3. Install the shaft bushings, being certain to centralize the shaft in the yoke formed by the lower control arms.

4. Install the assembly on the car by installing the pivot pin and attaching the shaft brackets to the frame.

Upper Control Arm Pivot, Remove—Details of this assembly is shown in Fig. 125.

1. Raise car with hoist and place a stand jack under the spring seat, allowing the jack to take the weight of the car. Then remove the wheel and tire.

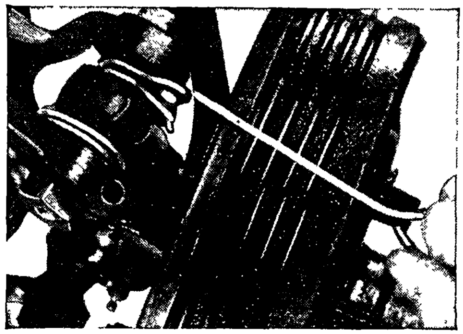


Fig. 136 Positioning seals at upper pivot pin. 1939-48

2. Remove rear threaded bushing. Then remove the clamp bolt on the front arm and remove the front bushing.

3. Loosen clamp bolt at upper end of knuckle support and unscrew upper pivot pin, using an Allen set screw wrench.

Upper Control Arm Pivot, Install—

1. Using a stiff wire hook, place a new seal over the end of each arm, Fig. 135.

2. While holding the knuckle support between the yoke formed by the arms, use an Allen set screw wrench to screw the pivot pin into the support, making sure the hole for the wrench is toward the front of the car.

3. Turn the pivot pin until the bolt section with the largest diameter is centered in the knuckle support, Fig. 135.

4. Tighten the clamp bolt at the upper end of the knuckle support.

5. Hold the knuckle support in the center of the control arm yoke. Start the rear bushing in the control arm and on the pivot pin. Then tighten the bushing securely and check to make sure the knuckle support is still in the center of the yoke.

6. Now start the front bushing on the pivot pin and screw it in until there is a clearance of from .020 to .040 in. between the hex head of the bushing and the upper control arm. This clearance must be maintained to prevent binding in the threads on the pivot pin.

7. Using a wire hook, slip the seals over the ends of the control arms and into their seats, Fig. 136. Then install the clamp bolt in the front control arm.

8. Replace the wheel, remove the stand jack and lower the car to the floor. Check and adjust caster and camber.

Front Shock Absorber—In removing the shock absorber, follow the instructions for removing the upper control arm pivot. Then remove the nuts which fasten the shock absorber to the frame and lift off the assembly.

After installing the upper control arm and shock absorber unit, check and adjust caster and camber.

Kingpins & Bushings, Remove—

1. Place a jack under the spring seat, raise the car off the floor and remove the wheel.

2. Remove the kingpin lock pin. Then remove the kingpin plug covers and lock rings from each end of the steering knuckle.

3. Remove the kingpin bearing plugs by driving through the lower plug with a sharp drift and forcing the kingpin upward until the upper plug is removed. The kingpin may then be removed by driving it out at the bottom, using a soft steel drift.

4. Remove steering knuckle and thrust bearing from the knuckle support and remove the floating bushings from the knuckle.

Kingpins & Bushings, Install—When replacing the floating kingpin bushings, it is not necessary to ream them to size as service bushings are machined to finished dimensions. However, when replacing these bushings, care must be exercised to make sure the oil groove in the bushing lines up with the grease fitting in the steering knuckle. These bushings should be free both on the kingpin and in the steering knuckle.

1. Install new bushings in the steering knuckle and place the knuckle on the knuckle support. Then install the thrust bearing between the lower yoke of the steering knuckle and knuckle support, making sure that the shield on the bearing is toward the top.

2. Install the kingpin from the bottom, making sure to line up the lock pin slot with the lock pin hole in the knuckle support.

3. After the kingpin is installed, check the clearance between the steering knuckle and knuckle support with a feeler gauge. If this clearance is more than .006 in., install a steel shim between the knuckle and the top of the knuckle support.

4. Install the kingpin lock pin, bearing plugs, lock rings and bearing plug covers. Install the wheel and check the toe-in and adjust if necessary.

FRONT END SERVICE, 1949-52

Fig. 137 shows the front suspension with telescoping shock absorbers mounted inside the coil springs. Elements of the 1948 retained include the lower control arms, coil springs and complete sealing.

Front Wheel Bearings, Adjust—Follow procedure outlined for 1948 models.

Shock Absorber, Remove—Fig. 138.

1. With a ¼ in. open end wrench, hold the upper stem from turning and remove upper stem retaining nut, grommet retainer and grommet.

2. Remove nut and lockwasher from special bolt which retains lower bracket to control arm and pull the shock absorber and mounting bracket out through the lower control arm.

3. Place mounting bracket in a vise and remove the lower stem retaining nut, grommet retainer and grommet and remove shock absorber from bracket.

4. Inspect rubber grommets for condition and replace with new ones if necessary.

Shock Absorber, Install—

1. Install grommet retainer, upper grommet, retainer bracket, lower grommet and retainer on bottom stem of shock absorber and install grommet retainer nut and tighten until it bottoms on shoulder of stem.

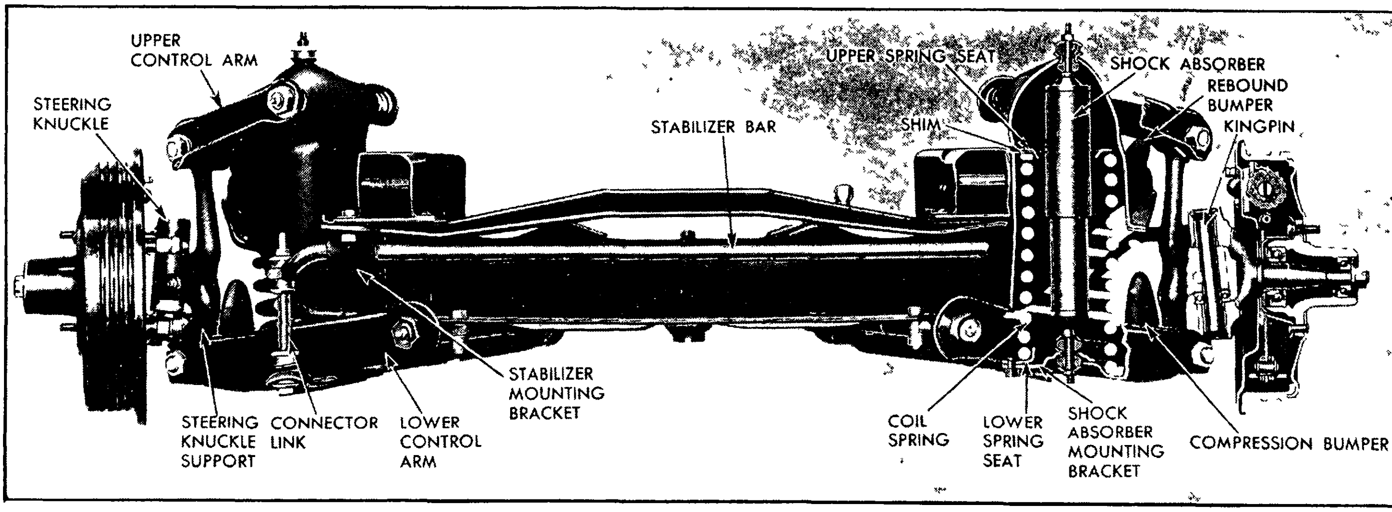


Fig. 137 1949-52 front suspension

2. Install grommet retainer and grommet on upper stem of shock absorber and install shock absorber up through lower control arm and spring housing.
3. Index upper stud through mounting hole in top of spring housing and index hole in retainer bracket over special bolt in lower control arm.
4. Install lockwasher and nut on special bolt and tighten nut securely.
5. Install grommet and retainer over upper stem of shock absorber.
6. Install retainer nut to shock absorber upper stem, holding stem with a ¼ in. wrench. Tighten nut until it bottoms on shoulder of stem.

Front Spring, Remove—

1. Disconnect stabilizer link from lower control arm.
2. Remove shock absorber as outlined previously.
3. Raise front end of car off floor and place stand jacks beneath frame side rails. Lower car until weight is carried on jacks.
4. Place an adjustable jack under the lower control arm inner shaft on side from which spring is to be removed.
5. Unfasten lower control arm inner shaft brackets from frame and drive out fastening bolts.
6 Lower jack slowly to relieve spring pressure and remove the jack. This allows the lower control arm to drop down, releasing the spring. If a shim is used, make sure it is removed from the upper spring seat.

Front Spring, Install—

1. Install flat end of spring up with shim (if used) in place. Then raise lower control arm, making sure lower end of spring seats in recess in lower spring seat.
2. Place adjustable jack under lower control arm inner shaft. Slowly raise arm with jack to compress the spring. Use a long drift punch through the shaft bracket hole and hole in frame cross member to maintain alignment (see Fig. 129).
3. Install bolts through bracket and frame and tighten nuts securely.
4. Remove adjustable jack, raise car and remove stand jacks from under

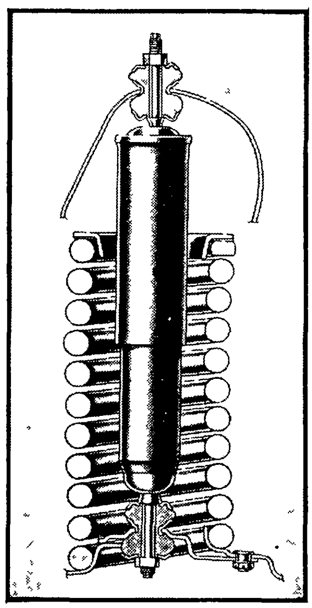


Fig. 138 Front shock absorber mounting, 1949-52

frame. Lower car to floor, connect stabilizer link, and install shock absorber.

Lower Control Arm Service—

1. To remove the arm, jack up car, remove wheel, front spring and tie rod end. Unfasten control arm from outer pivot and inner shaft from frame.
2. Fasten the control arm shaft in a vise and loosen the bushing lock nuts. Remove grease fittings and bushings, and take the control arm from the shaft and remove grease seals.
3. To assemble, fasten control arm shaft in vise and install new seals over threaded ends and up onto shaft shoulders.
4. Install bushing lock nuts on shaft with chamfered side of nuts toward ends of shaft.
5. Install shaft in control arm and thread bushings onto shaft and through control arm.
6. As bushings are threaded into shaft and through control arm, thread lock nuts onto bushing.
7. Install lower control arm assembly gauge J-3184, Fig. 139, indexing pin of tool with bolt hole in shaft and tighten bushing until control arm inner face contacts end of tool.
8. Tighten lock nut securely, holding lock nut with a wrench and tighten the bushing to 150-200 lbs. ft. torque.
9. Slip seals off shaft shoulders and into their seats and install grease fittings into ends of bushings.

Lower Control Arm, Install—Follow the procedure outlined for 1948 models.

Upper Control Arm Pivot—Follow the procedure outlined for 1948 models. Note, however, that the eccentric section of the pivot pin is no longer threaded. Further details are given under Upper Control Arm Shaft.

Upper Control Arm Shaft, Remove—

1. Raise front of car and place stand jacks under outer end of lower control arm, allowing jack to support vehicle.
2. Remove wheel, and take grease fittings from bushings.
3. Remove bushings from outer pivot and remove seals from end of pin.
4. Remove pivot pin clamp bolt from knuckle support and slide pivot pin out of support, using an Allen wrench to assist removal.
5. Swing knuckle suport with hub and drum away from upper control arm.
6. Remove bushings from shaft and remove arm from shaft. Note that on the left side of the car it is necessary to remove the sheet metal splash guard over the steering gear housing to get at the rear bushing.
7. Remove seals from ends of shaft and, using tool J-2958, remove shaft from spring housing from *rear to front,* Fig. 140.

Upper Control Arm Shaft, Install—

1. Install shaft in spring housing from *front to rear* using tool J 2958. Drive shaft into housing until end projects out back of spring housing 1⅛ in., Fig. 141. Replacement shafts are marked with an

Fig. 139 P sitioning lower control arm shaft with gauge J-3184. Gauge has a pin which fits into shaft bracket hole. 1949-52

"F" to indicate front end. Rear end of shaft has smaller threads and care must be exercised not to drive the shaft in too far since backing it off will leave it loose in spring housing.

2. Install new seals over ends of shaft and install control arm on shaft.
3. Start both front and rear bushings onto shaft, position arm by scale measurement, Fig. 141, and start bushings into arm, making sure threads index properly.
4. Tighten bushings until they seat and then torque tighten them to 45-60 lbs. ft.
5. Install grease fittings, lubricate and check operation of control arm. Arm should fall of its own weight.
6. Install sheet metal splash guard over steering gear housing.
7. Install outer pin and bushings as outlined for 1948 models.

Kingpins & Bushings—Follow procedure outlined for 1948 models.

STEERING GEAR

STEERING GEAR REMOVAL

1935-36—

1. Insert screwdriver under edge of horn button, pry up and lift out button.
2. Use puller to remove steering wheel.
3. Disconnect column jacket from instrument panel.
4. Remove floor boards.
5. Use puller to remove pitman arm.
6. Disconnect horn wire.
7. Unfasten steering gear from frame.
8. Remove brake pedal from pedal shaft.

Fig. 140 Removing upper control arm shaft with Tool J-2958. Shaft is removed from rear to front and installed from front to rear. 1949-52

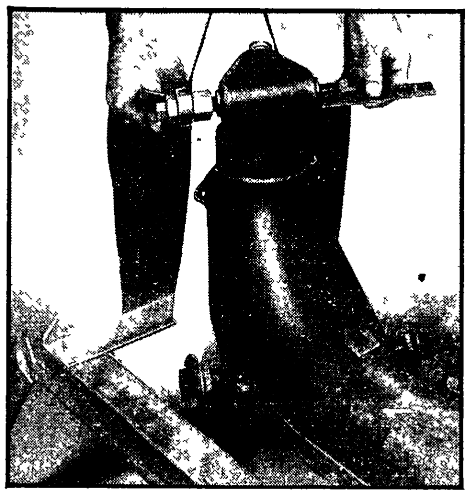


Fig. 141 Locate shaft in spring housing by measuring with steel scale so that shaft projects 1⅛ in. 1949-52

9. Remove steering gear from car.

1937-38—

1. Insert screwdriver under edge of horn button, pry up and lift out button.
2. Use puller to remove steering wheel.
3. Disconnect column jacket from instrument panel and from steering gear housing.
4. Use puller to remove pitman arm.
5. Disconnect horn wire and remove column jacket from steering post.
6. Unfasten steering gear from frame and remove gear from car.

1939—The Master "85" Model steering gear having the vacuum gearshift may be removed from the car in the same manner as that described below for Master DeLuxe Models except that the column jacket horn bushing should be left in place in the column jacket. The following operations cover the removal of the Master DeLuxe steering gear with vacuum gearshift.

1. Remove horn button, steering wheel nut, and use a puller to remove the steering wheel.
2. Remove column jacket upper bearing spring, spring seat and upper bearing with horn wire.
3. Remove column jacket grommet from dash.
4. Loosen column jacket instrument panel clamp bolts; not necessary to remove clamp.
5. Loosen lower column jacket clamp.
6. Use puller to remove pitman arm.
7. Loosen front screws in engine rear side pan.
8. Unfasten steering gear from frame.
9. With front wheels approximately 6" off floor, pull steering gear downward and out of car, leaving column jacket in place.

1940-48—

1. Remove horn button or ornamental cap, and steering wheel nut.
2. Use puller to remove steering wheel.
3. Remove "U" clamp which fastens column jacket to instrument panel.
4. Use puller to remove pitman arm.
5. Remove bolt from column jacket clamp at steering gear housing end and slide clamp up on column jacket.
6. Unfasten steering gear from frame and remove steering gear from below.

NOTE—On 1940 Master "85" models, it will also be necessary to remove left engine pan to gain clearance for removing steering gear.

1949-52—

1. Remove horn button or ornamental cap and take off steering wheel nut.
2. On models equipped with horn blowing ring, remove screws holding pivot ring and take off pivot ring, lock ring and horn blowing spring washer.
3. Use puller to remove steering wheel.
4. Remove upper control shaft clamp bolt from shaft connector.
5. Remove column jacket toe board grommet and seal from toe board.
6. Remove clamp which fastens column jacket to instrument panel.
7. Remove two clutch head screws that attach gearshift control upper support to column jacket. The upper control shaft and support may now be up out of engagement from shaft connector.
8. Remove clamp which retains shifter housing to column jacket. Then rotate shifter housing with lower control shaft and control rods attached away from column jacket.
9. Remove sheet metal splash guard covering steering gear housing.
10. Unfasten steering gear from frame.
11. Remove air duct from left fender skirt.
12. Rotate steering gear to clear fender skirt and raise gear, bringing it up and forward to remove it from engine compartment.

CHRYSLER

INDEX OF SERVICE OPERATIONS

NOTE—See appendix in back of book for data on power steering.

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Airstream 6	C6	118	In Block	3⅜ x 4½	241.5	6.00	93 @ 3400		45 @ 30
	Airstream 8	CZ	121	In Block	3¼ x 4⅛	273.8	6.20	105 @ 3400		45 @ 30
	Airflow 8	C1	123	In Block	3¼ x 4⅞	323.5	6.20	115 @ 3400		45 @ 30
	Imperial 8	C2	128	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
	Custom Imperial 8	C3	137-146	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
1936	Airstream 6	C7	118	In Block	3⅜ x 4½	241.5	6.00	93 @ 3400		45 @ 30
	Airstream 8	C8	121	In Block	3¼ x 4⅛	273.8	6.20	105 @ 3400		45 @ 30
	Airflow 8	C9	123	In Block	3¼ x 4⅞	323.5	6.20	115 @ 3400		45 @ 30
	Imperial 8	C10	128	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
	Custom Imperial 8	C11	137-146	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
1937	Royal 6	C16	116	In Block	3⅜ x 4¼	228.1	6.50	93 @ 3600		45 @ 30
	Imperial 8	C14	121	In Block	3¼ x 4⅛	273.8	6.70	110 @ 3600		45 @ 30
	Custom Imperial 8	C15	140	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
	Airflow 8	C17	128	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400		45 @ 30
1938	Royal 6	C18	119	In Block	3⅜ x 4½	241.5	6.50	95 @ 3600	180 @ 1200	45 @ 30
	Imperial 8	C19	128	In Block	3¼ x 4½	298.6	6.20	110 @ 3400	214 @ 1600	45 @ 30
	Custom Imperial 8	C20	144	In Block	3¼ x 4⅞	323.5	6.50	130 @ 3400	265 @ 1600	45 @ 30
1939	Royal 6	C22	119	In Block	3⅜ x 4½	241.5	6.50	100 @ 3600	184 @ 1200	45 @ 30
	De Luxe Windsor 6	C22	119	In Block	3⅜ x 4½	241.5	6.50	100 @ 3600	250 @ 1600	45 @ 30
	Imperial 8	C23	125	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	254 @ 1600	45 @ 30
	New Yorker 8	C23	125	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	254 @ 1600	45 @ 30
	Saratoga 8	C23	125	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	254 @ 1600	45 @ 30
	Custom Imperial 8	C24	144	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	254 @ 1600	45 @ 30
1940	Royal 6	C25S	122½	In Block	3⅜ x 4½	241.5	6.50	108 @ 3600	188 @ 1200	45 @ 30
	Windsor 6	C25W	122½	In Block	3⅜ x 4½	241.5	6.50	108 @ 3600	188 @ 1200	45 @ 30
	Traveler 8	C26K	128½	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	255 @ 1600	45 @ 30
	Saratoga 8	C26S	128½	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	255 @ 1600	45 @ 30
	New Yorker 8	C26N	128½	In Block	3¼ x 4⅞	323.5	6.80	135 @ 3400	255 @ 1600	45 @ 30
	Crown Imperial 8	C27	145½	In Block	3¼ x 4⅞	323.5	6.80	137 @ 3400	260 @ 1600	45 @ 30
1941	Royal 6	C28S	121½	In Block	3⅜ x 4½	241.5	6.80	112 @ 3600	190 @ 1200	40 @ 20
	Windsor 6	C28W	121½	In Block	3⅜ x 4½	241.5	6.80	112 @ 3600	190 @ 1200	40 @ 20
	Saratoga 8	C30K	127½	In Block	3¼ x 4⅞	323.5	6.80	137 @ 3400	255 @ 1600	40 @ 20
	New Yorker 8	C30N	127½	In Block	3¼ x 4⅞	323.5	6.80	137 @ 3400	255 @ 1600	40 @ 20
	Crown Imperial 8	C33	145½	In Block	3¼ x 4⅞	323.5	6.80	140 @ 3400	260 @ 1600	40 @ 20
1942	Royal 6	C34S	121½	In Block	3 7/16 x 4½	250.6	6.60	120 @ 3800	200 @ 1600	40 @ 20
	Windsor 6	C34W	121½	In Block	3 7/16 x 4½	250.6	6.60	120 @ 3800	200 @ 1600	40 @ 20
	Saratoga 8	C36K	127½	In Block	3¼ x 4⅞	323.5	6.80	140 @ 3600	260 @ 1800	40 @ 20
	New Yorker 8	C36N	127½	In Block	3¼ x 4⅞	323.5	6.80	140 @ 3600	260 @ 1800	40 @ 20
	Crown Imperial 8	C37	145½	In Block	3¼ x 4⅞	323.5	6.80	140 @ 3600	260 @ 1800	40 @ 20
1946-48	Royal 6	C38S	121½	In Block	3 7/16 x 4½	250.6	6.60	114 @ 3600	204 @ 1200	40 @ 20
	Windsor 6	C38W	121½	In Block	3 7/16 x 4½	250.6	6.60	114 @ 3600	204 @ 1200	40 @ 20
	Town and Country 6	C38	121½	In Block	3 7/16 x 4½	250.6	6.60	114 @ 3600	204 @ 1200	40 @ 20
	Saratoga 8	C39K	127½	In Block	3¼ x 4⅞	323.5	6.70	135 @ 3400	270 @ 1600	40 @ 20
	New Yorker 8	C39N	127½	In Block	3¼ x 4⅞	323.5	6.70	135 @ 3400	270 @ 1600	40 @ 20
	Town and Country 8	C39	127½	In Block	3¼ x 4⅞	323.5	6.70	135 @ 3400	270 @ 1600	40 @ 20
	Crown Imperial 8	C40	145½	In Block	3¼ x 4⅞	323.5	6.70	135 @ 3400	270 @ 1600	40 @ 20
1949	Royal 6	C45S	125½	In Block	3 7/16 x 4½	250.6	7.00	116 @ 3600	208 @ 1600	45 @ 45
	Windsor 6	C45W	125½	In Block	3 7/16 x 4½	250.6	7.00	116 @ 3600	208 @ 1600	45 @ 45
	Saratoga 8	C46K	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	New Yorker 8	C46N	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	Town and Country 8	C46	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	Crown Imperial 8	C47	145½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
1950	Royal 6	C48S	125½	In Block	3 7/16 x 4½	250.6	7.00	116 @ 3600	208 @ 1600	45 @ 45
	Windsor 6	C48W	125½	In Block	3 7/16 x 4½	250.6	7.00	116 @ 3600	208 @ 1600	45 @ 45
	Saratoga 8	C49K	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	New Yorker 8	C49N	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	Town and Country 8	C49	131½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	45 @ 45
	Crown Imperial 8	C50	145½	In Block	3¼ x 4⅞	323.5	7.25	135 @ 3200	270 @ 1600	50 @ 45

Year	Model Designation		Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1951	Windsor 6	C51	125½	In Block	3 7/16 x 4½	250.6	7.00	116 @ 3600	208 @ 1600	60 @ 50
	New Yorker V8	C52	131½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Crown Imperial V8	C53	145½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Imperial V8	C54	131½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Saratoga V8	C55	125½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
1952	Windsor 6	C51	125½	In Block	3 7/16 x 4¾	264.5	7.00	119 @ 3600	218 @ 1600	50 @ 45
	New Yorker V8	C52	131½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Crown Imperial V8	C53	145½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Imperial V8	C54	131½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50
	Saratoga V8	C55	125½	In Head	3 13/16 x 3⅝	331.1	7.50	180 @ 4000	312 @ 2000	60 @ 50

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note A	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935	C6	AC-46	.025	.020	35–38	153624	B	Positive	300		65–70
	CZ, C1	AC-46	.025	.017	27–30	16258374	B	Positive	300		65–70
	C2, C3	AC-46	.025	.017	27–30	16258374	C	Positive	300		65–70
1936	C7	AC-46	.025	.020	35–38	153624	B	Positive	300		65–70
	C8, C9	AC-46	.025	.017	27–30	16258374	B	Positive	300		65–70
	C10, C11	AC-46	.025	.017	27–30	16258374	C	Positive	300		65–70
1937	C16	CH-J8	.025	.020	35–38	153624	D	Positive	300		65–70
	C14	CH-J8	.025	.017	27–30	16258374	E	Positive	300		65–70
	C15, C17	CH-J8	.025	.017	27–30	16258374	C	Positive	300		65–70
1938	C18	CH-J8	.025	.020	35–38	153624	B	Positive	300		65–70
	C19	CH-J8	.025	.017	27–30	16258374	B	Positive	300		65–70
	C20	CH-J8	.025	.017	27–30	16258374	E	Positive	300		65–70
1939	C22	AL-A7	.025	.020	35–38	153624	B	Positive	300		65–70
	C23	AL-A7	.025	.017	27–30	16258374	B	Positive	300		65–70
	C24	AL-A7	.025	.017	27–30	16258374	E	Positive	300		65–70
1940	C25	AL-A7B	.025	.020	35–38	153624	B	Positive	300		65–70
	C26	AL-A7B	.025	.017	27–30	16258374	E	Positive	300		65–70
	C27	AL-A7B	.025	.017	27–30	16258374	E	Positive	300		65–70
1941–42	Six	AL-A7B	.025	.020	35–38	153624	B	Positive	425	425	65–70
	C30, C36	AL-A7B	.025	.017	27–30	16258374	B	Positive	425	425	65–70
	C33, C37	AL-A7B	.025	.017	27–30	16258374	E	Positive	425	425	65–70
1946–48	Six	AL-A5	.025	.020	35–38	153624	D	Positive	425	425	65–70
	Eight	AL-A5	.025	.017	27–30	16258374	D	Positive	425	425	65–70
1949–50	Six	AL-AR8	.035	.020	35–38	153624	B	Positive	450–500	450–500	65–70
	Eight	AL-AR8	.035	.017	27–30	16258374	B	Positive	450–500	450–500	65–70
1951–52	Six	AL-AR8	.035	.020	35–38	153624	D	Positive	450–500	450–500	65–70
	Eight	AL-4S140	.035	.017	F	H	B	Positive	450–500	450–500	80–85

A—Plus or minus .002″.
B—"O" mark on vibration damper.
C—Fifth line after "O" mark on vibration damper.
D—Second line before "O" mark on vibration damper.
E—Third line after "O" mark on vibration damper.
F—26-28 degrees (one set of points). Total dwell 32-36 degrees.
H—Cylinder numbering as viewed from rear of engine. Right bank, 2-4-6-8; left bank, 1-3-5-7. Firing order: 1-8-4-3-6-5-7-2.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935–36	Six	.006H	.008H	.010	45	B	2	46@2 1/32	.001–.003	.002–.004	.3410	.3400
	Eight	.006H	.008H	.011	45	2	4	46@2 1/32	.001–.003	.002–.004	.3410	.3400
1937	Six	.006H	.010H	.014	45	B	2	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	Eight	.006H	.010H	.011	45	2	4	46@2 1/32	.001–.003	.002–.004	.3410	.3400
1938	Six	.008H	.010H	.014	45	8	2	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	Eight	.006H	.010H	.011	45	2	4	46@2 1/32	.001–.003	.002–.004	.3410	.3400
1939	Six	.008H	.010H	.014	45	8	2	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	Eight	.008H	.010H	.011	45	6	12	52@2 1/32	.001–.003	.002–.004	.3410	.3400
1940–42	Six	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	Eight	.008H	.010H	.011	45	6	12	52@2 1/32	.001–.003	.002–.004	.3410	.3400
1946–50	Six	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	Eight	C	C	C	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
1951	Six	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	V8	Zero	Zero	Zero	45	15	15	52@1 11/16	.001–.003	.002–.004	.3725	.3715
1952	Six	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
	V8	Zero	Zero	Zero	45	15	15	46@1 11/16	.001–.003	.002–.004	.3725	.3715

A—BTDC means before top dead center; ATDC means after top dead center.
B—Top dead center.
C—With mechanical valve lifters, intake .008H, exhaust .010H, for timing .011. With hydraulic lifters, zero clearance.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Ring Gap, Minimum (Note A)		Clearance in Groove		Type	Fit
					Compression	Oil	Compression	Oil		
1935–37	All	Above	.003	5 to 7	.007	.007	.0015–.003	.0015–.003	E	F
1938	All	Above	.002	5 to 7	.007	.007	.0015–.003	.0015–.003	E	F
1939	Six	Above	.002	5 to 7	.007	.007	.002 –.004	.002 –.004	E	F
	Eight	Above	.002	5 to 7	.007	.007	.0015–.004	.0015–.004	E	F
1940–42	Six	Above	.002	5 to 7	.007	.007	B	.001 –.0025	E	F
	Eight	Above	.002	5 to 7	.007	.007	C	.001 –.0025	E	F
1946–50	Six	Above	.002	5 to 7	.007	.007	D	.001 –.0025	E	F
	Eight	Above	.002	5 to 7	.007	.007	D	.001 –.0025	E	F
1951–52	Six	Above	.002	5 to 7	.011	.011	D	.001 –.0025	E	F
	V8	Above	.002	9 to 12	.015	.015	.001 –.0025	.001 –.0025	E	F

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Top ring .002-.0035″, second ring .0015-.003″.
C—Top ring .002-.004″, second ring .0015-.0035″.
D—Top ring .0025-.004″, second ring .002-.0035″.
E—Floating type. Pin retained by snap rings in piston bosses.
F—Thumb push fit in piston and rod but with piston heated.

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935-36	Six	.003–.005	.001–.0035	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
	Eight	.003–.005	.0015–.0025	2.1865–2.1875	.001–.003	.006–.011	45–50	2.702–2.703	.001–.002	.003–.007	75–80
1937	Six	.002–.006	.0015–.0035	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
	Eight	.001–.008	.0015–.0035	2.1865–2.1875	.001–.003	.006–.011	45–50	2.702–2.703	.001–.002	.003–.007	75–80
1938	Six	.002–.006	.001–.003	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
	Eight	.001–.008	.001–.003	2.1865–2.1875	.001–.003	.006–.011	45–50	2.702–2.703	.001–.002	.003–.007	75–80
1939-40	Six	.002–.006	.001–.003	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
	Eight	.002–.006	.001–.003	2.1865–2.1875	.001–.003	.006–.011	45–50	2.702–2.703	.001–.002	.003–.007	75–80
1941-48	Six	.002–.006	.001–.003	2.124–2.125	.0005–.0015	.006–.011	45–50	2.499–2.500	.001–.0015	.003–.007	75–80
	Eight	.002–.006	.001–.003	2.1865–2.1875	.0005–.0015	.006–.011	45–50	2.702–2.703	.001–.0015	.003–.007	75–80
1949-50	Six	.002–.006	.0015–.0035	2.124–2.125	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.003–.007	75–80
	Eight	002–.006	.0015–.0035	2.1865–2.1875	.0005–.0015	.006–.011	45–50	2.702–2.703	.0005–.0015	.003–.007	75–80
1951-52	Six	.002–.006	.0015–.0035	2.124–2.125	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.003–.007	75–80
	V8	.002–.006	.001–.003	2.249–2.250	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.002–.007	80–85

Note A—Thrust taken by rear bearing on all models except V8. On V8s, thrust is taken by No. 3 bearing.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	C6	+1¼	+ ½	⅛	10
	CZ	+1¼	+ ½	⅛	5½
	C1-2-3	+2	+ ½	1/16	4
1936	C7	+1¼	+ ¼	1/16	10
	C8	+1¼	− ¼	1/16	5⅜
	C9-10-11	+2	+ ½	1/16	5
1937	C14-16	+1¼	+ ⅛	1/16	5⅜
	C15	+2	+ ⅛	1/16	5⅜
	C17	+2	+ ½	1/16	5
1938	C18, C19	+1¼	+ ⅛	1/16	5⅜
	C20	+2	+ ¼	1/16	5⅜
1939	C22	+1¼	+ ¼	1/16	5⅜
	C23	+ ½	Zero	1/16	6⅜
	C24	+2	+ ¼	1/16	5⅜
1940-41	All	Zero	+ ⅜	1/16	5⅜
1942-48	All	Zero	+ ⅜	1/32	5⅜
1949-50	Six	−2	+ ⅜	1/32	5⅜
	Eight	−2	+ ⅜	1/32	6⅞
1951-52	Six	−2	Zero	Zero	5¾
	V8	−2	Zero	Zero	5¾

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	C6	Woven	19 13/16	2	3/16	5/16
	CZ	Woven	22 5/32	2	3/16	5/16
	C1-2-3	Woven	24 27/32	2	¼	5/16
1936	C7-8	Molded	22 5/32	2	3/16	5/16
	C9-10-11	Molded	25	2	¼	5/16
1937	C14	Molded	22 5/32	2	3/16	5/16
	C15-17	Molded	25	2	¼	5/16
	C16	Molded	(A)19 13/16 (B)17 19/64	2	3/16	5/16
1938	C18	Molded	19 7/16	2	3/16	5/16
	C19	Molded	25⅛	2	3/16	5/16
	C20	Molded	29 5/16	2	¼	5/16
1939	C22	Molded	19 7/16	2	3/16	5/16
	C23	Molded	25⅛	2	3/16	5/16
	C24	Molded	29 5/16	2	¼	5/16
1940-1942	Six	Molded	19 7/16	2	3/16	5/16
	Eight	Molded	(A)25⅛ (B)22 3/16	2	3/16	5/16
1946-1948	Six	Molded	(A)23 (B)20⅜	2	3/16	5/16
	Eight	Molded	(A)25⅛ (B)22 3/16	2	3/16	5/16

Continued on page 446

Year	Model	Cooling System Capacity, Quarts (Without Heater)	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil			Capacity, Pounds or Pints	Grade of Oil		Capacity, Pounds or Pints	Grade of Oil	
					Above +32°F.	Above +10°F	Above −10°F.		Summer	Winter		Summer	Winter
1935	C6	17	15	6	20	20W	10W	2½ (A)	140 (B)	90 (B)	3¼	140	90
	CZ	20	15	6	20	20W	10W	2½ (A)	140 (B)	90 (B)	3¼	140	90
	C1	19	21	6	20	20W	10W	3¾ (C)	140 (B)	90 (B)	4⅕	140	90
	C2, C3	19	21	6	20	20W	10W	6¼	70	50	4⅕	140	90
1936	C7	19	15	6	20	20W	10W	2½ (A)	140 (B)	90 (B)	3¼	90H	90H
	C8	20	15	6	20	20W	10W	2½ (A)	140 (B)	90 (B)	3¼	90H	90H
	C9	17	21	6	20	20W	10W	3¾ (C)	140 (B)	90 (B)	4⅕	140	90
	C10, C11	17	21	6	20	20W	10W	6¼	70	50	4⅕	140	90
1937	C14	22	16	6	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
	C16	20	16	5	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
	C15	21	20	6	20	20W	10W	6¼	70	50	6¼	90H	90H
	C17	17	21	6	20	20W	10W	6¼	70	50	4	140	90
1938	C18	20	16	5	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
	C19	20	16	6	20	20W	10W	3¼ (C)	140 (B)	90 (B)	3¼	90H	90H
	C20	20	20	6	20	20W	10W	6¼	70	50	6¼	90H	90H
1939	C22	17	18	5	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
	C23	24	21	6	20	20W	10W	3½ (C)	140 (B)	90 (B)	3¼	90H	90H
	C24	24	21	6	20	20W	10W	4½	70	50	6¼	90H	90H
1940	C25	18	17	5	20	20W	10W	2¾ (E)	90 (F)	90 (F)	3¼	90H	90H
	C26	24	20	6	20	20W	10W	2¾ (E)	90 (F)	90 (F)	3¼	90H	90H
	C27	24	20	6	20	20W	10W	4	50	50	4½	90H	90H
1941	C28	18	17	5	20	20W	10W	2¾	90 (G)	90 (G)	3¼	90H	90H
	C30	24	20	6	20	20W	10W	2¾ (E)	90 (F)	90 (F)	3½	90H	90H
	C33	24	20	6	20	20W	10W	4	50	50	5	90H	90H
1942	C34	18	17	5	20	20W	10W	2¾	90 (G)	90 (G)	3¼	90H	90H
	C36	26	20	6	20	20W	10W	2¾	90 (G)	90 (G)	3½	90H	90H
	C37	26	20	6	20	20W	10W	2¾	G	G	5	90H	90H
1946-48	C38	18	17	5	20	20W	10W	2¾ (J)	90 (G)	90 (G)	3¼	90H	90H
	C39	26	20	6	20	20W	10W	2¾ (J)	90 (G)	90 (G)	3½	90H	90H
	C40	26	20	6	20	20W	10W	3	G	G	5	90H	90H
1949	C45	17	17	5	30	20W	10W	2¾ (J)	80 (G)	80 (G)	3¼	90H	90H
	C46	21	20	6	30	20W	10W	2¾ (J)	80 (G)	80 (G)	3½	90H	90H
	C47	21	20	6	30	20W	10W	3	G	G	5	90H	90H
1950	C48	17	17	5	30	20W	10W	2¾(J)	80(G)	80 (G)	3¼	90H	90H
	C49	21	20	6	30	20W	10W	3	(G)	(G)	3½	90H	90H
	C50	21	20	6	30	20W	10W	3	(G)	(G)	5	90H	90H
1951-52	C51	15	17	5	30	20W	10W	2¾(J)	80(G)	80(G)	3¼	90H	90H
	C52, C54	25	20	5	30	20W	10W	3(K)	(G)	(G)	3½	90H	90H
	C53, C55	25	20	5	30	20W	10W	3(K)	(G)	(G)	5	90H	90H

A—With overdrive, 4½ pints.
B—With overdrive, use S.A.E. 70 for summer; S.A.E. 50 for winter.
C—With overdrive, 6¼ pints.
D—With overdrive, 3¼ pints.
E—With overdrive, 4 pints.
F—With overdrive, use S.A.E. 50.
G—For semi-automatic transmission, use S.A.E. 10W engine oil.
H—Hypoid gear lubricant.
J—For semi-automatic transmission, 3 pints.
K—For torque converter, approximately 10½ qts.

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1949-	Six	Molded	25⅛	2	E	5/16
1950	Eight	Molded	25⅛	2	5/32	5/16
	Imperial 8	Molded	D	D	D	5/16
1951-	C51	Molded	25⅛	2	13/64	5/16
1952	C52, 54, 55	Molded	25⅛	2	3/16	5/16
	C53	Molded	D	D	D	5/16

A—Front wheel. C—For 1950 Town & Country Models, see Imperial 8.
B—Rear wheel. D—Disc type brake. See Brake chapter.
E—13/64 on 1949 and 5/32 on 1950.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-52	All	.006–.010	Shims	Shims	.003–.008

FIRST SERIAL NUMBER (CHRYSLER)

LOCATION—1935-42: On right front door pillar. 1946-52: On left front door pillar.

Year	Model	
1935	C6	6800001
	CZ	6701501
	C1	6601201
	C2	7012301
	C3	7528551
1936	C7	6823301
	C8	6710501
	C9	6606201
	C10	7014901
	C11	7803851
1937	C16	6865101
	C14	6719601
	C15	7804001
	C17	7019401
1938	C18	7532801
	C19	6734001
	C20	7805501
1939	C22 Royal	7574001
	C22 Windsor	6948301
	C23 Imperial	6742201
	C23 New Yorker	6609901
	C23 Saratoga	6672701
	C24	7806201
1940	C25S	7625001
	C25W	6955201
	C26K	6750101
	C26S	6673501
	C26N	6613401
	C27	7806551
1941	C28S	7657501
	C28W	7901601
	C30K	6756501
	C30N	6624101
	C33	7807501
1942	C34S	70001001
	C34W	70501001
	C36K	6762501
	C36N	6674201
	C37	7808401
1946	C38S	70011001
	C38W	70515001
	C38 Town & Country	71000001
	C39K	6765001
	C39N	7025001
	C39 Town & Country	7400001
	C40	7810001
1947	C38S	70023023
	C38W	70564429
	C38 Town & Country	71000128
	C39K	6766546
	C39N	7037249
	C39 Town & Country	7402037
	C40	7810167
1948	C38S	70029674
	C38W	70633017
	C38 Town & Country	71002880
	C39K	6768486
	C39N	7062598
	C39 Town & Country	7405174
	C40	7810908
1949	C45S	70041001[1]
	C45S	65002001[2]
	C45W	70725001[1]
	C45W	67005001[2]
	C46K	6772001
	C46N	7094001[3]
	C46	7410001[4]
	C47	7813001
1950	C48S	70058001[1]
	C48S	65004001[2]
	C48W	70794001[1]
	C48W	67011001[2]
	C49K	6774501
	C49N	7119001[3]
	C49N	7411501[4]
	C50	7813501
1951	C51-1	70081001[1]
	C51-1	65007001[2]
	C51-2	70891001[1]
	C51-2	67026001[2]
	C52	7165001
	C53	7814501
	C54	7736501
	C55	76500001[1]
	C55	66500001[2]
1952	C51-1	70094301[1]
	C51-1	65008901[2]
	C51-2	70952301[1]
	C51-2	67033301[2]
	C52	7199901
	C53	7815101
	C54	7753601
	C55	76512101[1]
	C55	66501801[2]

[1] Detroit, Mich. [2] Los Angeles, Cal. [3] New Yorker. [4] Town and Country.

CHRYSLER-DE SOTO-DODGE-PLYMOUTH

TEXT APPLIES TO ALL THE ABOVE CARS EXCEPT WHEN STATED OTHERWISE

ENGINE

ENGINE SIZE DATA

1935-52 ALL CARS—The letter "A" with the engine number indicates "special standard" cylinder bore, which is .020" larger than standard.

The letter "B" with the engine number indicates "special standard" main and connecting rod bearings which are .010" smaller than standard.

The letters "AB" with the engine number indicates "special standard" engine with "special standard" cylinder bores, as well as "special standard" main and connecting rod bearings.

The letters in the circular bosses on the block are for the use of factory inspectors only and should not be used in connection with the engine number.

ENGINE REMOVAL

1951-52 V8 MODELS — In removing the engine it is not necessary to remove any of the sheet metal; nor is it necessary to take out the transmission. The procedure is as follows:

1. Drain cooling system.
2. Disconnect propeller shaft at front.
3. Disconnect wires and linkage at transmission.
4. Remove exhaust pipes.
5. Remove hood and battery.
6. Disconnect necessary items such as fuel lines, wires, radiator hoses, etc.
7. Remove carburetor, including lower throttle body and heat by-pass tube.
8. Remove radiator shroud (if equipped).
9. Attach a suitable lifting fixture to the carburetor flange studs on the intake manifold. Attach a chain hoist to the eyebolt (tool No. C-3060 is available for this operation).
10. Place a jack under the transmission to relieve the weight.
11. Remove engine rear support mounting bolts and cross member.

NOTE—On all cars except Windsor long wheelbase models, the cross member is secured to the frame by four bolts. On Windsor long wheelbase models the cross member is *welded* to the frame side members. Therefore, to remove the engine, after performing Steps 1 through 9 above, the fender and grille assembly must be removed. Then lift engine out from front of car. On other models, continue as follows:

12. Remove engine front support mounting bolts.
13. Lower jack under transmission and remove.
14. Raise engine and, at the same time, work it out toward the left front fender. By working it out thus it will not be necessary to disturb the heater system.

1942-52 Except V8 Models—To remove the engine from these models, proceed as follows:

1. From under the car, disconnect propeller shaft from transmission, hand brake linkage, gearshift rods at transmission, speedometer cable and back-up light wire at transmission, exhaust pipe at manifold, fuel pump flexible line, and clutch pedal linkage.
2. Remove floor covers and disconnect wires to solenoid, governor and interrupter switch on models with automatic transmission.
3. Remove transmission.

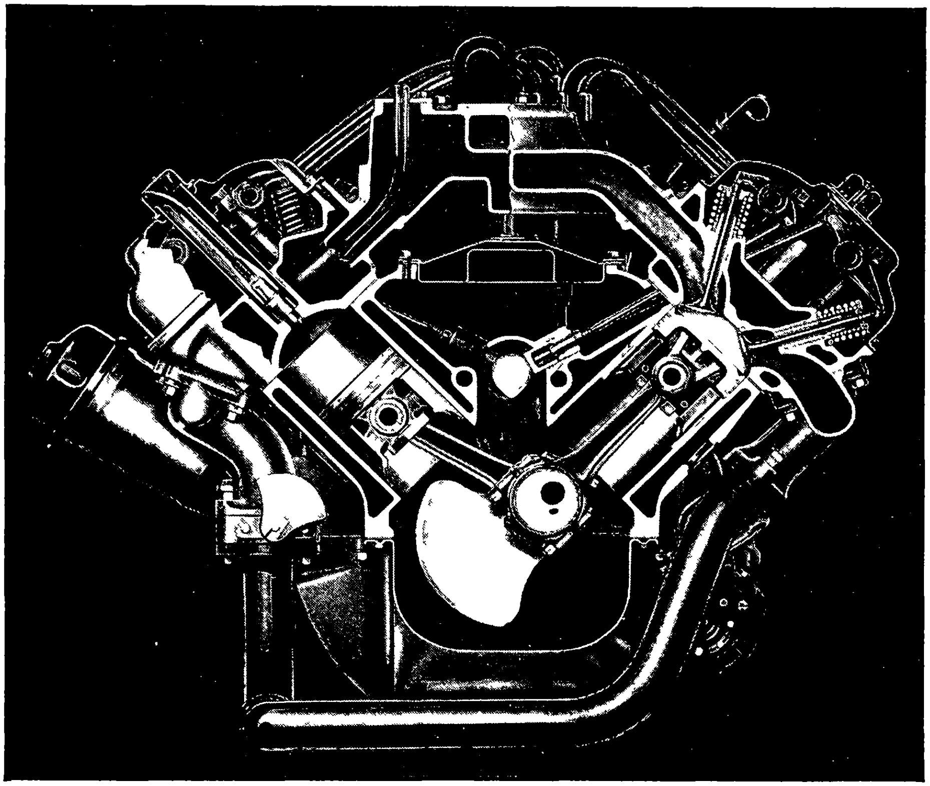


Fig. A Chrysler and De Soto V8 engine. 1951-52

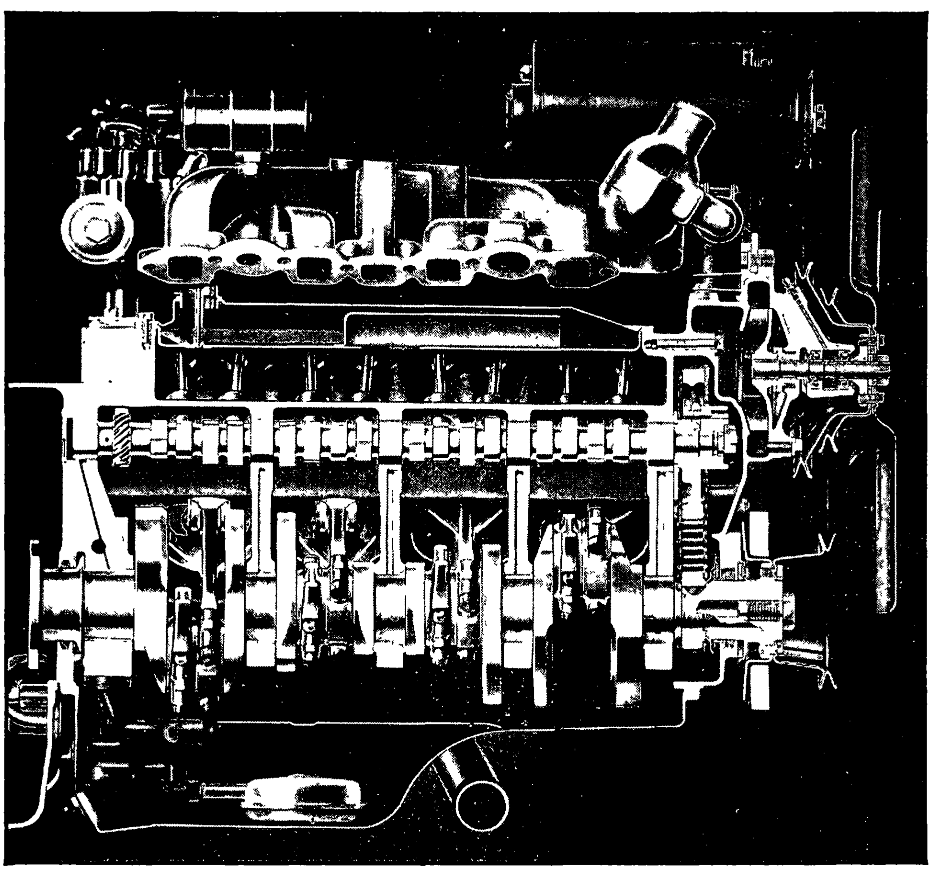


Fig. B Chrysl r and D S t V8 ngin . 1951-52

FIRST ENGINE NUMBER (CHRYSLER)

LOCATION—On left front of cylinder block.

Year	Model	
1935	C6	C6-1001
	CZ	CZ-1001
	C1	C1-1001
	C2	C2-1001
	C3	C3-1001
1936	C7	C7-1001
	C8	C8-1001
	C9	C9-1001
	C10	C10-1001
	C11	C11-1001
1937	C16	C16-1001
	C14	C14-1001
	C15	C15-1001
	C17	C17-1001
1938	C18	C18-1001
	C19	C19-1001
	C20	C20-1001
1939	C23	C23-1001
	C24	C24-1001
1940	C25	C25-1001
	C26	C26-1001
	C27	C27-1001
1941	C28	C28-1001
	C30	C30-1001
	C33	C33-1001
1942	C34	C34-1001
	C36	C36-1001
	C37	C37-1001
1946	C38	C38-1001
	C39	C39-1001
	C40	C40-1001
1947	C38	Note A
	C39	Note A
	C40	Note A
1948	C38	Note A
	C39	Note A
	C40	Note A
1949	C45	C45-1001
	C46	C46-1001
	C47	C47-1001
1950	C48	C48-1001
	C49	C49-1001
	C50	C50-1001
1951	Six	C51-1001
	V8	C51-8-1001
1952	Six	C52-1001
	V8	C52-8-1001

A—Continued from previous year.

4. Remove hood and radiator.
5. At upper side of engine, disconnect starter and ground cables, wires at generator, wire to coil (and carburetor, if equipped), oil pressure gauge line, accelerator linkage and bracket, air cleaner and horn, and heat indicator tube at cylinder head.
6. Install lifting fixture.
7. Remove front and rear engine supports and lift out engine.

1939-41 ALL CARS—To remove the engine with the clutch and transmission, take off the hood and front bumper and, after draining the cooling system, disconnect water hose.

Remove radiator and sheet metal as a unit. Remove propeller shaft and, if equipped with overdrive, remove the solenoid from the overdrive adapter plate. On models with power shift, remove the vacuum control at the transmission.

Disconnect fuel pump line, exhaust pipe at manifold, oil gauge line at oil

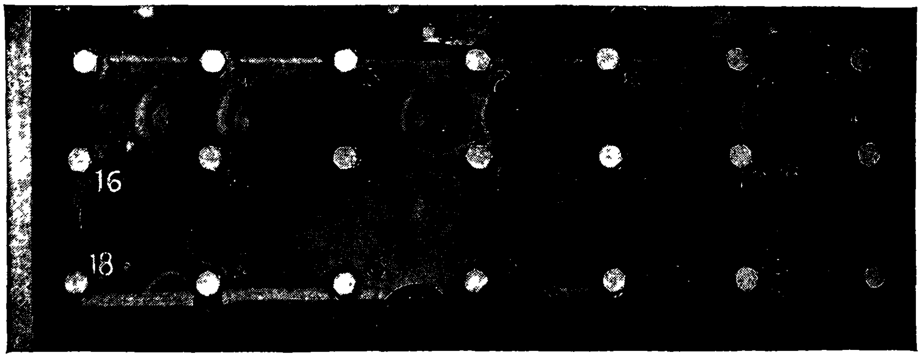


Fig. 1 Cylinder head tightening sequence. 1935-52 sixes

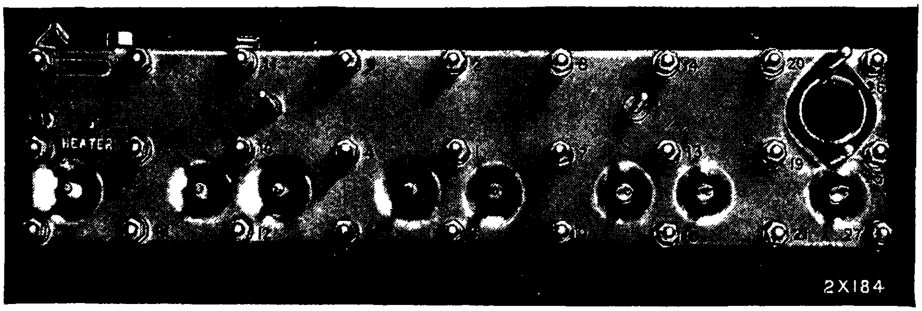


Fig. 2 Cylinder head tightening sequence. 1935-50 eights

gauge flexible tube, throttle and choke controls, heat indicator tube and bulb at cylinder head, starter cable at starter, coils wires at coil, speedometer cable at transmission, battery ground cable, wires at generator, hand brake cable at brake band, gearshift controls at transmission, and clutch pedal linkage.

Remove crankcase ventilator breather pipe, front and rear engine mounting bolts and, after loosening the engine splash pans at both sides, lift out the engine.

1935-38 ALL CARS—After draining the cooling system, remove hood and radiator brace rods on 1935-37 cars, and the hood side panels on 1938 models. Take off fan blades and radiator. Remove engine front support bolts.

Disconnect starter cable, generator wire, distributor wires, fuel lines at pump, throttle control rods, oil pressure gauge line.

After removing floor boards, disconnect hand brake cable, propeller shaft, clutch release fork, and remove transmission. Disconnect exhaust pipe, remove bolts from rear engine mounting and hoist engine out of chassis.

CYLINDER HEAD, L-HEAD ENGINES

1935-52 ALL CARS—The general procedure for removing a cylinder head is as follows:

1. Drain cooling system.
2. Remove fuel line from carburetor.
3. Remove carburetor air cleaner.
4. Remove carburetor.
5. Remove upper radiator hose, spark plugs, engine heat indicator unit and cylinder or capscrews.
6. Lift cylinder head from block, using lifting hooks in two of the spark plug holes. Do not use a screwdriver, chisel or other sharp instrument to drive between the head and block to loosen the head as damage may result.

INSTALLATION NOTES—Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block.

If possible, use a torque wrench when tightening cylinder head nuts or capscrews. Uneven or excessive tightening may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder heads in the order shown in Figs. 1 and 2, tightening a little at a time in the proper sequence about three times around before final tightening to the torque values given in the *Tune Up Chart.* After the engine has warmed up to operating temperature, recheck the nuts and adjust torque as required.

V8 ENGINE CYLINDER HEADS

1951-52—After draining the cooling system, remove either head in the following manner:

1. Remove carburetor air cleaner.
2. Remove generator.
3. Disconnect fuel, vacuum and water lines at carburetor.
4. Disconnect carburetor kickdown switch and dashpot wire.
5. Disconnect linkage at carburetor.
6. Disconnect coil wires.
7. Remove heat indicator bulb.
8. Disconnect vacuum booster brake pipe (if equipped).
9. Disconnect heater hose, water outlet and by-pass hoses.
10. Remove capscrews which fasten intake manifold to cylinder head.
11. Remove intake manifold, being careful not to damage the heat tube which goes down into the heat by-pass port in the right-hand cylinder head. Tilt the manifold to the right so the heat tube can be pulled straight out of the by-pass port opening.
12. Disconnect exhaust pipe-to-manifold flanges.
13. Remove ignition cable covers, ignition cables and cylinder head covers.
14. Lift out push rods.

NOTE—The rocker arm assembly attaching bolts also hold the cylinder head to the engine block. When these bolts are removed, the cylinder head is loose and is only held in position by two dowel pins.

CAUTION—Extreme care must be exercised when handling the cylinder heads to prevent marring or scratching the gasket face. The head gaskets are extremely thin and any defacing of the surface of either the block or head would involve extensive repairs to overcome a cylinder head gasket leak. Also, when handling a cylinder head, it should be remembered that the intake valve guides are feather-edged and protrude above the top of the cylinder surface. If the head were to rest on these surfaces, bending of the valve guides would result, causing the valve stems to bind and possibly preventing the valves from seating.

INSTALLATION NOTES—Make certain no foreign particles have been allowed to fall into the cylinder bores. Clean cylinder bores before installing head.

Final tightening of cylinder head capscrews should be 80-85 lbs. ft. torque. Head cover studs should be tightened to 12-17 lbs. ft.; ignition cable cover screw 5-10 lbs. ft.

VALVE SERVICE, 1935-52 L-HEAD ENGINES

VALVE ADJUSTMENT—Valve tappets should be adjusted with engine running

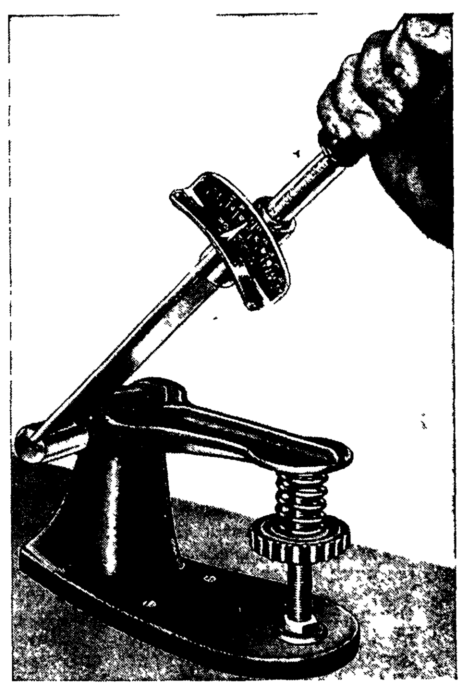


Fig. 3 Fixtur and t rqu wrench f r ch cking valv spring pressure. 1935-52

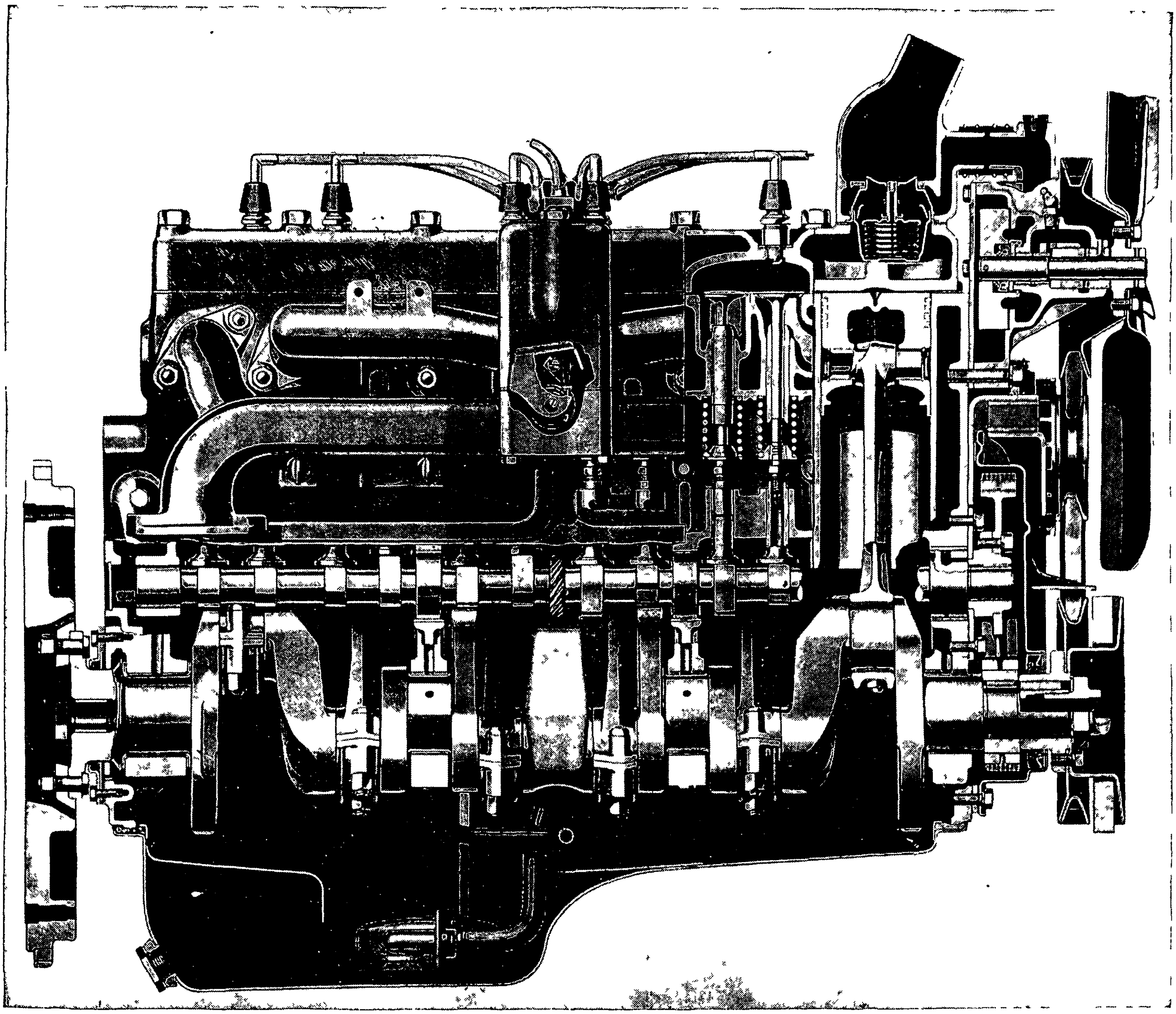


Fig. C Plymouth 1946-52 engine. Typical of all Chrysler-built sixes

and at normal operating temperature. It is important that the clearances given in *Valve Chart* be maintained to insure satisfactory engine performance. If the car is driven at continuous high speeds, an additional .002" clearance for exhaust tappets is desirable.

If the car being serviced is one wherein the valves are not accessible when the hood is raised, proceed as follows:

1. Raise right front end of car and support it with a stand.
2. Remove right front wheel and splash shield access cover.
3. Remove valve chamber covers.
4. With engine idling and warmed up to operating temperature, adjust the intake valves and then follow through by adjusting all exhaust valves.

VALVES, REMOVE—After taking off the cylinder head as outlined previously, take off the valve chamber covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the valve locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so that they can be identified as to the valve port from which they were removed.

VALVE SPRINGS—After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring tension on a spring testing fixture if one is available, Fig. 3. If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced. Likewise, any spring that stands shorter than the new spring used for comparison should be discarded.

VALVE GUIDES — Clean the valve guides with a wire guide brush and check the clearance between valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between valve stems and guides will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide

Fig. 4 Valve guide removing tool. 1935-52 L-Head engines

on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the valve guide.

If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed.

If it is necessary to replace valve guides, the tools shown in Figs. 4 and 5 should be used. If they are not available, the old guides can be driven down and out of the valve chamber; or they can be pulled out by using a suitable piece of pipe together with a long bolt and suitable washers.

After the new guides have been installed, they should be reamed, Fig. 6, to provide the clearances given in the *Valve Data* chart.

VALVES, REFACE—Clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads as well as the gum which might have accumulated on the stems.

In refacing valves, take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced. In other words, the valve head margin must be at least 3/64", otherwise the valve must be replaced. This margin is the area above the contact surface of the valve face.

Inspect the valve seats in the block for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valve guides are required, they must be installed and reamed before refacing

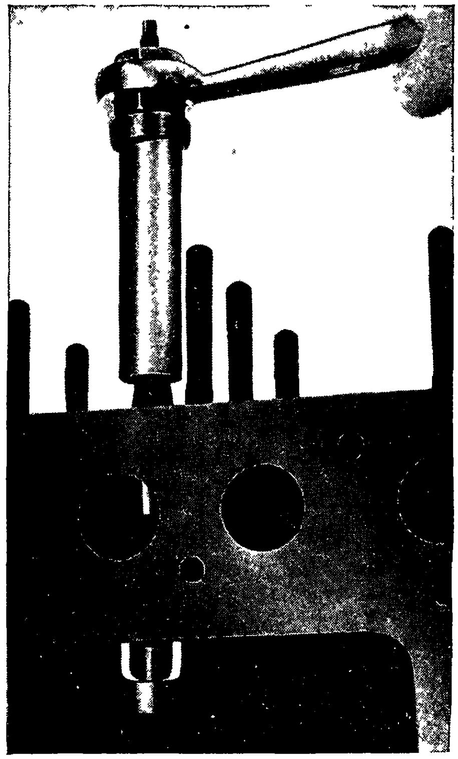


Fig. 5 Valve guide installing tool. 1935-52 L-Head engines

the seats if the equipment used for refacing the seats has a valve guide pilot.

The valve seat width after refacing should be a liberal 1/16" for intake seats but not more than 3/32" in any case. The width of exhaust seats should be 3/64" to a liberal 1/16".

A simple check can be made to prove the fit of the valve in the valve seat by spreading a thin film of Prussian Blue on the valve face and then inserting the valve in the valve seat. With hand pressure, rotate the valve ¼ turn, remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indicate an inaccurate valve and valve seat refacing operation.

EXHAUST VALVE SEAT INSERTS—Since these inserts are too hard to reface by ordinary valve grinding methods, a high speed grinder, Fig. 7, or special lapping equipment should be used to perform this operation. When using this equipment, be sure valve guides are clean and the valve guide pilot is a snug fit in order to assure a concentric finish. Finished seats should be checked with a dial indicator and runout should not exceed .001".

To remove an insert (if a suitable puller is not available) drill two holes at opposite sides of the insert, but not all the way through. Then cut through the undrilled portion with a sharp chisel and remove the two pieces.

To install a new insert, first remove all burrs and sharp edges from the seat recess. Then chill the new insert with dry ice to obtain maximum contraction and place it in the recess.

If a standard insert is too loose (less than .002" press fit) a .010" oversize seat

Fig. 6 Reaming valve guides. 1935-52 L-Head engines

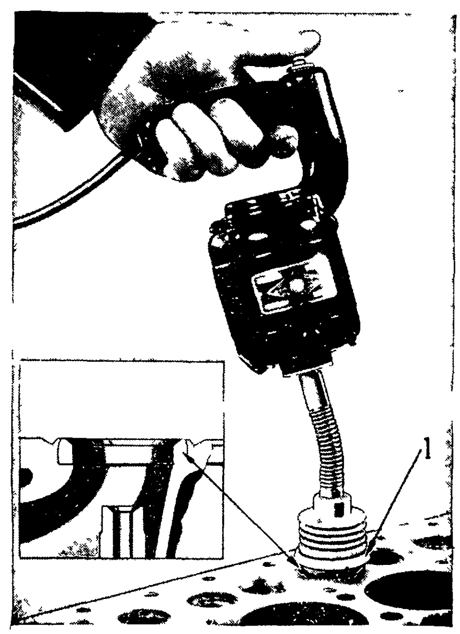


Fig. 7 High speed grinder for refinishing exhaust valve seat inserts. 1935-52

is available. Before it can be installed, however, the recess in the block must be machined to fit the seat.

V8 ENGINE VALVE SERVICE

1951-52—After removing the cylinder head (or heads) as outlined previously, disassemble as follows:

1. With a suitable valve spring compressor, compress the springs and remove the valve locks.
2. Remove the spring compressing tool and take out spring retainers and

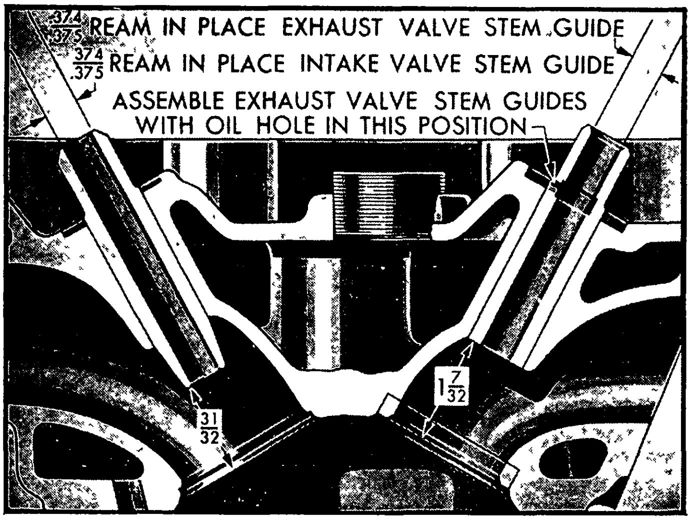


Fig. 9 Chrysler and De Soto V8 valve guide position. 1951-52

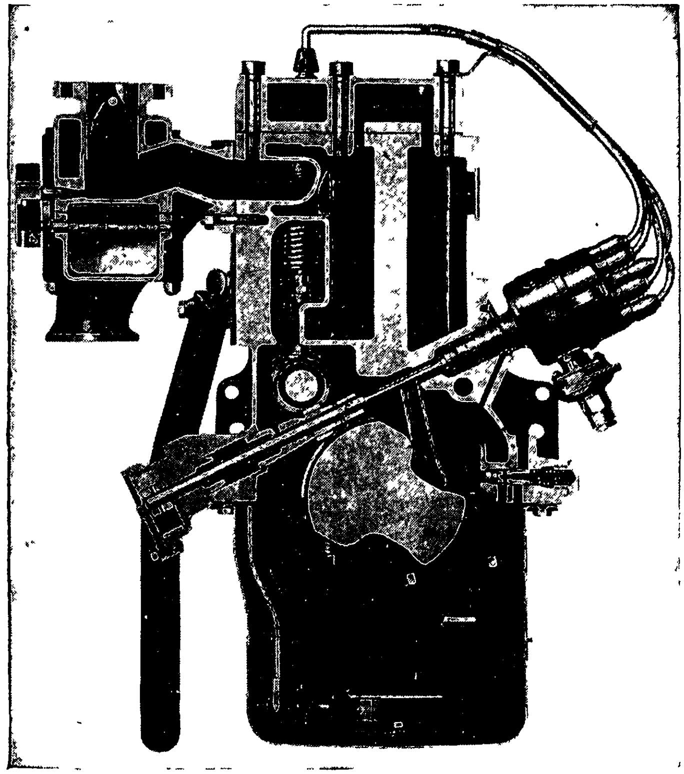


Fig. D Chrysler 1946-52 six engine. Typical of all Chrysler-built six s

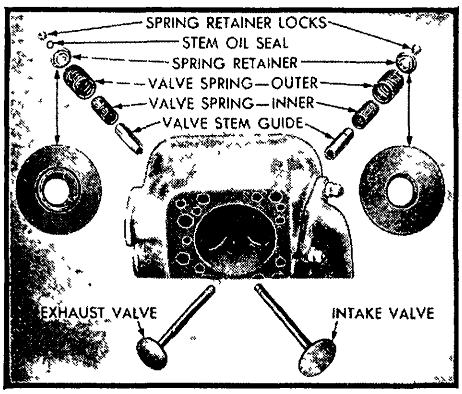


Fig. 8 Chrysler and De Soto V8 valv details. 1951-52

springs. It should be noted for reassembling purposes that the intake spring retainers differ slightly from the exhaust spring retainers and that thin gaskets are used on the intake valves under the keepers, Fig. 8.

3. Check the keeper grooves in the valve spring for burrs. Remove burrs with a file before removing the valves. This will prevent scoring of valve guides.

INSPECTION—

1. Remove all carbon from valves with a fine brass wire brush.
2. Inspect each valve and discard any that are found to be cracked, warped or burned.
3. Measure the stem of each valve in several places with a micrometer. Intake valves should measure .372-373"; exhaust valves .371-372". If wear exceeds .002", replace the valve.
4. Remove carbon and varnish deposits from interior of valve guides.
5. After all traces of carbon and varnish have been removed, check clearance between valve stem and guide, using a dial indicator. Special sleeves are available which are used on the valve stems to keep the valves raised off their seats when placed back in the cylinder head.
6. Attach a dial indicator to the cylinder head so that the indicator stem will contact the edge of the valve head. When the side movement of the valve is checked, the dial indicator movement must not exceed .008" on intake valves and .009" on exhaust valves. These dimensions are the maximum allowable; otherwise, replacement of valve guides is recommended.

VALVE GUIDES, REPLACE—Remove the old guides by driving them out through the top of the cylinder head. Drive the new guides in place by driving them up through the valve port opening. To determine how far the guides should be driven in, refer to Fig. 9.

When installing exhaust valve guides, make certain that the oil holes in the top of the guides are facing up, Fig. 9.

After valve guides are properly installed, ream each guide so the inside diameter measures .374-375", as shown in Fig. 9.

EXHAUST VALVE SEAT INSERTS—Refer to this item under *Valve Service, L-Head Engines.*

VALVE SPRINGS—Valve springs should be checked by measuring their free length. The uniformity should not vary more than $\frac{1}{16}$". The outer spring should measure $2\frac{1}{32}$"; inner spring $1\frac{29}{32}$".

Each spring also should be checked for squareness. This can be done with a steel square and surface plate. Stand each spring and the square on end on the surface plate and slide the spring up to the straight edge of the square. Then gradually revolve the spring, while at the same time noticing the space between the top coil of the spring and the square. This space should not exceed $\frac{1}{16}$"; if more, replace the spring.

When reassembling valve springs, make certain that the closed coils are toward the cylinder head.

If valves and seats are reground, check the installed height of the valve springs. If the height is $1\frac{3}{4}$" or more, install a $\frac{1}{16}$" spacer (Part No. 1400482) in the head counterbore to bring the spring height back to the nominal $1\frac{11}{16}$". If valve spring loads are not maintained, hydraulic lifter pump up will restrict engine speed and cause valve burning.

VALVES & SEATS, REFACE—Refer to this item under *Valve Service, L-Head Engines.*

VALVE OPERATING CLEARANCE—When valves and seats are reground, the position of the valve in the head is changed so as to shorten the operating length of the hydraulic lifter. This means that the plunger is operating closer to its bottomed position, and less clearance is available for thermal expansion of the valve train during high speed driving.

Design of plunger travel includes a safety factor for normal wear and toughening up of valve seats. However, if face and seat grinding is carried to the point where the valve position is changed $\frac{1}{32}$" or more from its factory installed position, the dimension from the valve spring seat in the head to the valve tip should be checked with Gauge No. C-3061.

The end of the cylindrical gauge and the bottom of the slotted area represent the maximum and minimum allowable

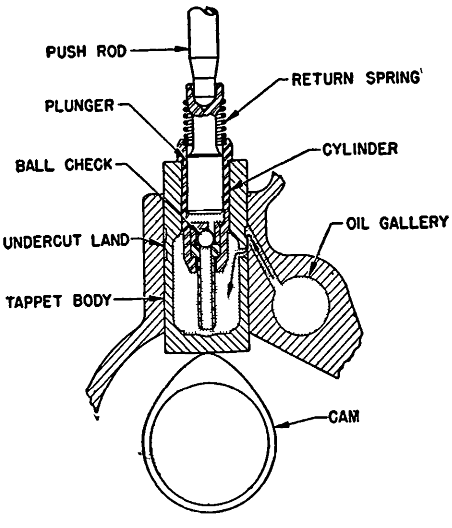


Fig. 10 Chrysler and De Soto V8 hydraulic valv lifter. 1951-52

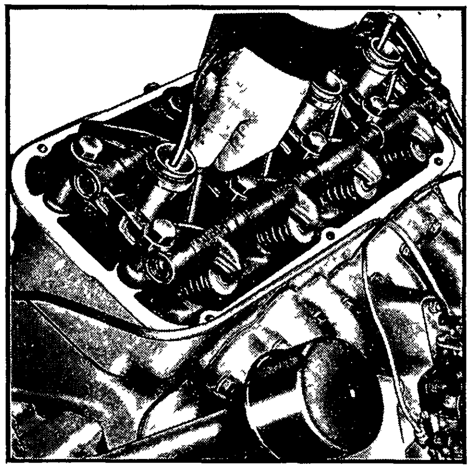


Fig. 11 Chrysler and De Soto V8, 1951-52. Checking for noisy valve lifter by feeling rocker arm

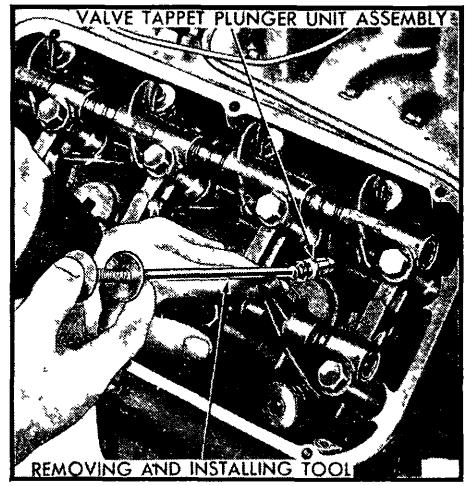


Fig. 14 Chrysler and De S t V8, 1951-52. Removing valve lifter with special t ol

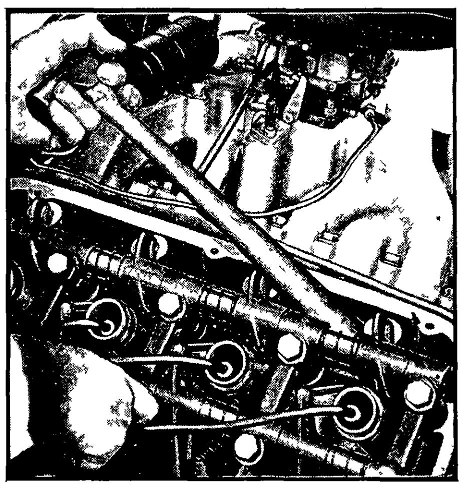


Fig. 12 Chrysler and De Soto V8, 1951-52. Applying pressure against side of valve spring to determine if noise is caused by worn valve guides or cocked valve springs

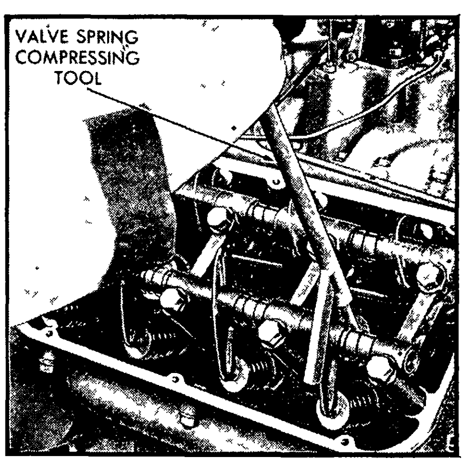


Fig. 13 Chrysl r and D S t V8, 1951-52. C mpr ssing valve spring t r m v push r d

extension of the valve stem tip beyond the spring seat. If the tip exceeds the maximum, grind the tip to approach, but not go below, the minimum allowable on the gauge.

HYDRAULIC VALVE LIFTERS

V8 ENGINES, 1951-52 — Fig. 10 shows the design of the valve lifter used in these engines. Detailed service is contained in the *Hydraulic Valve Lifters* chapter.

Before disassembling any part of the engine to check for valve lifter noise, check the oil pressure at the gauge and the oil level in the crankcase. Oil pressure should be between 40 and 65 lbs. at 1500 rpm. The oil level in the pan should never be above the "Full" mark on the dipstick nor below the "Add Oil" mark. Either of these conditions could be responsible for noisy valve lifters. If these conditions are not responsible for the noise, proceed as follows:

Remove the cylinder head covers and reinstall the spark plug wires. Run the engine at idle and feel each rocker arm as shown in Fig. 11 to determine which is noisy. It should be remembered, however, that worn valve guides or cocked valve springs are sometimes mistaken for noisy valve lifters. If such is the case, the noise will probably be dampened by applying side thrust on the valve spring as shown in Fig. 12. If the noise is not appreciably reduced, it can then be assumed that the noise is in the valve lifter.

VALVE LIFTER REMOVAL—On some early production 1951 engines it will be found necessary to remove the valve chamber cover in order to remove valve lifter units due to the smaller push rod hole in the cylinder head. On subsequent production engines, the push rod holes are enlarged, making it necessary only to remove the cylinder head cover. To remove a lifter, proceed as follows:

1. Install valve spring compressing tool, Fig. 13, over rocker arm so that heel of tool rests on valve stem side.
2. Make sure valve is seated and lifter body is resting on low point of camshaft lobe.
3. Using handle of tool for leverage, compress valve springs enough to raise rocker arm above push rod. While holding it in this position, slide rocker arm to one side.
4. Insert tool shown in Fig. 14 over push rod and withdraw push rod and plunger unit, being careful not to pull lifter body from its bore. Should it become necessary to remove the lifter body, refer to *Valve Lifter Cover, Remove.*

VALVE LIFTER, INSTALL—Using the tool shown in Fig. 14, insert push rod and plunger unit down through push rod hole and into lifter body. Make certain that the push rod is properly positioned in the valve lifter plunger cap. Position the rocker arm so that it is partially seated on the valve stem. Compress the valve stem and springs until the rocker arm can slide into position over the push rod.

VALVE LIFTER COVER, REMOVE—

1. Drain cooling system.
2. Remove carburetor air cleaner.
3. Remove generator.
4. Disconnect fuel, vacuum and water lines at carburetor.
5. Disconnect carburetor kickdown switch and dashpot wire.
6. Disconnect accelerator linkage at carburetor.
7. Remove heat indicator bulb, and disconnect coil wires.
8. Disconnect vacuum booster brake pipe (if equipped).
9. Disconnect heater hose, water outlet and water by-pass hoses.
10. Remove capscrews holding intake manifold to cylinder head. Use great care when removing the intake manifold to prevent damaging manifold heat tube assembly. This tube goes into the heat by-pass port in the right-hand cylinder head. When removing the manifold tilt it to the right so the heat tube can be pulled straight out of the by-pass port opening.
11. Remove valve lifter cover breather pipe.
12. Lift off cover and baffle assembly.
13. When cover is reinstalled, tighten manifold capscrews to a torque of 25-30 lbs. ft.

MECHANICAL VALVE LIFTERS

1935-52 L-HEAD ENGINES — Since these lifters are of the mushroom type operating in guide holes bored in the cylinder block, it is necessary to remove the camshaft in order to remove the lifters.

Follow instructions for removing the camshaft. Then remove the oil pan and take the lifters out through the bottom of the engine.

Lifters are furnished in oversizes of .001, .008, .030 and .060". When reaming the lifter guides for oversize lifters, the cylinder head and valves will have to be removed so that the reamer pilot can be inserted through the valve stem guide hole.

TIMING CHAIN COVER V8 ENGINES

1951-52—After draining the cooling system, remove the cover as follows:

1. Remove water hoses.
2. Remove generator adjusting bracket.
3. Remove water pump.
4. Remove vibration damper retainer capscrew and washer.
5. Remove two of the vibration damper pulley bolts and install Puller C-355 or its equivalent. Then pull off crankshaft pulley and damper as a unit.
6. Remove fan belt dust seal.
7. Remove vibration damper hub key from crankshaft.
8. Remove left engine bank exhaust pipe.
9. Remove fuel pump.
10. Remove oil level dipstick.
11. Remove starting motor.
12. Remove oil pan.
13. Remove nine chain case cover-to-engine block capscrews, including the one in the center of the water pump opening.
14. Drive the cover off the two dowel pins with a fiber mallet or its equivalent.

COVER OIL SEAL—Drive the old oil seal out from the front of the case, using Driver C-3050 or its equivalent.

Place the new seal on the chain case cover with the projecting flange facing the inside of the cover. Then drive the new seal in place with installing tool C-3051 or its equivalent.

CHAIN CASE COVER, INSTALL—Replacing the cover is largely the reverse of the removal procedure. Make certain that the surfaces of the cover and cylinder block are clean. Then install a new gasket. Be sure the crankshaft oil slinger is installed with the flange end pointing toward the seal.

When installed, tighten the cover capscrews to 30-35 lbs. ft. torque. Tighten the vibration damper retaining nut to 130-140 lbs. ft. torque.

Adjust generator belt so that ¾" slack can be obtained when pressure is applied to the belt between pulleys. The fan belt should have ½" slack when pressure is applied between pulleys.

L-HEAD ENGINE CHAIN CASE COVER

1935-52—When installing the chain case cover on these engines, place a new gasket in the cover, then drive the oil seal

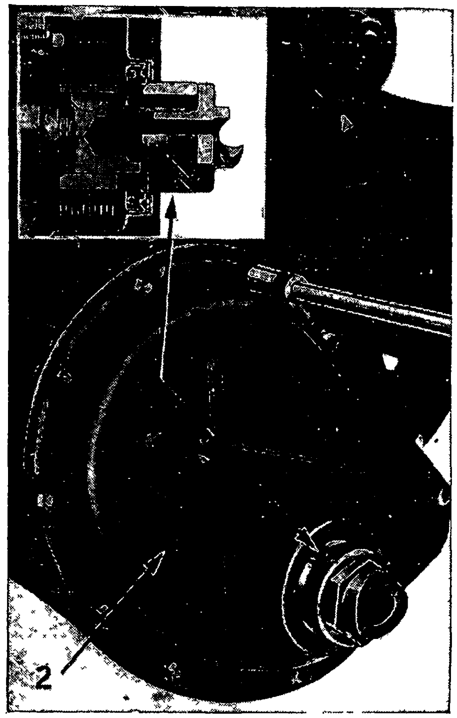


Fig. 15 1935-52 L-Head engines. Showing special centering tool for chain case cover oil seal

in position, using a drift or a flat piece of metal slightly larger than the seal to assure a tight, even contact between the seal and its seat.

When fastening the cover, care must be used to center the seal on the crankshaft before tightening the cover screws. A special centering tool, Fig. 15, is available to make the installation. When using this tool, tighten the screws only enough to hold the cover in place. Then insert the tool, holding it by the crankshaft starting jaw, tightening the jaw nut only finger tight. As the cover screws are being tightened and the gasket is being compressed, tighten the jaw nut, maintaining a slight tension between the centering tool and the seal. Then remove the tool, install the starting jaw and tighten it to a minimum of 108 lbs. ft. torque.

V8 ENGINE TIMING CHAIN

1951-52—After removing the chain case cover as outlined previously, remove the camshaft sprocket hub nut, fuel pump eccentric and dowel assembly. The camshaft sprocket and timing chain may now be taken off.

To install, rotate the crankshaft until the zero mark on the crankshaft sprocket is exactly in line with the center of the camshaft. Temporarily install the camshaft sprocket (less chain) and line up the hub dowel pin hole with the sprocket dowel pin hole, while at the same time positioning the camshaft sprocket zero mark exactly in line with the center of the crankshaft. A straight edge should be used to check the accuracy of this alignment.

Remove the camshaft sprocket again and position it in the timing chain. Then place the chain on the crankshaft

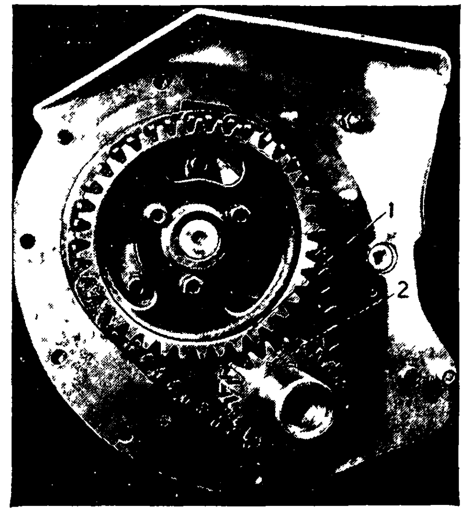


Fig. 16 1935-52 L-Head engines. Marks on sprock ts (1 and 2) should line up as sh wn for correct valv timing

sprocket. Install the camshaft sprocket, being sure both zero timing marks are facing each other and in line with the center of both the camshaft and crankshaft.

L-HEAD ENGINE TIMING CHAIN

1935-52—For correct valve timing, the timing chain and sprockets should be assembled so that the marks on the sprockets line up as shown in Fig. 16. Follow the general procedure outlined for V8 engines.

V8 ENGINE CAMSHAFT

1951-52—To remove the camshaft, remove the valve lifter cover as outlined previously, then proceed as follows:

1. Remove cylinder head covers and push rods.
2. Remove valve lifters, arranging them in a board with numbered holes so they may be reinstalled in their original bores.
3. Remove ignition distributor.
4. Remove chain case cover, chain and camshaft sprocket.
5. Remove camshaft thrust plate screws.
6. Remove distributor and oil pump drive gear (tool C-3021 is available for this operation).
7. Pull out the camshaft, using care not to damage the camshaft bearings with the cam lobes.
8. Remove camshaft hub and thrust plate.
9. If camshaft bearings are to be replaced at this time, it is recommended that the engine be removed and the crankshaft taken out in order that any chips or foreign material may be removed from the oil passages.
10. Drive out the camshaft rear welch plug.
11. Camshaft bearing tool C-3034 is available for removing camshaft bearings. Install the proper size adapters and horseshoe of the tool in back of each bearing to be removed and drive the bearing out.

INSTALLATION—Install the new camshaft bearings by reversing the tool adapter and driving each bearing in place. It should be noted when installing the bearings that the oil hole must be exactly in line with the main bearing oil line.

Install a new camshaft rear welch plug. Install the thrust plate on the camshaft and press on the hub and key. The hub is properly installed when a feeler gauge .002 to .006" can be inserted between the hub and thrust plate.

Complete the installation in the reverse order of removal.

L-HEAD ENGINE CAMSHAFT

1935-52—The general procedure for removing the camshaft is outlined below. In addition, on some earlier models it may be necessary to take off the front end sheet metal in order to provide space to extract the camshaft from the engine. This can be determined by measuring the length of the engine and comparing it with the space available between the chain case and front grille.

1. Remove radiator, cylinder head, fuel pump, oil pump and valve cover plates.
2. Support front of engine and remove front support, chain case cover, chain and camshaft sprocket.
3. Raise valves and hold them up by inserting two wooden wedges under each valve head, Fig. 17. (This operation is not necessary if valves are to be ground as the valves will have to be removed anyway.)
4. Raise valve lifters and hold them up with wire, spring type clothes pins, Fig. 17, or other suitable means.
5. Rotate the camshaft as it is being withdrawn from the engine so that the cam lobes will clear successive obstacles.
6. On 1941-50 Chrysler Eights, it is necessary to remove the two oil feeder lines in the valve chambers, and to have No. 4 piston on the top of its stroke so that the camshaft will clear the crankshaft throws and counterbalances.

PISTONS & RODS, REMOVE

1935-52 ALL ENGINES—After removing the cylinder head (or heads) and oil pan, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove connecting rod caps and push the pistons and rods out of the cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure rods and pistons are properly numbered so they can be reinstalled in their proper cylinders. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1951-52 V8 ENGINES—When installing the piston and rod assembly, first stagger the ring gaps at 120-degree angles to each other. The two compression rings are marked "Top" and should be installed with this word toward the top of the piston. The oil ring can be installed in either direction.

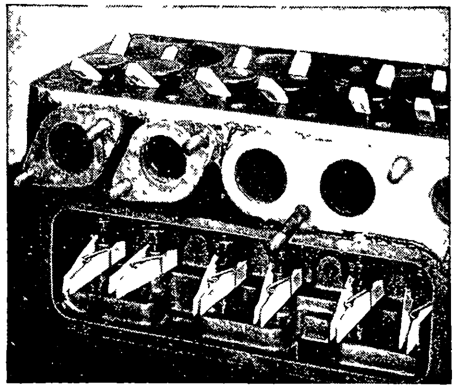


Fig. 17 1935-52 L-Head engines. Method of holding up valves and tappets for camshaft removal

Insert the piston and rod assembly in the cylinder with the letter "F" on the piston toward the front of the engine.

1935-52 L-HEAD ENGINES—When assembling the piston to the connecting rod, assemble aluminum pistons so that the slotted side is opposite the oil hole in the connecting rod.

Install the piston and rod assembly in the cylinder so that the oil hole in the connecting rod is toward the valve side of the engine.

PISTONS

1935-52 ALL ENGINES—Standard size pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages.

Service pistons are also furnished in .010, .020, .030, .040, .050, and .060".

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin. Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

NOTE—Due to the necessity of maintaining piston assembly balance in V8 engines, all pistons are machined to the same weight in grams, which is of the utmost importance in this type engine. Only finished pistons are available for service.

It is very important that refinished cylinder bores are trued up to have not more than .0005" out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fibre brush.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore. Therefore, the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees between the temperature of parts is sufficient to produce a variation of .0005".

With the piston pin and rings removed and cylinder wall and piston dry and clean, insert the piston upside down in the cylinder bore. The piston is properly fitted when it has a slight drag in the bore, but still is free enough to travel slowly through the bore of its own weight.

PISTON PINS

1935-52 ALL ENGINES—Piston pins are available in oversizes of .003 and .008". Fit the piston pin in both the piston and rod with a thumb press fit with parts at normal room temperature (about 70°). Do not drive the pin in place as to do so will cause distortion of the piston skirt.

PISTON RINGS

1935-52 ALL ENGINES—Piston rings are available in the following sizes: standard to .009" oversize, .010 to .019" oversize, .020 to .029" oversize, .030 to .039" oversize, .040 to .049" oversize, and .050 to .060" oversize.

When new rings are to be installed without reboring cylinders, the glazed cylinder wall should be slightly dulled, but without increasing the bore diameter. This is done with a "Glazebuster" or with a hone equipped with the finest grade of stones.

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. The latter operation must be measured with the ring about two inches from the bottom of the cylinder bore to which it is fitted. Cylinder bores and piston grooves must be clean, dry and free from carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston and Ring Data* chart for ring groove clearances and end gap clearances.

CONNECTING ROD BEARINGS

1935-52 L-HEAD ENGINES—Connecting rod bearings consist of two half shells, the upper half having an oil spray hole which communicates with the oil hole in the rod.

When the bearings are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the bearings will

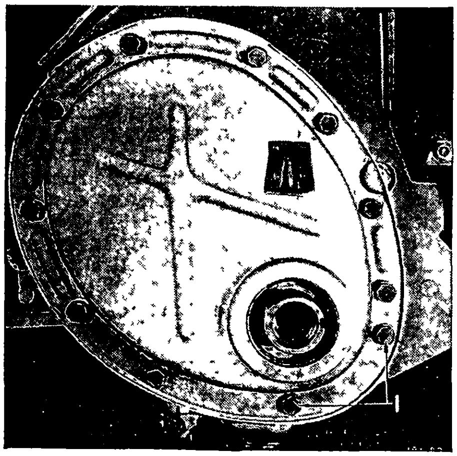


Fig. 18. 1940-52 Sixes. Tw scr ws (1) must be removed before front main bearing cap can be taken off

be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the bearings must never be filed flush with the parting surface of the rod and cap for the above reasons.*

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the rod or cap be filed in an attempt to adjust bearing clearance.

Service bearings are furnished in standard size and several undersizes, including undersizes for reground crankshafts.

The clearance of connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber, and full instructions for its use are furnished with the envelope in which it is contained.

Lacking Plastigage, however, clearance may be checked with a .002" test shim ¾" square. Place the test shim between the bearing and shaft journal. Install the cap, tightening the nuts to the recommended torque which is listed in the *Engine Bearing Data* chart. A locked bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed. Do not overlook removing the test shim.

1951-52 V8 ENGINES—The connecting rods, at the bearing inserts, are chamfered on one side. This chamfer must be toward the crankshaft fillet. This means that when the connecting rods are assembled to the pistons, the assemblies of one engine bank are not interchangeable with those of the other bank.

The "V" slot across one bolt hole of each bearing cap is an oil passage for lubricating the opposite cylinder wall and piston pins. Therefore, when installing the bearing cap, always make certain that the "V" slot oil passage is toward the top of the engine.

Connecting rod bearing clearance is checked in the same manner outlined above for L-head engines.

CRANKSHAFT & MAIN BEARINGS

1951-52 V8 ENGINES—The crankshaft is supported by five main bearings, each of which contain replaceable upper and lower bearing halves. The halves of Nos. 1, 2 and 4 bearings are alike and interchangeable with one another. No. 3 bearing controls the crankshaft thrust and is not interchangeable with the others; the upper and lower halves, however, are interchangeable. No. 5 bearing halves are not interchangeable.

Main bearings may be removed and installed without removing the engine. The bearings are made to size and do not require line reaming or adjustment. However, when installing a new bearing upper half, slightly chamfer the sharp edge on the plain side.

When it is necessary to install new bearing shells, it is advisable to measure the shaft journals with a micrometer for being out-of-round. If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft. Undersize bearings are available for reground crankshafts.

Before installing the new bearings, use a suitable brush to clean out the oil passages in both the shaft and crankcase. If possible, blow out the holes with compressed air. Be sure the journals are not nicked or scored and that all parts are thoroughly clean.

After installing the bearings, check the running clearance to be sure it is standard (see *Engine Bearing Data* chart). Use Plastigage or a .002" test shim about ¾" square. Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque. The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct. Do not overlook removing the test shim.

1935-52 L-HEAD ENGINES—When necessary to install a complete set of main bearings, be guided by the following:

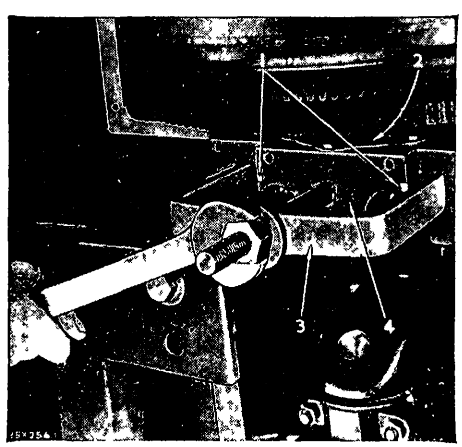


Fig. 19 1935-50 Chrysler Eights. Using pull r t remov rear main bearing cap. Same t l sh uld b us d n fr nt main b aring cap. 1. Cap oil s als. 2. Bearing il seal. 3. Pull r. 4. Bearing cap

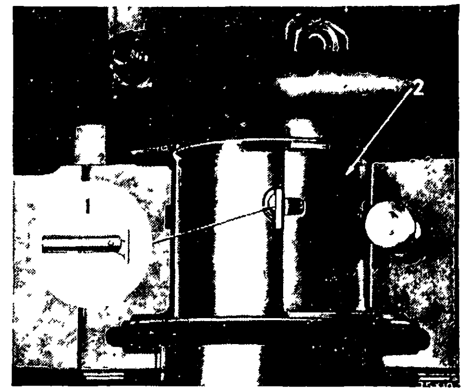


Fig. 20 1935-52. Using special tool (1) in oil hole t turn upper main bearing in plac

On 1935-38 De Soto, 1935-37 Chrysler Sixes and 1935-38 Chrysler Eights, it is necessary to remove the engine from the chassis. On all other models, it is not necessary to remove the engine.

Before the front main bearing cap can be removed, it will be necessary to unfasten the oil pan front end seal plate from the chain case cover.

On 1941-50 Chrysler Eights, the two lower screws in the chain case cover fasten directly to the front main bearing cap.

On models prior to 1940, the chain case cover will have to be taken off to get at the screw which fastens to the seal plate.

On 1940-52 Sixes, merely remove the two screws indicated in Fig. 18 which will release the seal plate.

On 1935-50 Chrysler Eights, the front and rear main bearing caps are sealed in position but can be removed by using the puller shown in Fig. 19.

To install new main bearings on all engines, remove the cap and take out the worn lower shell. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out. The tool shown in Fig. 20 may also be used for this operation.

Place the new upper shell on the crankshaft journal, with the locating lug in the correct position, and rotate the shaft to turn the shell in place, using the flattened cotter pin or the tool shown in Fig. 20. Install the lower shell in the cap and install the cap, tightening them to the recommended tension as given in the *Engine Bearing Data* chart.

Check the clearance of main bearings in the same manner outlined for V8 engines.

REPLACEMENT CAPS — In case of warpage or other damage to main bearring caps, replacement caps are available which have stud holes $\frac{1}{64}$" larger than the original caps and $\frac{1}{16}$" shorter. This permits shimming or filing to adjust for variations between original and replacement caps. Never file, dress down or shim original bearing caps.

CRANKSHAFT END THRUST

1935-52 ALL ENGINES—End thrust of the crankshaft is taken on the flanges of the rear main bearing on all L-head

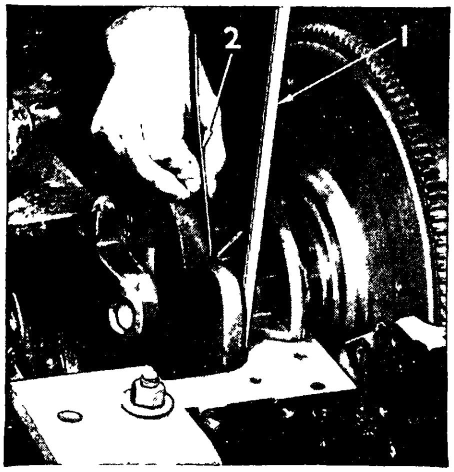


Fig. 21 1935-52 L-Head engines. Ch cking crankshaft end play with pry bar (1) and feeler gauge (2)

engines, and by the flanges on No. 3 main bearing on V8 engines.

To check the amount of end play in the crankshaft, measure the space between the thrust bearing flange and the side of the adjacent thrust shoulder, Fig. 21. If the clearance is insufficient (see *Engine Bearing Data* chart) the bearing flanges may be dressed down. If too much clearance is present, install a new thrust bearing.

REAR MAIN BEARING OIL SEAL

1951-52 V8 ENGINES—A braided asbestos type oil seal is pressed into the upper and lower grooves behind the rear main bearing. Directly in front of this seal is an oil slinger which deflects the oil back into the oil pan. Should the lower half of the seal become damaged during servicing, replacement can be made as follows:

With the bearing cap and lower bearing half removed, install a new seal so that both ends of the seal protrude above the cap. Tap the seal down into position or roll it snugly in its groove with a smooth rounded tool. Then cut off the protruding ends of the seal with a sharp knife or razor blade.

Whenever the crankshaft is removed, it is advisable to replace both the upper and lower halves of the seal in the same manner.

1935-42 CHRYSLER & DE SOTO; 1935-52 DODGE & PLYMOUTH—Locate the seals and gaskets carefully before the cap is installed, Fig 22. To replace the upper seal it is necessary to remove the flywheel.

On 1939-42 Chrysler Eights, the front and rear main bearing caps have square cut grooves in their sides in which rubber seals are inserted. When installing these seals, use a prick punch at an angle to upset the bottom of the groove in the cap slightly so that the rubber seal will not slide out of place while the cap is being installed.

1946-52 CHRYSLER L-HEAD & DE SOTO—These models are equipped with a one-piece rubber seal for the rear main bearing, which is installed as follows:

1. Remove engine oil pan.
2. Remove lower clutch housing attaching screws.
3. Remove nuts from transmission-to-clutch housing lower studs.
4. Slide clutch pan forward, remove studs and lay pan aside.
5. Loosen all main bearing capscrews three turns.
6. Remove rear main bearing cap. A puller is needed on Chrysler L-Head Eights.
7. Slide old oil seal out of its slot.
8. Install new seal with its wiping edge forward as follows:
9. Apply soap or cup grease to one end of the seal, being careful not to get any of this lubricant between the ends so the split can close and seal properly when installed.
10. Start one end of the seal in the slot and push it in until end is near top of bearing.
11. Start other end and work into place.
12. Work seal into position so that joint or split comes together near the top.
13. Wipe a little more lubricant around the lip of the seal so that bearing flange will slip into place.
14. On Chrysler L-Head Eights, front and rear bearing caps have square cut grooves in their sides in which rubber gaskets are inserted. Care must be taken to keep these seals in position while cap is being installed.

ENGINE OILING

OIL PAN REMOVAL

1951-52 V8 ENGINES—To remove the pan, take out the oil level dipstick and drain the oil. Take off the starting motor and exhaust cross-over pipe. Remove the oil pan attaching screws and drop the pan.

When the pan is installed, tighten the attaching screws 12-17 lbs. ft. torque.

1935-52 L-HEAD ENGINES—To remove the pan, take off the clutch housing pan to prevent damaging the oil pan gaskets on the housing. Remove the oil pan screws, drop it on the tie rod, lift up on the oil strainer to clear the baffle inside the pan and lower the pan.

NOTE—To remove the oil pan front screws on Chrysler C8, C-14, C15, C16, and De Soto 1937 models, crank the engine to bring No. 1 piston in the middle of the cylinder bore. Then use a long-handled speed wrench with a universal socket, together with a 5-inch extension and a ½-inch ferret type socket in combination to remove the screws. When installing the pan, start the screws by hand and use the above combination of tools to tighten them in place.

CAUTION—When installing the pan on all six-cylinder engines, position the end gaskets so they protrude ⅛ to ¼ inch above the oil pan, Fig. 23. Do not cut off these ends as they will compress into place when the oil pan is installed.

NOTE—When installing the oil strainer on 1941-52 Plymouths, position the elbow so that the strainer will be located as shown in Fig. 24. Proper installation

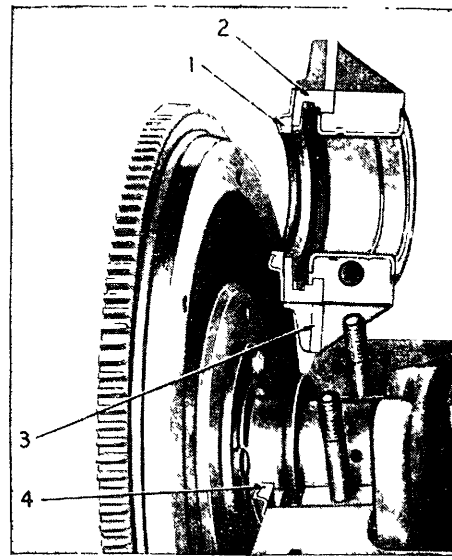


Fig. 22 1935-42 Chrysl r and De Soto and 1935-52 D dge and Plymouth. 1 and 4. R ar main bearing oil seal. 2 and 3. Gaskets

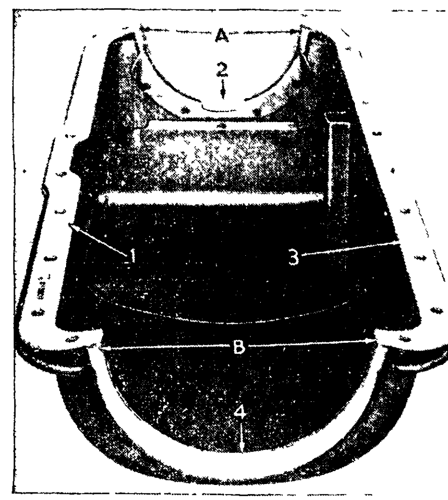


Fig. 23 1935-52 Six s. Oil pan gaskets (1 and 4). A and B show gasket lips

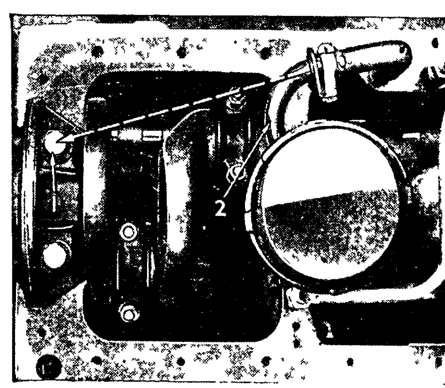


Fig. 24 1941-52 Plymouth. Install il strain r as sh wn. 1. Rear main b aring cap b lt. 2. Oil strainer elb w

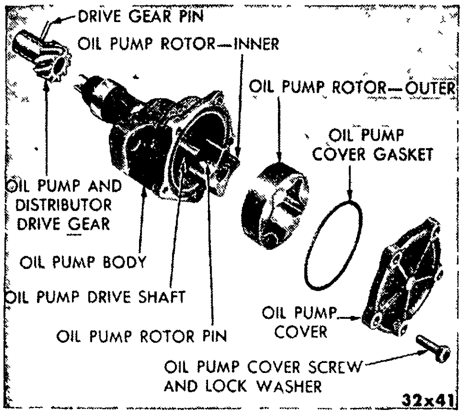


Fig. 25 1941-52. R t r type oil pump

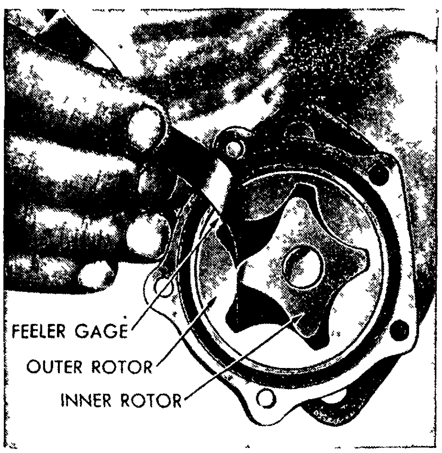


Fig. 26 1941-52. Measuring clear- ance b twe n inner and outer rotors

is important to prevent interference between the strainer and the oil pan baffles.

OIL PUMP, REMOVE & INSTALL

1951-52 V8 ENGINES—The oil pump is easily removed after dropping the oil pan by removing the two screws which fasten the pump to the rear main bearing cap.

1935-52 L-HEAD ENGINES—Before removing the oil pump, rotate the crankshaft and make sure the DC mark on the vibration damper or crankshaft pulley lines up with the pointer on the chain case cover and the distributor rotor is ready to fire No. 1 spark plug. After the pump is removed, do not bump the starter or let the engine turn as this will change the ignition timing.

Use a new gasket when installing the pump. If the engine crankshaft was accidentally moved while the pump was off, rotate the engine until No. 1 cylinder is in firing position. Then set the distributor rotor in No. 1 firing position and install oil pump, being sure rotor remains in correct position.

OIL PUMP, OVERHAUL

1941-52 ROTOR TYPE—To disassemble the pump, Fig. 25, remove cover and gasket. Hold hand over cover opening and,

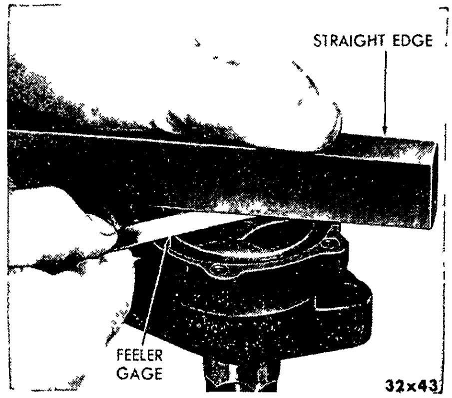


Fig. 27 1941-52 Rotor Pump. Measuring depth of oil pump body

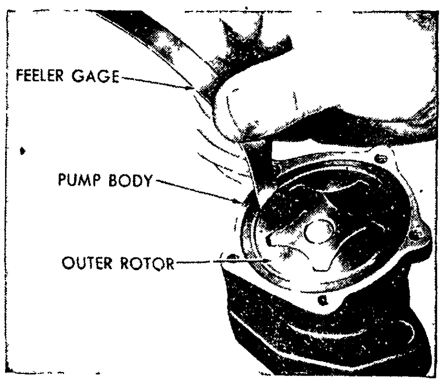


Fig. 28 1941-52. Measuring clearance between outer rotor and oil pump body

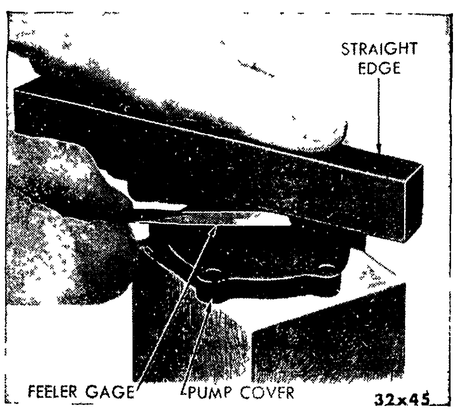


Fig. 29 1941-52. Checking oil pump cover

with pump upside down, turn shaft until outer rotor slips out. Drive out the straight pin securing the drive gear to the shaft. Press the shaft out of the gear and slide the shaft and inner rotor out of the body. Wash and dry all parts.

INSPECTION — Match the rotors together as shown in Fig. 26 and measure the clearance at the point illustrated. It should be .010" or less; if more, replace both rotors.

Place a straightedge across the pump body between the screw holes, Fig. 27, and measure the clearance between the

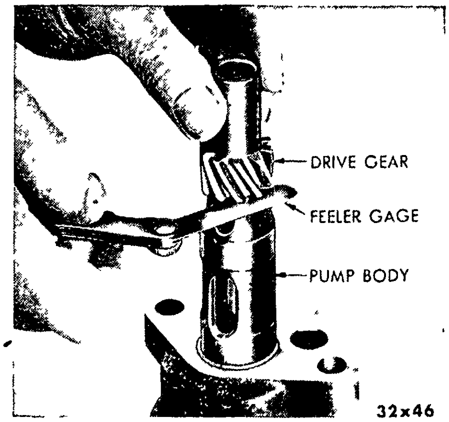


Fig. 30 1941-52. Measuring oil pump drive shaft end play

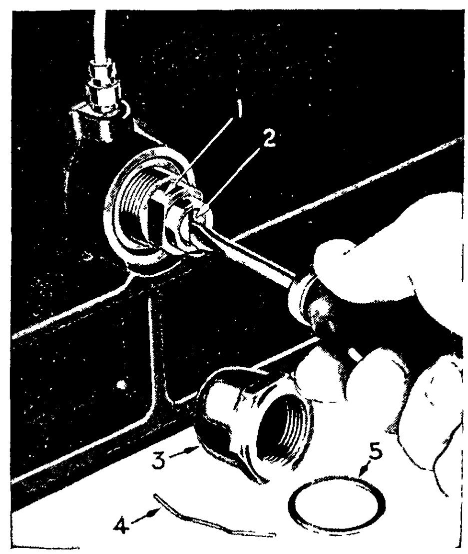


Fig. 31 1935-50 Chrysler Eights. Oil pressure relief valv adjustm nt. 1. Body. 2. Spring r tain r. 3. Cap. 4. Lock wire. 5. Gasket

top of the rotors and straightedge. This measurement should be .004" or less.

Press the outer rotor to one side and measure the clearance between the pump body and rotor, Fig. 28. The measurement should be .008" or less.

Should either of the above measurements be more than specified, replace the pump body.

Place the straightedge across the cover, Fig. 29, and try to insert a .001" feeler gauge between the cover and straightedge. If the feeler can be inserted or if the cover is scratched or grooved, install a new cover.

PUMP ASSEMBLY—When installing a new rotor on the drive shaft, press the rotor on until the end of the shaft is flush with the face of the gear. Install a new pin. Slide the shaft and rotor into the pump body.

Press the drive gear on the shaft until the shaft end play is from .003 to .010". Press the rotor down into the body and measure the clearance as shown in Fig. 30. Install the pin, peening over both

ends. If the pin holes do not line up, drill a new hole at right angles to the other hole and install the pin.

Slide the outer rotor in place in the body. Install a new cover gasket and tighten the screws evenly.

1935-42 GEAR PUMP — Remove the pump cover and idler gear. Drive out the pin and take off the upper drive gear. Then pull the shaft and lower drive gear out of the housing.

OIL PRESSURE REGULATOR

1951-52 V8 ENGINES—The oil pressure relief valve is built into the oil pump and is not adjustable.

1935-52 L-HEAD ENGINES—On all six-cylinder engines, oil pressure is controlled by a relief valve on the left side of the engine. Different colored springs are used in the relief valve. The standard spring is not painted. Springs lighter than standard are painted red. Springs heavier than standard are painted green. If the spring has to be changed, the same color spring should be installed.

On Chrysler L-head eight-cylinder engines, the oil pressure relief valve is adjustable by turning the adjusting screw, Fig. 31.

COOLING SYSTEM

RADIATOR CORE, REMOVE

Chrysler 1935-38—Remove water hose and fan blades. Unbolt core from shell and lift out carefully to clear water pump. On 1937-38 models, remove hood side panels.

Chrysler Six, 1939—Remove water hose, water pump, and hood side panels. Disconnect headlamp wires at junction block and push them through the radiator core flange. Remove radiator support screws and lift out core.

Chrysler Eight, 1939 — Remove hood, lower side panels, lower splash pan, front bumper and both front wheels. Unfasten the fenders from the grille shell, and the fender supports from the radiator supports. Take off the fan shroud. Disconnect the radiator shell from the radiator support. Spread the fenders and pull the shell forward. Remove radiator support bolts and lift out core.

Chrysler Six, 1940—Remove hood, fan blades and water hose. Unfasten the core from the support and lift it out.

Chrysler Eight, 1940—Remove the hood, carburetor air cleaner, fan belt, fan shroud, water pump and back plate, all hose and elbows including one on cylinder head. Remove the radiator drain cock so the core will clear the splash shield. Unclip the headlamp wires from the core. Unfasten the core from its support, tilt it forward, and lift it out.

Chrysler 1941-52—On 1941 Eights, it is necessary to take off the radiator and front fender unit to remove the core. On all other models, remove the core as follows:

Remove hood, radiator ornament, water pump and fan. Unclip headlamp

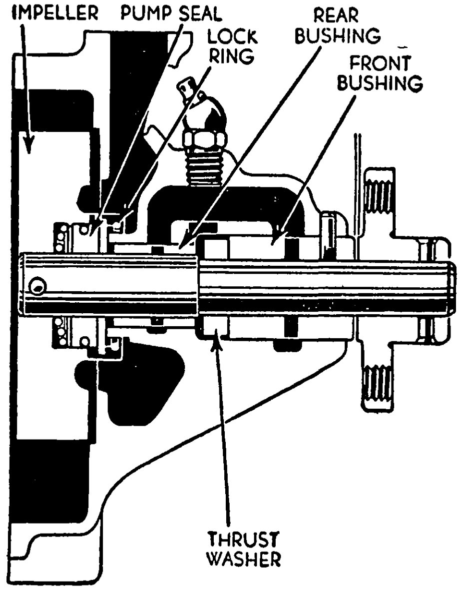


Fig. 32 1935-52 Sixes. Bushing type water pump

wires and move out of the way. Unfasten the core from its support and lift it up and out over the engine.

De Soto Airstream 1935-36 — Remove hood, radiator brace rods, water hose, fan blades, radiator core hold-down bolts, and all bolts holding core to shell. Lift core up and out over the engine.

De Soto Airflow 1935-36—Raise hood to wide open position. Remove water hose and radiator core tie rods. Unfasten radiator lower mountings and lift out core.

De Soto 1937-38—On 1937 models, raise hood. On 1938 remove hood and side panels. Take off fan pulley and hub, radiator tie rods and water hose. Unfasten core from its support and lift it out.

De Soto 1939—Remove hood, side panels, water hose and fan blades. Disconnect headlamp wires at junction block and push them through side flange of radiator core. Unfasten core from its support and lift it out.

De Soto 1940-52—Remove water hose and fan blades. Unfasten core from support and lift it out.

Dodge 1935-38 — Remove hood, brace rods, hood side panels (1938) fan blades and water hose. Unfasten core from its support and from radiator shell and lift the core out over the engine.

Dodge 1939—Remove hood, side panels, water hose, fan and pulley. Unfasten headlamp wires from junction block and push them through side flange of radiator core. Unfasten core from its support and lift it out.

Dodge 1940-52—Remove water hose and fan blades. Unfasten core from its support and lift it out.

Plymouth 1935-38—Remove hood, radiator brace rods, fan blades, water hose. Unfasten core from its mountings and lift it out.

Plymouth 1939—Remove hood, side panels, water hose, fan and pulley. Unfasten headlamp wires from junction block and push them through side flange of radiator core. Unfasten core from its mounting and lift it out.

Plymouth 1940—Remove hood and water pump. Disconnect engine water outlet hose. Bend back clips which hold headlamp wires to radiator core. Unfasten core from its support and lift it out.

Plymouth 1941—Disconnect water hose. Unclip headlamp wires and move them out of the way. Remove brackets at upper corners of radiator support, disconnect support from core and lift out core.

Plymouth 1942-52—Remove water hose. Unfasten core from its support and lift out core.

WATER PUMP, REMOVE

1951-52 V8 Engines—Drain cooling system. Remove fan and both belts. Remove belt pulley. Unfasten attaching screws and lift off pump.

Chrysler, De Soto, Dodge, Plymouth, 1935-38—(On Chrysler C17 and 1938 Plymouth, removal of radiator core is necessary.) Remove fan blades and bypass elbow from pump body. Unfasten pump from engine and lift out.

Chrysler Six, De Soto, Dodge, 1939-52—Remove fan blades and pulley and bypass elbow from pump body. Detach fan adjusting strap from generator and strap adjusting stud from cylinder block. Unfasten pump and lift out. (On 1939 Chrysler and De Soto, remove hood lower side panels.)

Chrysler Eight 1939—Remove hood lower side panels, fan shroud, fan blades and pulley, and by-pass elbow from

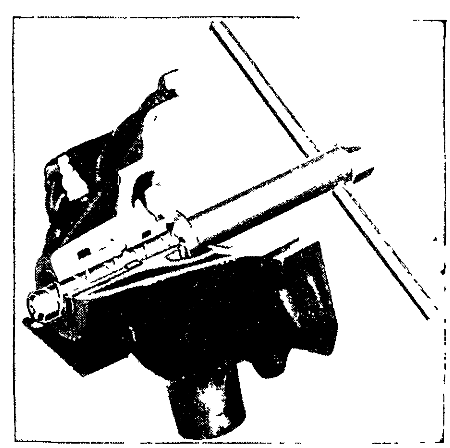


Fig. 33 Showing t l used f r lin - burnishing bushings and facing seal surfac of h using. 1935-52

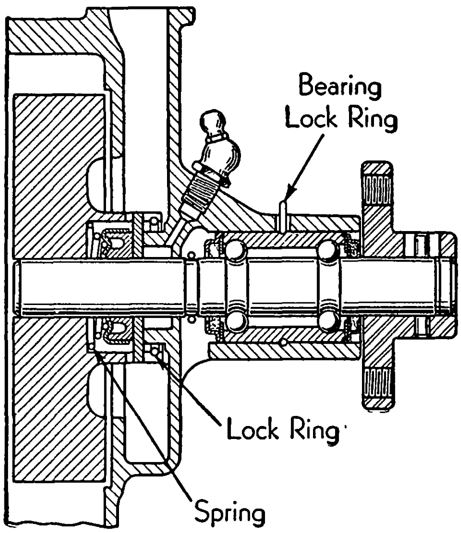


Fig. 34 1941-50 Chrysler Eights. Water pump

pump. Unfasten the pump from the back plate and lift it off.

Chrysler Eight 1940 — Remove fan belt and necessary hose and elbows. Loosen fan shroud. Disconnect pump from back plate. Remove nut from lower right side of pump and pull pump forward. Take out stud from which nut was removed and lift out pump, fan and shroud.

Chrysler Eight 1941-50—Remove fan belt and loosen fan shroud from radiator core. Disconnect necessary hose and elbows. Unfasten pump from back plate, take off fan belt adjusting strap and lift out the pump and fan.

Plymouth 1939—Remove hood lower side panels. Disconnect fan blades and push the pulley and belt from pump shaft. Remove radiator outlet hose and the by-pass elbow from the pump body. Take off the cylinder head water outlet elbow and hose. Disconnect pump from engine and lift it off.

Plymouth 1940—Remove fan belt and disconnect water pump hose. Unfasten the pump from the engine and push the pump against the radiator core. With stud pliers or a pipe wrench used on the studs between the pump and block, remove the studs and lift off the pump and fan blades.

To make installation easier, clean and oil the threads of the studs.

Plymouth 1941-52—Remove fan belt and disconnect water pump hose. Unfasten the pump from the engine and lift out the pump and fan blades.

WATER PUMP, OVERHAUL

1951-52 V8 ENGINES—The water pump shaft is mounted on two ball bearings, separated by a spacer. To disassemble:

1. Drive pin out of fan hub.
2. Pull off fan hub.
3. Remove bearing retainer.
4. Remove impeller and shaft assembly through rear of body.
5. Remove seal retainer washer lock ring, washer and seal.
6. Withdraw outer shaft bearing, spacer, inner shaft bearing and water thrower.

NOTE—The contacting surface of the seal is on the impeller hub face. For maximum sealing efficiency, check the distance between the shaft shoulder and the impeller hub face. This measurement has been established at 1⅛" but is, however, permitted to be increased to $1\frac{3}{16}$". Should the seal face be scored or damaged in any way, replace the impeller.

1935-52 BUSHING TYPE PUMP — To disassemble the pump, see Fig. 32 and proceed as follows:

Drive pin out of fan pulley hub and use a puller to pull hub off the shaft. Remove cover and pull impeller and shaft out of body. If either impeller or shaft is to be replaced, drive out the pin holding these parts together. Drive the front bushing pin into the shaft hole of the bushing to permit removal of the bushings. Pull the bushings from the body, pulling them out toward the front. Remove the seal, spring and retainer washers from the shaft.

If new bushings are to be installed, insert the thrust washer in the body with flat side facing out. Press the front bushing in with the oil groove on top and grooved end out. Press in the rear bushing, allowing $\frac{3}{32}$ inch clearance between the rear end of the bushing and the impeller housing. Drill and pin the front bushing. Remove any burrs inside the bushings and line burnish both bushings and reface the seal seat with the tool shown in Fig. 33. Then continue to assemble the pump as follows:

Install the impeller on the shaft and drill for a ⅛ inch impeller pin. Install the pin and peen over both ends. Assemble the seal thrust spring, seal retainer, seal and seat retainer washer with glazed surface against seal. Install the seal retainer lock ring.

Insert the shaft and press on the fan pulley hub, leaving .003 inch clearance between the bushing and hub. Drill the shaft (if a new one is being used) and install the retaining pin. If the old shaft is being used, position the hub on the shaft so that the shaft can be drilled 90 degrees from the old hole. Remove all traces of old gaskets and install new ones. Lubricate the pump and install on the engine.

Chrysler Eight 1938-50—To disassemble the pump, see Fig. 34 and proceed as follows: Drive out the pin and pull the pulley off the shaft. Remove the pump cover and pull off the impeller. Release the lock ring and take out the shaft. Remove the lock ring from the impeller hub and take out the seal parts.

When assembling, be sure the seal parts are installed as shown in Fig. 33. If a new shaft, impeller or fan pulley hub is being used, see that the outer face of the impeller and the front face of the fan hub are flush with the ends of the shaft. Shaft end play should be from .0025 to .0045 inch, measured with a feeler gauge between the pump body and fan pulley hub.

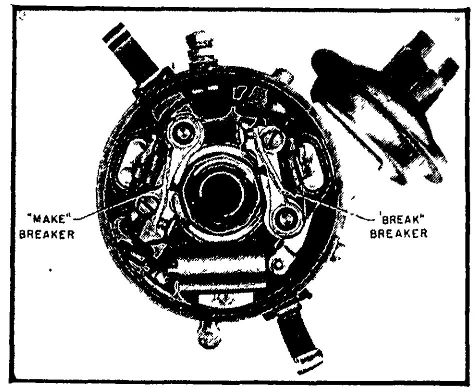


Fig. 34A 1951-52 Chrysler and De S t V8. Ignition distribut r

ELECTRIC SYSTEM

IGNITION TIMING

1951-52 V8 ENGINES — Two sets of points are used for the purpose of building up the primary current so that when operating at high speed, efficient operation is assured.

The points, Fig. 34A, are connected in parallel between coil and ground and are staggered in relation to the eight-lobe cam. The overlapped contacts result in longer coil saturation, and as they are in a parallel circuit, no ignition occurs until both sets of points are open.

As the cam rotates, the first set of points closes the primary circuit. As it rotates a little further, the second set of points closes, but since they are connected in parallel, the circuit is not changed. Further rotation of the cam causes the first or "circuit maker" points to open. But, again, the circuit is not interrupted because the second or "circuit breaker" points are still closed. Later, the "circuit breaker" points open and break the primary circuit, causing a spark at the plug.

SETTING POINTS—Since the "make" and "break" points are timed to close and open at the exact instant necessary for efficient engine operation, adjustment of points is an important factor in correct distributor operation.

New points can be adjusted with a feeler gauge. If points are used but are still clean and make flat contact with each other a dial indicator tool (see *Ignition Systems* chapter) can be satisfactorily used. If points are pitted or badly worn, they should be replaced because metal may be burned, causing a resistance that would cause poor point operation.

FEELER GAUGE OR DIAL INDICATOR METHOD—Rotate the distributor shaft until the rubbing block of one set of points is on the high spot of the cam. Then, with a screwdriver blade in the triangular opening, close or open the points to a clearance of .015 to .018" by turning the screwdriver blade against the stationary point plate. Check the clearance with a clean feeler blade or dial indicator.

DWELL METER METHOD—If points are set by means of a dwell meter, *block*

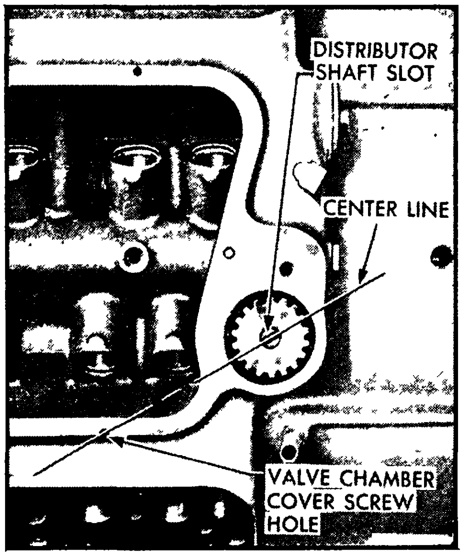


Fig. 34B 1951-52 Chrysler and De S t V8. Locating slot in oil pump drive shaft for distributor installation

one set of points open by means of a clean insulation material placed between the contacts while adjusting the other set to show 27½ to 30 degrees of closure on the dwell meter. The total dwell angle of both sets of points is 34 to 36 degrees.

After setting the points, tighten the lock screw. Then turn the distributor shaft until the rubbing block of the second set of points is on the high spot of the cam and adjust the second set of points in the same manner.

ADJUSTING IGNITION TIMING—With the distributor properly installed on the engine as outlined below, set the ignition timing with a timing light so that with the engine idling, the timing light will flash when the pointer on the engine is opposite the DC mark on the vibration damper. Chalk-mark the spot on the vibration damper so that it stands out when the light flashes.

INSTALLING DISTRIBUTOR — Rotate the crankshaft until No. 1 cylinder is in firing position—which is when the DC mark on the vibration damper is opposite the pointer on the engine block.

Position the oil pump shaft so it lines up with the slot in the drive gear as shown in Fig. 34B.

Install the drive gear so that after it spirals in place, it indexes with the oil pump shaft and the slot in the top of the gear lines up with the valve lifter cover cap screw hole, Fig. 34B.

Install the distributor and, assuming that the vibration damper, oil pump shaft and drive gear are properly positioned, the distributor rotor should be pointing toward the left front corner of the valve lifter chamber opening as shown in Fig. 34C.

1935-52 L-HEAD ENGINES—Crank engine to bring No. 1 piston up on its compression stroke and stop when the pointer on the timing case cover, Fig. 35, is in line with the specified timing

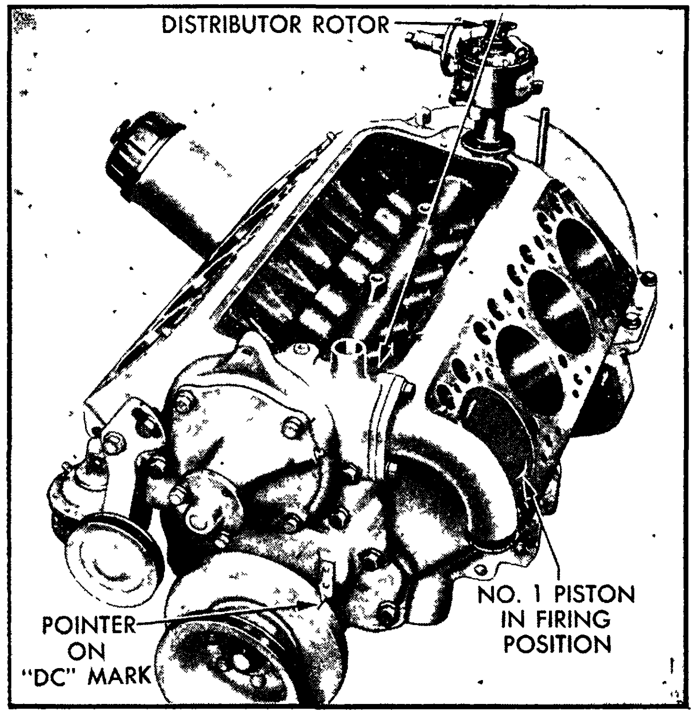


Fig. 34C 1951-52 Chrysler and De Soto V8. Lining up distributor rotor with corner of valve lifter chamber for correct ignition timing

mark on the vibration damper (see *Tune Up Chart*). Loosen the distributor body clamp and rotate the distributor until the points close. Then turn it in the opposite direction until the points just begin to open and tighten the clamp bolt.

To compensate for the grade of fuel being used, and for best performance and fuel economy, it may be necessary to alter the timing slightly from the specified setting. The best setting is one which will produce a slight ping when accelerating from 10 mph with wide open throttle.

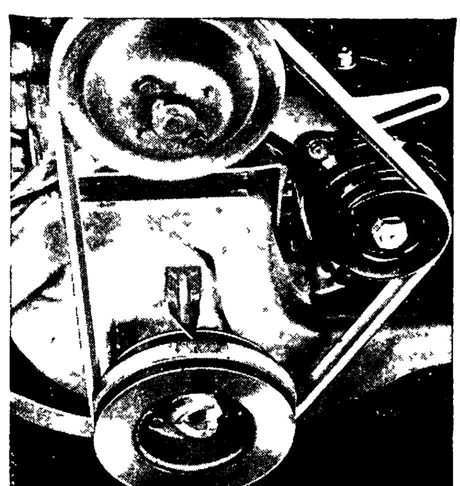


Fig. 35 D gre marks n vibrati n damper f r igniti n timing. 1935-52 L-H ad ngines

CLUTCH

CLUTCH PEDAL, ADJUSTMENT

Chrysler, De Soto, Dodge Plymouth, 1935-48—As shown in Figs. 36 and 37, one adjustment locates the clutch pedal by means of the stop screw and should be adjusted to bring the pedal to its highest position without striking the floor board. The other adjustment is for free pedal travel and should be set so the free travel is one inch.

1949-51 — Fig. 38. To adjust clutch pedal height and over-center spring, proceed as follows:

1. Loosen pedal height stop screw lock nut.
2. Adjust screw until pedal arm clears underside of floor panel.
3. Tighten stop lock nut.
4. Adjust clutch release fork adjusting nut until pedal has 1 to 1⅛" free play.
5. Check height of over-center spring bracket so that it is assembled with $1\frac{13}{16}$" height, measuring from top of bracket to left front frame body insulator bracket.
6. Make sure clutch release over-center spring block is in position on pivot at clutch release over-center spring bracket.
7. Turn clutch release over-center spring eye adjusting nut on eye bolt until a measurement is 1¼" between rear edge of over-center spring bracket and end loop of over-center spring at eye.

CLUTCH, REMOVE & INSTALL

1935-52 Without Fluid Drive—

1. Remove transmission and clutch pan.

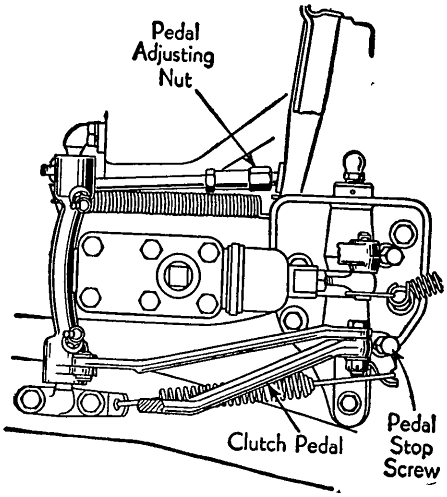


Fig. 36 Clutch linkage. Typical of all 1937-39 six cylinder

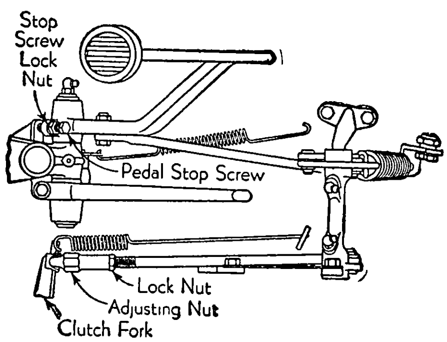


Fig. 37 Clutch linkage. Typical f all 1940-48

2. Pull out clutch release bearing and sleeve.
3. Mark clutch cover and flywheel so they may be assembled in the same relative position and thus maintain original balance.
4. Remove capscrews which attach clutch cover to flywheel. Loosen each capscrew a few turns in succession until cover is free.
5. The clutch assembly and disc can then be removed from the clutch housing.

When installing clutch, observe the following precautions:

1. Coat main drive gear pilot bearing in end of crankshaft with short fiber wheel bearing grease (medium).
2. Clean surfaces of flywheel and pressure plate, making certain no oil or grease remains on these parts.
3. Hold cover plate and disc in place and insert a special clutch aligning tool or spare main drive gear through the hub of the disc and into the pilot bearing in crankshaft.
4. Bolt clutch cover loosely to flywheel, being sure marks previously made are lined up.
5. To avoid distortion of clutch cover, tighten cover bolts a few turns each in progression until all are tight. The final tightening with a torque wrench should be from 15 to 20 lbs. ft.
6. Transmission may then be installed by guiding it into place with pilot studs.

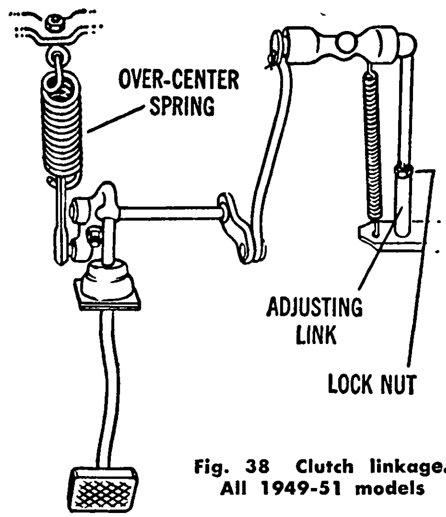


Fig. 38 Clutch linkage. All 1949-51 models

Care must be taken not to bend the driven disc. Use a floor jack to support the transmission so that the main drive gear may be guided through the disc safely.

7. Adjust clutch pedal free travel.

1939-52 With Fluid Drive—The clutch on these cars is removed in the same manner as outlined for models without fluid drive but the installation of the disc differs slightly, as follows:

1. Clean surface of clutch driving plate and clutch pressure plate, using a clean, dry cloth, making sure that no oil remains on these parts.
2. Hold clutch disc in place and bolt clutch cover plate loosely to clutch driving plate with marks on cover and drive plate lined up.
3. Insert a special clutch aligning tool or a spare main drive gear through the hub of the driving plate and into the fluid drive runner inner bearings in the runner hub.
4. Clutch cover bolts should then be tightened a few turns at a time each in progression until they are all tight. Transmission may then be installed.

FLUID DRIVE

FLUID DRIVE, REMOVE & REPLACE

Chrysler 1939-52, De Soto & Dodge 1941-52—Remove the clutch throwout fork, transmission and clutch housing pan *Mark the clutch cover and driving plate* so that these parts may be attached in the same relative position. (On 1939 Chryslers, drop the oil pan and rear main bearing cap.) Remove the clutch. Unfasten the fluid drive from the crankshaft and lift it away from the crankshaft flange.

Before installing, clean the mating surfaces of the crankshaft and driver

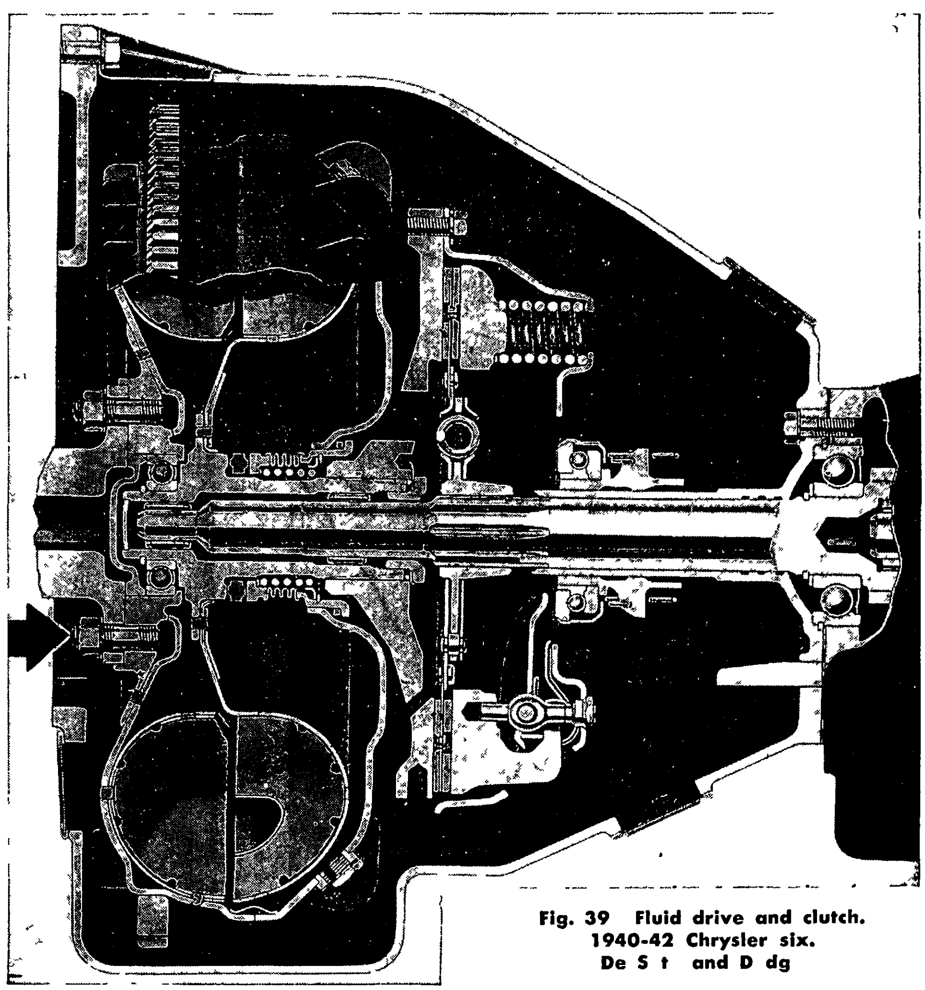


Fig. 39 Fluid drive and clutch. 1940-42 Chrysler six. De S t and D dg

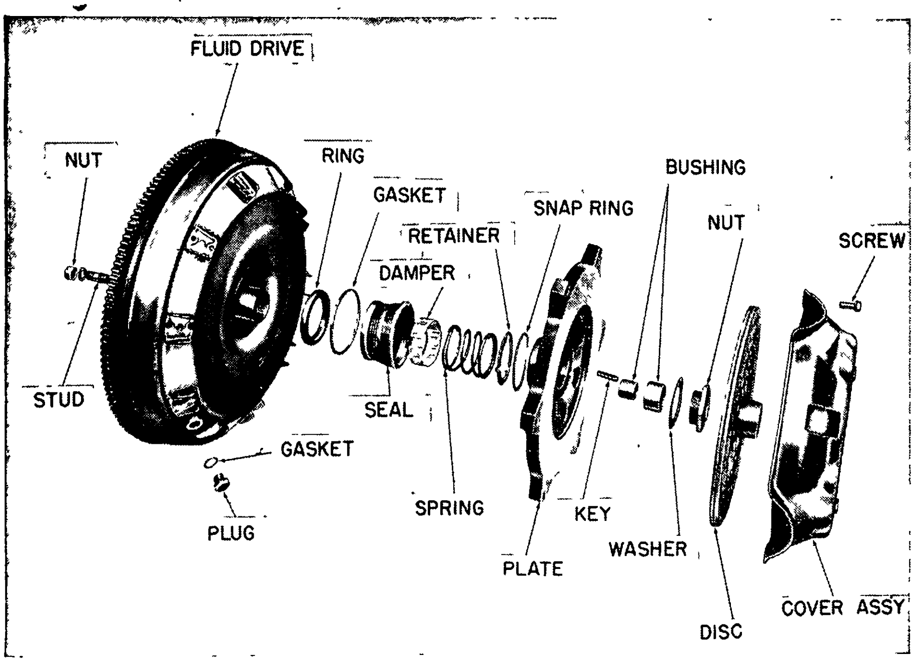


Fig. 40 Fluid drive and clutch. 1946-52 Chrysler, De Soto and Dodge

flange, and make sure that no burrs are present which would upset the balance of the assembly.

FLUID DRIVE SERVICE

1939-52—Figs. 39 and 40 show two views of the fluid drive. Note that in Fig. 39 the runner hub is supported on needle bearings, whereas in the later design, Fig. 40, bushings are used. Likewise in Fig. 40 a seal damper has been added to eliminate the possibility of a squeal or chatter being set up in the seal.

Figs. 40A and 40B illustrate the two types of seals that have been used. The housing type seal shown in Fig. 40B is interchangeable with the bellows type shown in Fig. 40A as an assembly only. No attempt should be made to interchange individual parts.

The loss of fluid from the fluid drive unit will be evidenced by excessive engine speeds, similar to a slipping clutch. The cause of the fluid loss should be determined by an inspection after removing the clutch housing pan. If leakage is at the seal at the front end of the hub at the clutch driving plate, new parts must be installed.

To service either of the fluid drive seals, proceed as follows after removing the fluid drive unit. Cleanliness is of the utmost importance during the following operations.

Bellows Type Seal—

1. Remove filler plug and drain unit.
2. Bend down tab on lockwasher, and with special tools shown in Fig. 40C, or equivalent, remove clutch driving plate retainer nut.
3. With puller shown in Fig. 40D, remove driving plate from runner hub.
4. Using special fluid drive bellows spring compressing sleeve C-613, Fig. 40E, compress spring, using driving plate retainer nut. Remove the snap ring from the bellows seal retainer and withdraw the spring retainer, spring, and damper (if so equipped).
5. With special wrench C-545, Fig. 40F, unscrew the bellows assembly. To help hold the wrench in place, screw the retainer nut on the hub.
6. With two pieces of wire bent to form hooks, lift out the loose floating seal ring.

Important—Before installing the new bellows seal, make sure that the sealing surfaces of the runner hub, floating seal ring and bellows seal are perfectly clean and free from scratches or marks of any kind. Do not attempt to recondition the sealing surfaces. Instead, install new parts. To install the new seal, proceed as follows:

1. Place floating seal ring over hub and against sealing surface of runner hub. Then screw bellows seal into place, making sure gasket is in place and that retainer is pulled up tight.
2. Place seal damper on end of seal compression spring and insert spring and damper in the sequence shown in Fig. 40A.
3. Turn spring and damper counter clockwise slowly until damper and spring bottom in seal spring recess. This will permit spiral coil spring to obtain position and not upset the shape of the damper.
4. Place retainer over spring and, using tool C-613 and nut, Fig. 40E, compress spring and install snap ring.
5. Insert key in runner hub and assemble clutch driving plate to fluid drive runner hub. Tighten nut securely and anchor it by turning edges of nut locking washer. The fluid drive unit may then be installed on the car.

Housing Type Seal—Fig. 40B.

1. With coupling removed, remove filler plug and drain the unit.
2. Bend back tab of lockwasher and, with special wrench C-607, Fig. 40C, remove drive plate retainer nut.
3. Holding drive plate securely, Fig. 40D, remove the drive plate with puller C-665. Remove key.
4. Thoroughly clean back plate of fluid drive adjacent to seal housing. Cover seal housing opening with a towel or other cloth to retain snap ring and spring. Using a screwdriver, pry one end of snap ring up and out. Remove snap ring and spring.
5. Using special spanner wrench C-545, Fig. 40F, unscrew seal housing. To assist in holding wrench in place, screw retainer nut on hub. The seal ring gasket and retainer will come out with the seal housing. Lift out seal ring with two pieces of hooked wire. Do not attempt to remove the seal housing without first removing the snap ring and spring as this will destroy the seal gasket.

Important—Before installing the seal ring, make certain the sealing surfaces are perfectly clean and free from scratches or marks of any kind. Do not attempt to recondition these sealing surfaces. If the surface of the seal ring is damaged, install a new one. However, if the surface on the runner hub is damaged, a new fluid drive assembly will be necessary.

Using the eracer end of a lead pencil under a clean cloth, press the cloth against the seal surface while rotating the runner hub. Repeat this operation until no oil or dirt appears on the cloth. Blow out any remaining lint particles with an air hose.

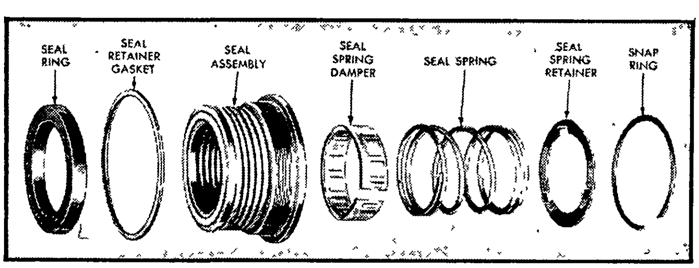


Fig. 40A Expl ded view f fluid driv bell ws type s al, 1939-52

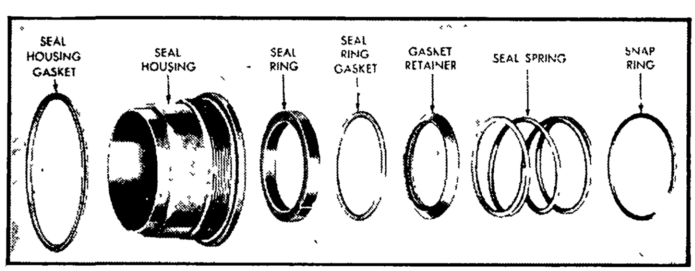


Fig. 40B Expl ded view f housing type seal f r fluid driv , 1939-52

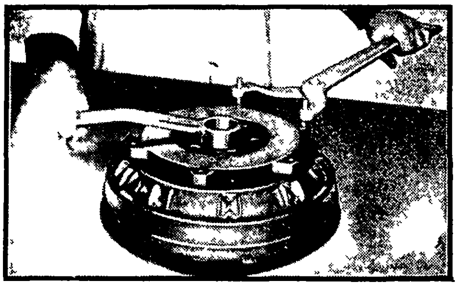


Fig. 40C Rem ving clutch plate nut. 1939-52 fluid drive

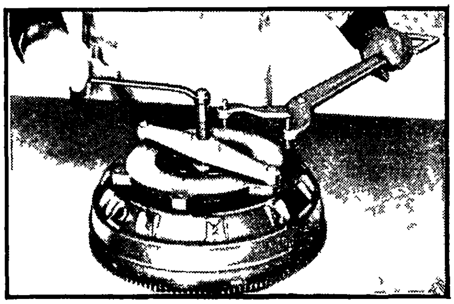


Fig. 40D Rem ving clutch driving plat fr m fuid drive, 1939-52

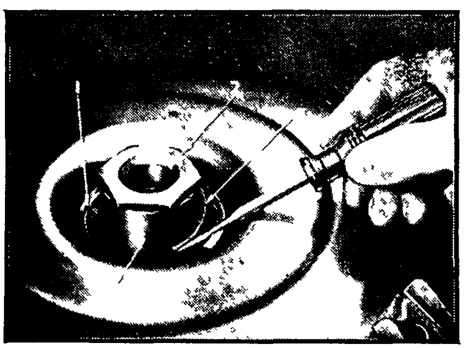


Fig. 40E Rem ving retainer snap ring fr m fluid drive, 1939-52
1. **Wr nch sl t in seal**
2. **Drive plate nut**
3. **Snap ring**
4. **Spring c mpression sleeve (C-613)**

Never use a metallic object such as a screwdriver to apply cloth or chamois against the runner hub seal surface as damage to this surface will result.

Installing Housing Type Seal—

1. Inspect the seal housing for burrs in the spanner wrench slots, the chamfer, top edge of bore and around the snap ring groove. Carefully remove all burrs.

2. Wash all parts (except gaskets and oil seals), including tools needed for assembly purposes in a cleaning solvent and dry with compressed air.

3. Screw the seal housing in place, finger tight, so the seal housing gasket contacts both the flange of the seal housing and machined face on the back plate of the fluid drive.

4. Special tool C-885 has been designed to install the seal ring and consists of two parts: SP-788 and SP-791. Using aligning tool SP-791, place the seal ring

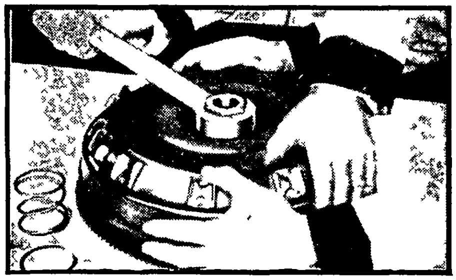


Fig. 40F Removing or installing seal housing from fluid drive, 1939-52

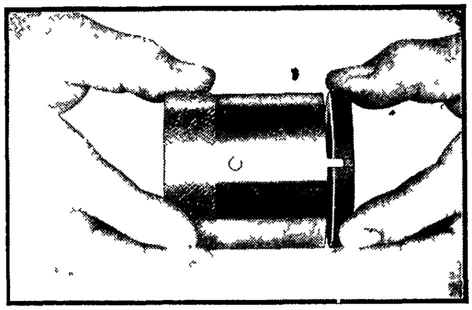


Fig. 40G Squaring seal ring on locators of aligning tool, 1939-52

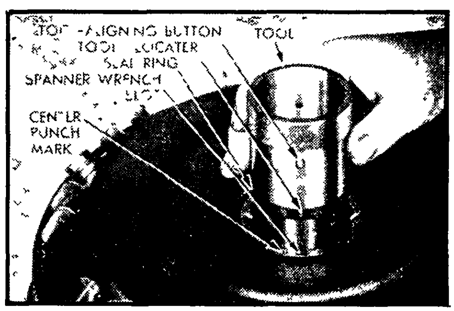


Fig. 40H Locating seal ring in seal housing, 1939-52

squarely on the locators, Fig. 40G, being careful to enter both locators at the same time. Enough tension should be maintained on the locators at all times to just hold the seal ring in place. Place aligning tool with seal ring installed into the seal housing as shown in Fig. 40H.

5. Lower the tool into the seal housing, aligning the button of the tool with the spanner wrench slot nearest the center punch mark, Fig. 40H. Slide the pilot sleeve SP-788 *gently* down inside Tool SP-791, Fig. 40J, to push the seal ring off the locators and onto the two small indentations at the bottom of the seal housing. Do not drop pilot tool in aligning sleeve as chipping of the seal ring will result.

6. Remove the seal ring installing tools and install the seal ring gasket, making sure that it is in full contact with the seal ring.

7. Install seal ring gasket retainer with the angular face down.

8. A special 3-piece tool (C-884) is designed to compress the spring and, at the same time, install the snap ring. Push the angular end of the inner sleeve out until approximately ⅛ in. shows, Fig. 40K. Place the angular end of the inner

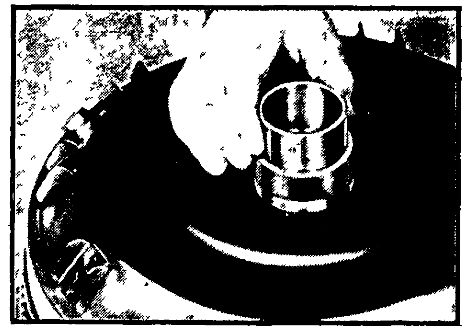


Fig. 40J Pushing seal ring ff l cators, using special pilot sleeve inside aligning tool. 1939-52 fluid driv

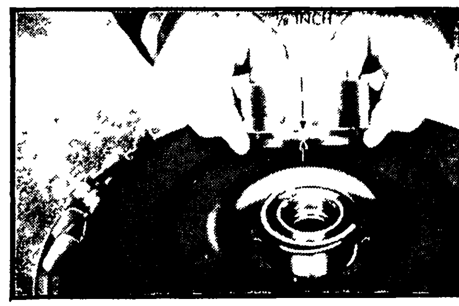


Fig. 40K Positioning inner sleev of tool. 1939-52 fluid driv

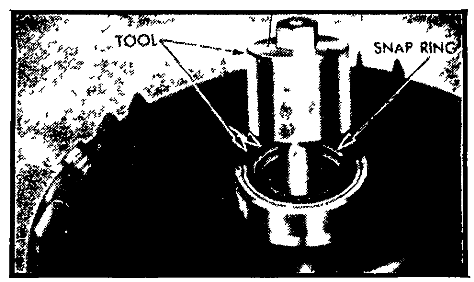


Fig. 41 Tool in position for installing snap ring. 1939-52 fluid driv

sleeve in the chamfer of the seal housing and push the outside collar down so it seats on the face of the seal housing, Fig. 41. Place snap ring on top of spring and install pusher portion of tool as shown in Fig. 41. The snap ring is installed by pressing quickly and heavily on the top of the tool.

9. Tighten seal housing with spanner wrench (C-545) to the required torque of 270 lbs. ft. Install drive plate and then the key.

10. Install drive plate retainer nut and washer. With the aid of tool shown in Fig. 40C, tighten nut securely. Lock retainer nut by bending edge of washer up and center punch washer at small drive plate hole.

Filling — Remove the screen from the inspection hole in the right side of the clutch housing. Rotate the fluid drive to bring the filler plug hole on a level with the inspection hole. Fill the unit with special fluid drive fluid until it runs out of the hole. Use a new gasket and tighten the filler plug securely.

FLUID DRIVE RING GEAR

1939-52—Two methods of attaching the starter ring gear to the fluid drive housing have been used. The first method was a slight press fit with a gas weld at six points equally spaced around the circumference of the housing. The second and present method is to heat the starter ring to a uniform temperature at which the ring gear can be placed in position on the housing without using force.

In replacing a ring gear, every possible precaution should be taken so as not to upset the balance of the unit. If a ring gear is replaced that was formerly welded, all the weld material should be removed by grinding or turning on a lathe. When replaced properly, the gear should be parallel to the crankshaft flange within .025 inch to prevent any run-out of the assembly. Under no circumstances should a ring gear be forced or pounded onto the housing.

TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1935-38 Chrysler, De Soto, Dodge, Plymouth—After removing floor boards, proceed as follows:

1. Disconnect battery cable.
2. Remove propeller shaft.
3. Disconnect overdrive control cable (if equipped).
4. Detach speedometer cable.
5. Disconnect hand brake rod or cable.
6. On C18 Chrysler and De Soto 1938 with overdrive, remove hand brake band. On C19 with overdrive, take off hand brake drum as well.
7. On C19, C20, support engine with jack and remove rear engine mountings.
8. Remove transmission cover.
9. Remove clutch release fork pivot screw or clevis pin and pull fork out of housing. (On some Chrysler and De Soto models, the fork may be left in but must be turned backward to clear the release bearing when transmission is being removed.)
10. Remove two upper transmission mounting studs and insert guide pins in their place.
11. Remove other mounting studs and slide transmission back and out.

Reverse the order of the above procedure to install, being sure to use the guide pins to guide the transmission in safely.

1939 Chrysler, De Soto, Dodge, Plymouth—After removing floor boards, proceed as follows:

1. Unfasten battery cable at transmission.
2. Remove propeller shaft, and disconnect hand brake cable.
3. On Chrysler and De Soto with overdrive, remove hand brake assembly and universal joint flange. Remove overdrive solenoid. Unfasten control cable from transmission lever.
4. Disconnect speedometer cable, and gearshift linkage from transmission.
5. Remove transmission cover.

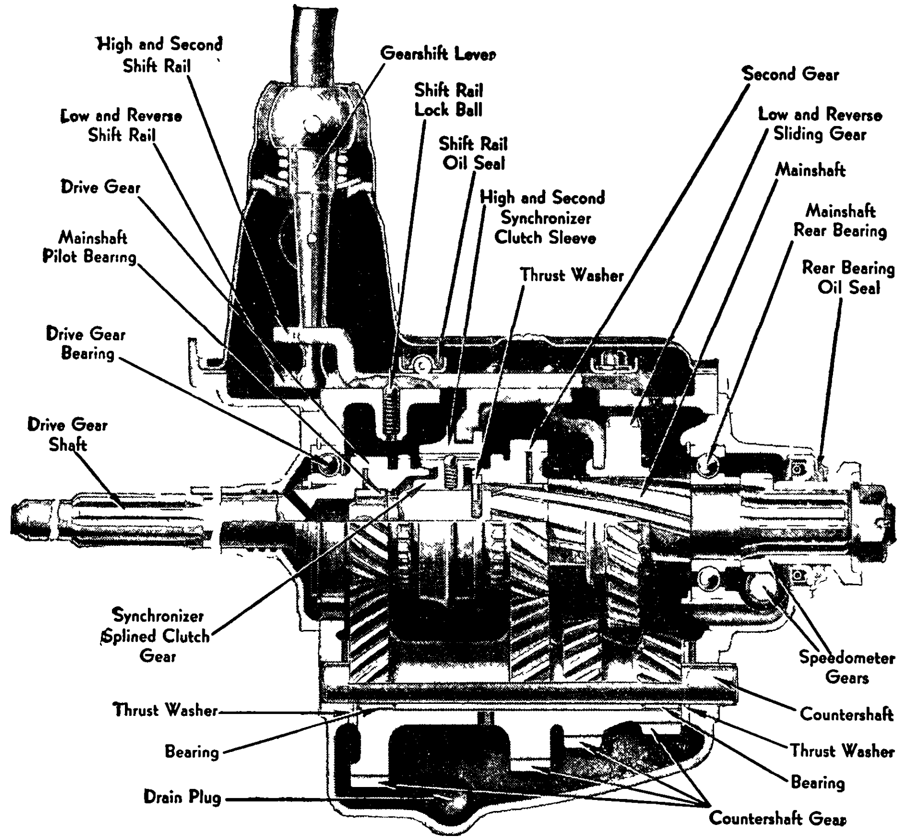


Fig. 42 Transmission. 1935-38 Chrysler, De Soto, Dodge and Plym uth

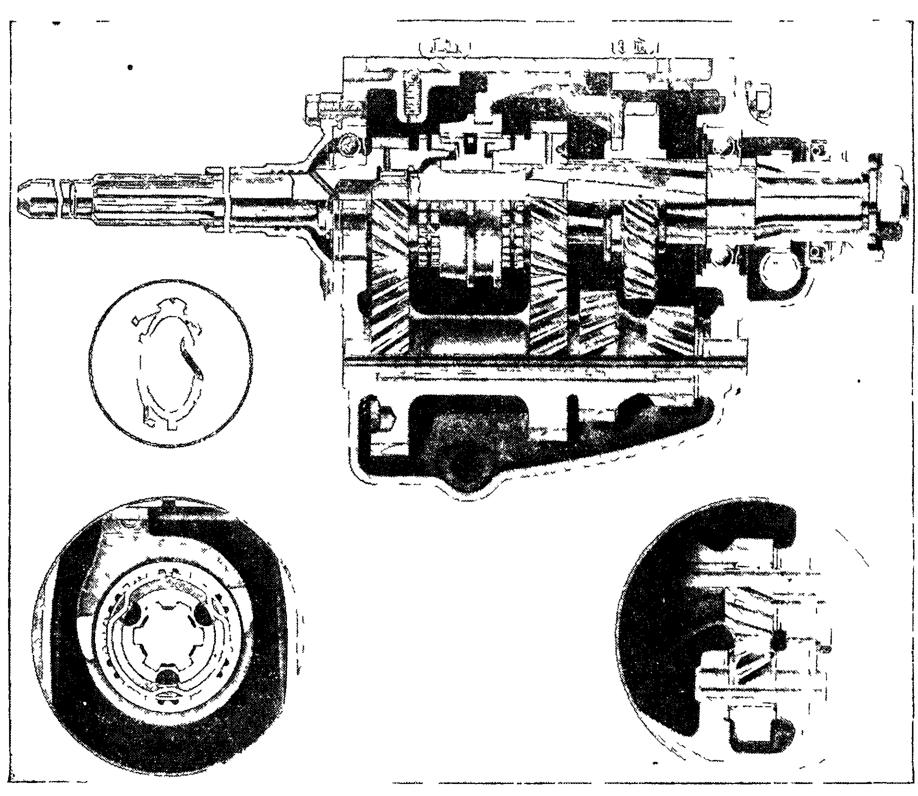


Fig. 43 Transmissi n. 1939 Chrysler six, De S t , D dge and Plym uth

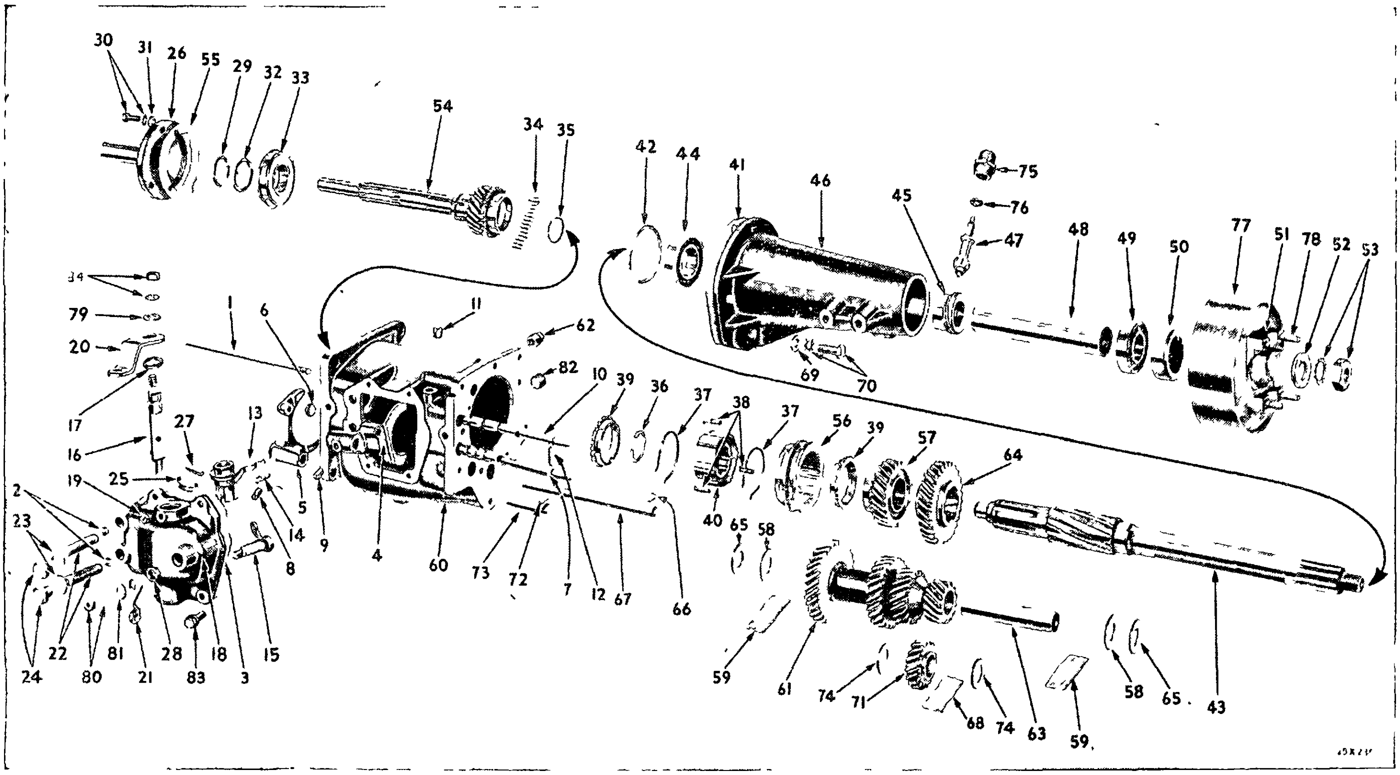


Fig. 45 Standard transmission. Typical of all 1940-52

1—Rail
2—Ball
3—Gasket
4—Fork-low and reverse
5—Fork-second and direct
6—Plug
7—Rail-second and direct
8—Lock screw
9—Lock screw
10—Rail-low and reverse
11—Plug
12—Interlock
13—Lever
14—Spring
15—Cam and shaft
16—Shaft
17—Seal
18—Housing
19—Screw and washer
20—Lever
21—Lever
22—Spring
23—Washer
24—Screw
25—Lock spring
26—Retainer
27—Pin
28—Seal
29—Snap ring
30—Screw
31—Grommet
32—Washer
33—Bearing
34—Bearing rollers
35—Snap ring
36—Snap ring
37—Spreader spring
38—Shifting plate
39—Stop ring
40—Clutch gear
41—Gasket
42—Snap ring
43—Mainshaft
44—Bearing
45—Speedometer gear
46—Extention
47—Speedometer pinion
48—Spacer
49—Bearing
50—Oil seal
51—Flange
52—Washer
53—Nut and Washer
54—Drive pinion
55—Gasket
56—Clutch sleeve
57—Second gear
58—Thrust washer plate
59—Bearing rollers
60—Case
61—Countershaft gears
62—Drain plug
63—Bearing spacer
64—Low and reverse gear
65—Thrust washer
66—Key
67—Countershaft
68—Bearing rollers
69—Grommet
70—Screw and washer
71—Reverse idler gear
72—Key
73—Reverse idler shaft
74—Washer
75—Speedometer pinion sleeve
76—Oil seal
77—Brake drum
78—Bolt
79—Washer
80—Nut and washer
81—Washer
82—Plug
83—Housing screw
84—Nut and washer

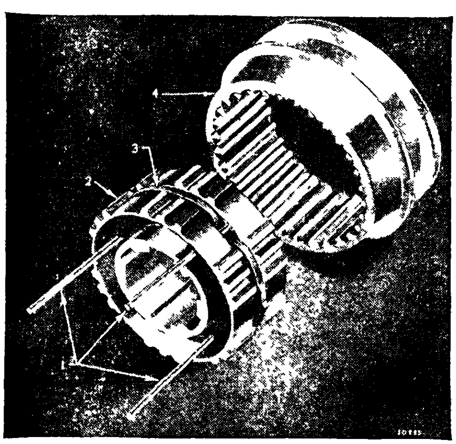


Fig. 44 Installing synchr nizer clutch g ar fricti n ring on 1939 m dels. 1. Friction ring pins. 2. Clutch gear. 3. Fricti n ring. 4. Clutch sleev

6. Remove two upper transmission mounting studs and insert guide pins in their place.

7. Remove other mounting studs and slide transmission back and out.

NOTE—On Chrysler and De Soto with overdrive, the assembly is removed by sliding the unit back on the guide studs. While pulling it back, rotate it so its right side is facing the top. When the clutch shaft is free of the release bearing, tip the transmission upward at the front and push it forward so the clutch shaft goes above the release bearing and between two release levers. Lower the rear end of the unit and pull it back out of the chassis.

On all models, the assembly is replaced in the reverse order of removal but be sure to use the guide pins to guide it in safely.

1940-52 Three Speed on Chrysler, De Soto, Dodge, Plymouth—It is not necessary to remove the floor boards.

1. On cars without overdrive, disconnect propeller shaft at front. (On cars with overdrive, remove propeller shaft and both universals. Remove solenoid and disconnect control cable.)

2. On all cars, disconnect speedometer cable, hand brake cable, and gearshift rods from transmission.

3. Remove two upper transmission mounting studs and insert guide pins in their place.

4. Remove other mounting studs and slide the transmission back and out.

When installing, use the guide studs and handle the transmission carefully to avoid damage to the clutch disc.

TRANSMISSION, OVERHAUL

1935-38 Chrysler, De Soto, Dodge; 1935-38 and P7 1939 Plymouth — (For detailed service on overdrive transmission, see *Overdrive* chapter.) To disassemble the standard transmission, Fig. 42, proceed as follows:

1. Remove shift rails and forks.

2. Use puller to remove universal joint flange.

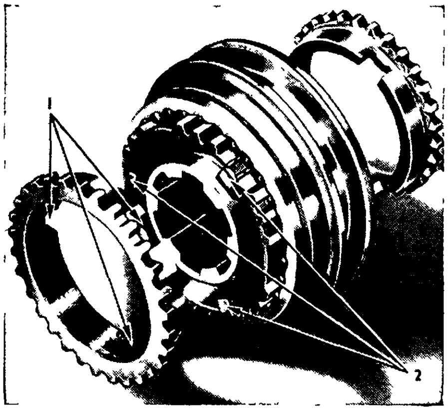


Fig. 46 Shifting plates (2) fit in st p ring slots (1). 1940-52 standard transmission

3. Remove brake support.
4. Pull mainshaft through rear of case.
5. Remove lock plate and drive countershaft out rearward, allowing cluster gear to lie in case.
6. Pull main drive gear out through front.
7. Lift out cluster gear and related parts.
8. Push idler shaft through rear and lift out gear.
9. To remove second speed gear from mainshaft, push a wire through hole in outer edge of second gear thrust washer, press down plunger until washer can be rotated so that its internal slots line up with flange on mainshaft. Then slide washer and gear off mainshaft.

Assembly Notes—Use new gaskets and snap rings, making sure snap rings fit snugly in their grooves.

When assembling cluster gear, place steel washer plates next to gear and bronze washers next to transmission case. Bronze washers should be selected to give from .002 to .008 inch end play.

End play of the second speed gear should be from .003 to .008 inch and thrust washers of several thicknesses are available to maintain this adjustment.

TRANSMISSION, OVERHAUL

1939 Chrysler, De Soto, Dodge and P8 Plymouth—(For detailed service on over drive transmissions, see *Overdrive* chapter.) To disassemble the transmission, see Fig. 43 and proceed as follows:

1. Remove shift rails and forks.
2. Use puller to remove universal joint flange.
3. Remove brake support.
4. Pull mainshaft through rear of case.
5. Remove lock plate and drive countershaft out rearward, allowing cluster gear to lie in case.
6. Pull main drive gear out through front.
7. Lift out cluster gear and related parts.
8. Push idler shaft out through rear and lift out gear.
9. To disassemble mainshaft, release snap ring from its front end and pull the hub out of the sliding sleeve, using care not to lose the balls and springs which hold the two units in neutral position. The second speed gear may then be removed.

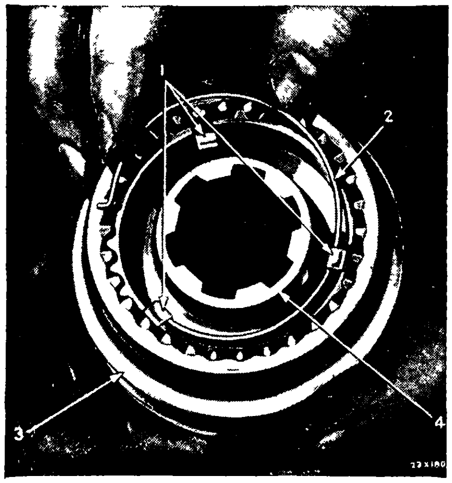


Fig. 47 Installing synchronizer shifting plates and spreader spring on 1940-52 standard transmission. 1. Shifting plates. 2. Spreader spring. 3. Clutch sleeve. 4. Clutch gear

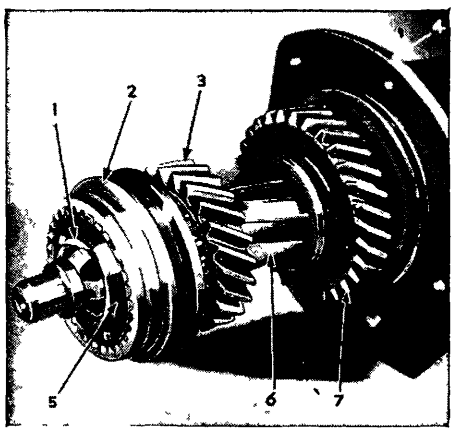


Fig. 48 Mainshaft and extension on 1940-52 standard transmission. 1. Snap ring. 2. Clutch sleeve. 3. Second speed gear. 4. Extension. 5. Clutch gear. 6. Mainshaft. 7. Sliding gear

Assembly Notes—Use new gaskets and snap rings, making sure snap rings fit snugly in grooves.

When assembling cluster gear, place steel washer plates next to gear and bronze washers next to case. Bronze washers should be selected to provide from .002 to .008 inch end play in gear.

Second speed gear should have from .003 to .008 inch end play, which can be adjusted by selecting the proper thickness thrust washer.

Assemble the synchronizer unit as shown in Fig. 44, so that the ends of the friction ring (3) straddle a tooth of the clutch sleeve and that reverse bends in friction ring are directly over the three holes of the clutch gear as shown in the insert of Fig. 44.

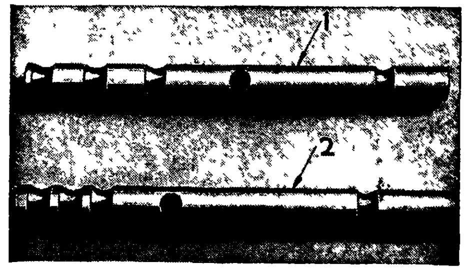


Fig. 49 Shift rails on 1940-52 standard transmission. 1. First and reverse. 2. Second and high

Fig. 50 Installing gearshift h using on 1940-52 standard transmissi n. 3. Housing. 4. Pilot studs

When installing the mainshaft, be careful not to tilt the bronze synchronizing rings in the clutch hub.

Install the flat bronze spring between the high speed synchronizing ring and clutch hub, with the three raised fingers toward the ring.

TRANSMISSION, OVERHAUL

1940-52 Chrysler, De Soto, Dodge, Plymouth — (For detailed service on overdrive transmissions, see the *Overdrive* chapter. Four-speed transmission service is given further on in this section.) To disassemble the standard transmission, see Fig. 45 and proceed as follows:

1. Remove speedometer drive pinion.
2. Take off cover and gear selector, roll transmission over and remove balls.
3. Use a puller to remove mainshaft flange and brake drum.
4. Remove shifter fork guide rail.
5. With gears in neutral, remove shift fork lock screws.
6. Remove plug for lower shift rail.
7. Slide shift rails out through front of case.
8. Lift out shift forks.
9. Remove extension housing and mainshaft, being careful not to allow synchronizer to become disassembled.

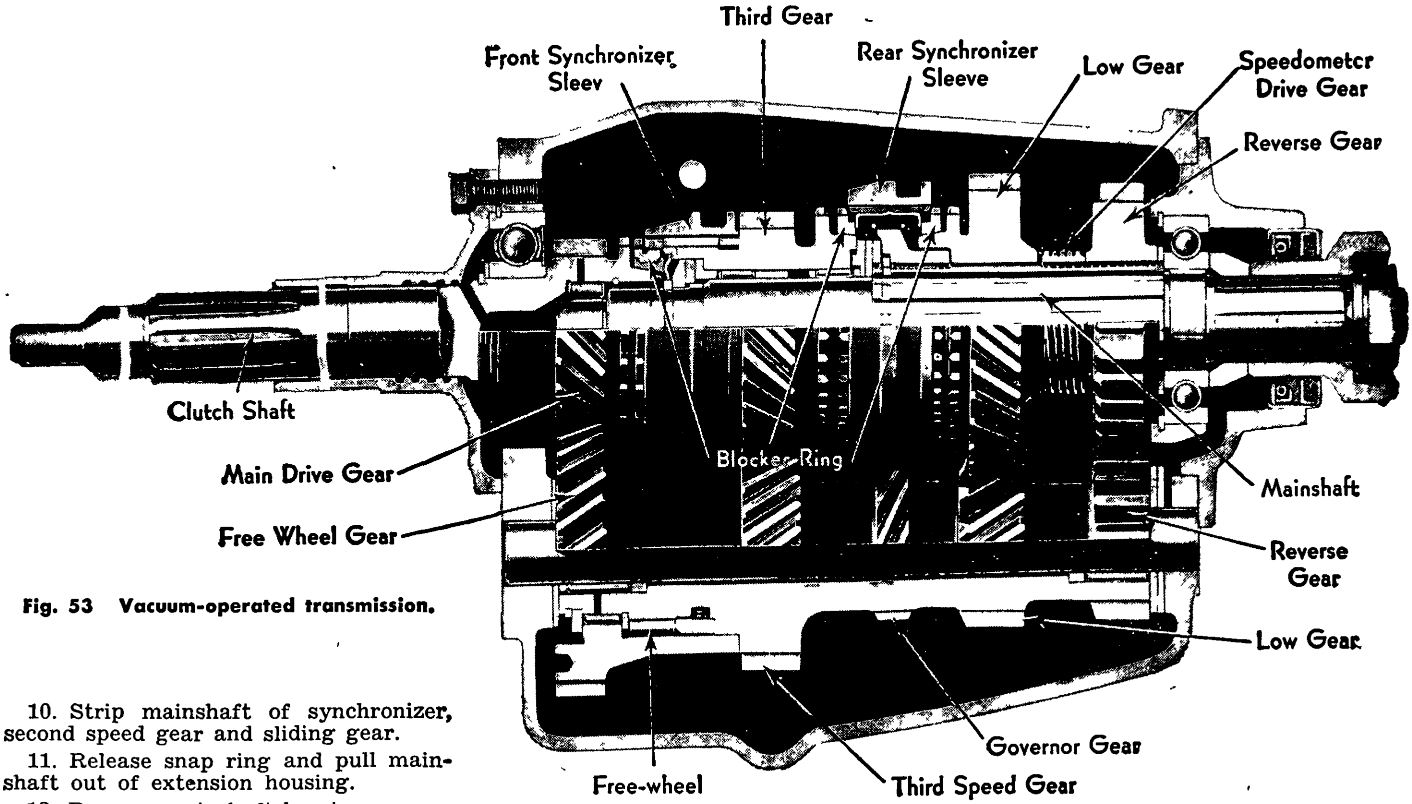


Fig. 53 Vacuum-operated transmission.

10. Strip mainshaft of synchronizer, second speed gear and sliding gear.
11. Release snap ring and pull mainshaft out of extension housing.
12. Remove mainshaft bearing, spacer and speedometer drive gear.
13. Pull bearing and oil seal from extension housing.
14. Drive countershaft through rear of case, allowing cluster gear to lie in case.
15. Remove main drive gear and bearing, and disassemble parts.
16. Lift out cluster gear and related parts.
17. Drive reverse idler shaft out rearward and lift out gear.

Assembly Notes—Use new gaskets, oil seals and snap rings, being sure snap rings fit snugly in their grooves.

When assembling cluster gear, place steel washer plates next to gear and bronze washers next to case. Select the proper thickness bronze washers to provide end play of from .002 to .008 inch.

If a special oil seal drift is not available, be sure that oil seal protrudes $\frac{7}{32}$ inch out of the mainshaft extension housing.

Referring to Figs. 46 and 47 for synchronizer assembly, place one bent up end of synchronizer spring into pocket of shifting plate. Then install bent up end of other spring into pocket of same plate on opposite side of synchronizer. Spring on one side should leave plate in opposite direction from spring on other side.

Assemble the synchronizer unit on the mainshaft as shown in Fig. 48.

If second speed gear end play is not within .003 and .008 inch, use a snap ring of different thickness.

Install first and reverse shifter rail (1, Fig. 49) on top, other rail on bottom.

Install gearshift housing as shown in Fig. 50.

VACUUM OPERATED TRANSMISSION

1941-42 CHRYSLER SIX & DE SOTO

NOTE — The semi-automatic transmission used on 1941 Chrysler eight-cylinder cars combine an overdrive unit and a conventional three-speed transmission in which low gear is blocked out. The automatic shifting feature performs much the same as the Vacamatic used in six-cylinder models. However, in the low range, shifts are between second and second overdrive while in the high range shifts are between high and high overdrive. Use of a lower rear axle ratio and the larger engine permits starting in the high range.

1941-42 Chrysler Six & De Soto—Vacamatic and Simplimatic transmissions are identical in operation and design, differing only in their trade name. The transmission, Fig. 53, consists of a four-speed unit with a fluid coupling which permits up to 98% of the driving in high without manipulating the clutch pedal or gearshift lever.

The shift lever has two forward speed positions which are selected manually. In either the high or low range position of the lever, there is an automatic shift up or down on two separate gear ratios, giving a total of four speeds forward.

When the lever is in the high range position, the car is started in third and remains in this gear until the throttle is closed above 15 mph, when the device automatically engages fourth gear.

A shift from fourth to third may be made at any speed between 53 and 15-mph by pushing the accelerator pedal all the way down. Above 53 mph the car runs in fourth.

When the lever is in the low range position, the car starts in low, shifts to second above 8 mph upon closing the throttle, and shifts back again from second to first whenever the accelerator is fully depressed between 27 and 8 mph.

For reverse, the shift lever is moved to the same position as on a conventional three-speed transmission.

The clutch must be disengaged whenever the shift lever is operated.

CONTROL SYSTEM

Fig. 54 is a diagram of the control system used on 1941 and early 1942 models while Fig. 55 illustrates the later 1942 design. In the former a diaphragm type vacuum unit is employed while the latter uses the piston type vacuum cylinder.

Centrifugal Governor — The governor is the flyball type equipped with contact points which are opened by the outward movement of the flyballs at a predetermined speed. Reduction of speed reduces centrifugal force moving the flyballs inward and closing the points.

Kickdown Switch—The switch is linked to the accelerator pedal and is brought into play when the pedal is pressed down to its limit. It is incorporated in the carburetor and is rendered inoperative by the carburetor venturi vacuum lifting clear of the plunger contact at speeds of 50 to 55 mph in high range and 27 mph in low range.

Vacuum Control Units — In the diaphragm type, Fig. 54, the shifting action is controlled by a solenoid which regulates the opening and closing of the combined vacuum and atmospheric valve.

When the solenoid is energized, it holds the air valve open and the vacuum valve closed. De-energizing the solenoid closes the air valve and opens the vacuum valve. Vacuum pulls the diaphragm and its sliding shaft inward. The operating lever spring on the transmission shifts the synchro clutch forward to lock the drive pinion to the mainshaft. Before the stroke is completed the sliding shaft momentarily closes the ignition interrupter switch just before the synchro clutch is engaged.

In the piston type Fig. 55, a set of contact points is enclosed under a removable cover for the purpose of interrupting the ignition circuit. The power cylinder is controlled by a solenoid operated vacuum valve. When the solenoid valve opens the vacuum line the piston and stem are drawn in, compressing the return spring. When the piston reaches the "in position", it contacts the holding coil which holds it in.

Interrupter Switch — The ignition interrupter switch closes when the piston reaches the top of the stroke. The interrupting or shorting action takes place only when the relay points close due to engagement of the kickdown switch.

Relay—A simple generator feed relay is used with the controls shown in Fig. 54, while a double point relay is used in Fig. 55. On the latter, one set of points control the circuit to the vacuum valve solenoid and holding coil. The other points control the interrupter circuit.

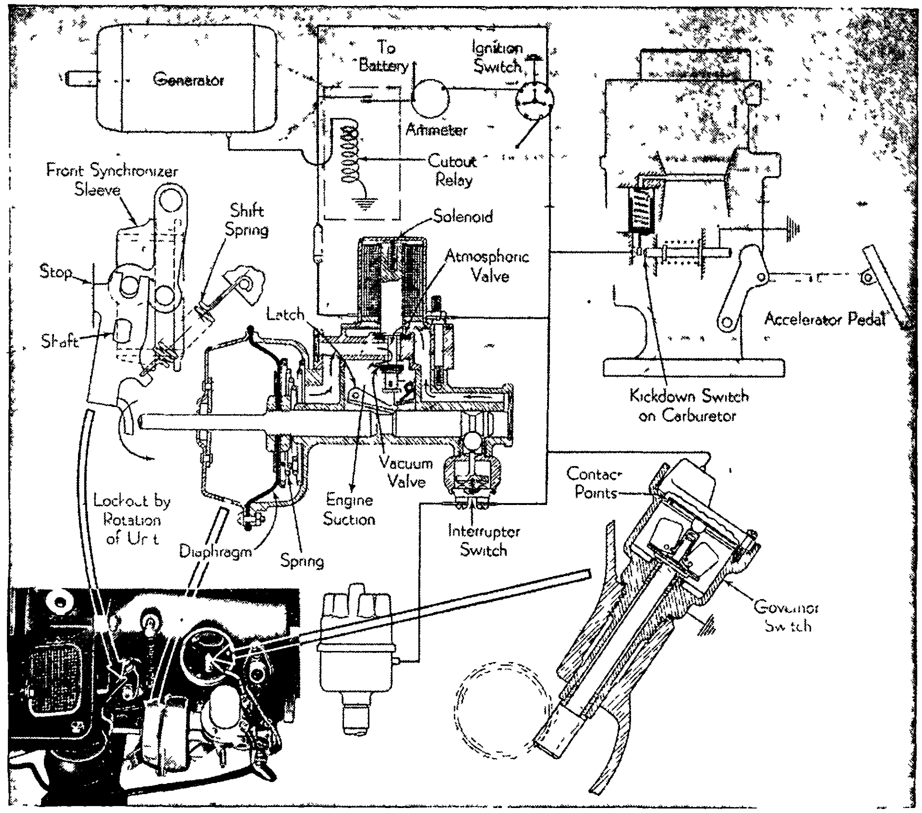


Fig. 54 Vacuum-operated transmission controls, employing a diaphragm typ vacuum unit. 1941 and early 1942 Chrysler six and De Sot

TROUBLE DIAGNOSIS

Before attempting to make any checks or adjustments, be sure that the accelerator pedal and related linkage are not binding or operating sluggishly. The engine idle speed should not be above 475 rpm or 4½ mph when driving on a level road. Otherwise, the automatic change to lower gear ratios will not function properly.

If the accelerator pedal fails to kickdown and the transmission remains in second or fourth gear, it is probably caused by:

1. Improper adjustment between vacuum unit stem and shift lever. This clearance should be $\frac{5}{32}$ inch.
2. Failure in solenoid circuit.
3. Failure in interrupter switch circuit.
4. Improper mechanical function at transmission or vacuum unit.

If kickdown is permanent and the transmission remains in first or third gear, it is probably caused by:

1. Leaks in vacuum system.
2. Engine idling too fast.
3. Failure in solenoid circuit.
4. Improper mechanical function in transmission or vacuum unit.

If shift is sluggish, it may be caused by:

1. Sticking accelerator linkage.
2. Engine idling too fast.
3. Improper dashpot adjustment at carburetor.
4. Improper mechanical function at transmission or vacuum unit.

If engine stalls on turns when kicking down correction may require some or all of the following measures:

1. Set engine to proper idle and inspect interrupter switch and connections.
2. Clean and oil vacuum and piston packing (piston type). Use light oil or shock absorber fluid and adjust cylinder shaft to $\frac{5}{32}$ inch clearance.
3. Inspect governor for releasing too low.
4. Look for internal causes which may be binding or sticking synchronizer sleeve, damaged main drive gear or misalignment between transmission and clutch housing.

Locking in gear and at times grounding out ignition may be corrected by:

1. Always shifting to neutral before turning off ignition.
2. Inspecting for damaged fuse or faulty interrupter switch or connections.
3. Cleaning and lubricating vacuum cylinder and adjusting shaft to $\frac{5}{32}$ inch clearance.
4. Freeing synchronizer shifting sleeve, which may be sticking, or the main drive gear damaged.

If there is no kickdown on acceleration, check carburetor throttle switch and the interrupter switch. Damaged main drive gear or synchronizer sleeve may also be the cause of this condition.

Grease leaks at transmission countershaft may be due to shaft being installed the wrong way. The shaft is slightly larger at the back end and should be removed and installed from that end.

If engine stalls on stops, determine if transmission grease is too heavy, or if the governor speed is too low. On late 1942 types, check the operation of the feed relay. Binding or sticking synchronizer sleeve may also cause stalling.

Sticking or remaining in high gear may be due to a defective fuse, a defective governor or dirty points, causing poor contact. Feed relay may be defective on cars with piston type vacuum cylinder. Clean, lubricate and adjust vacuum cylinder. Binding of synchronizer sleeve or damaged main drive gear are other factors to be checked.

Heavy engagement going into high can be the result of the vacuum cylinder exhaust line being clogged.

If transmission fails to go into high, check for a broken spring on automatic shift lever. Set engine to proper idle and inspect accelerator linkage for cause of high idle. Air leaks due to loose linkage pin in diaphragm type vacuum cylinder or a damaged diaphragm may also restrict shift into high gear.

Spinning of reverse gear or failure to go into reverse can be caused by damaged roller bearings or tightness of the bushing in the fluid coupling resulting in the main drive gear shaft turning. Burnish solid type bushings to fit shaft freely. Misalignment between clutch housing and transmission is another condition to check.

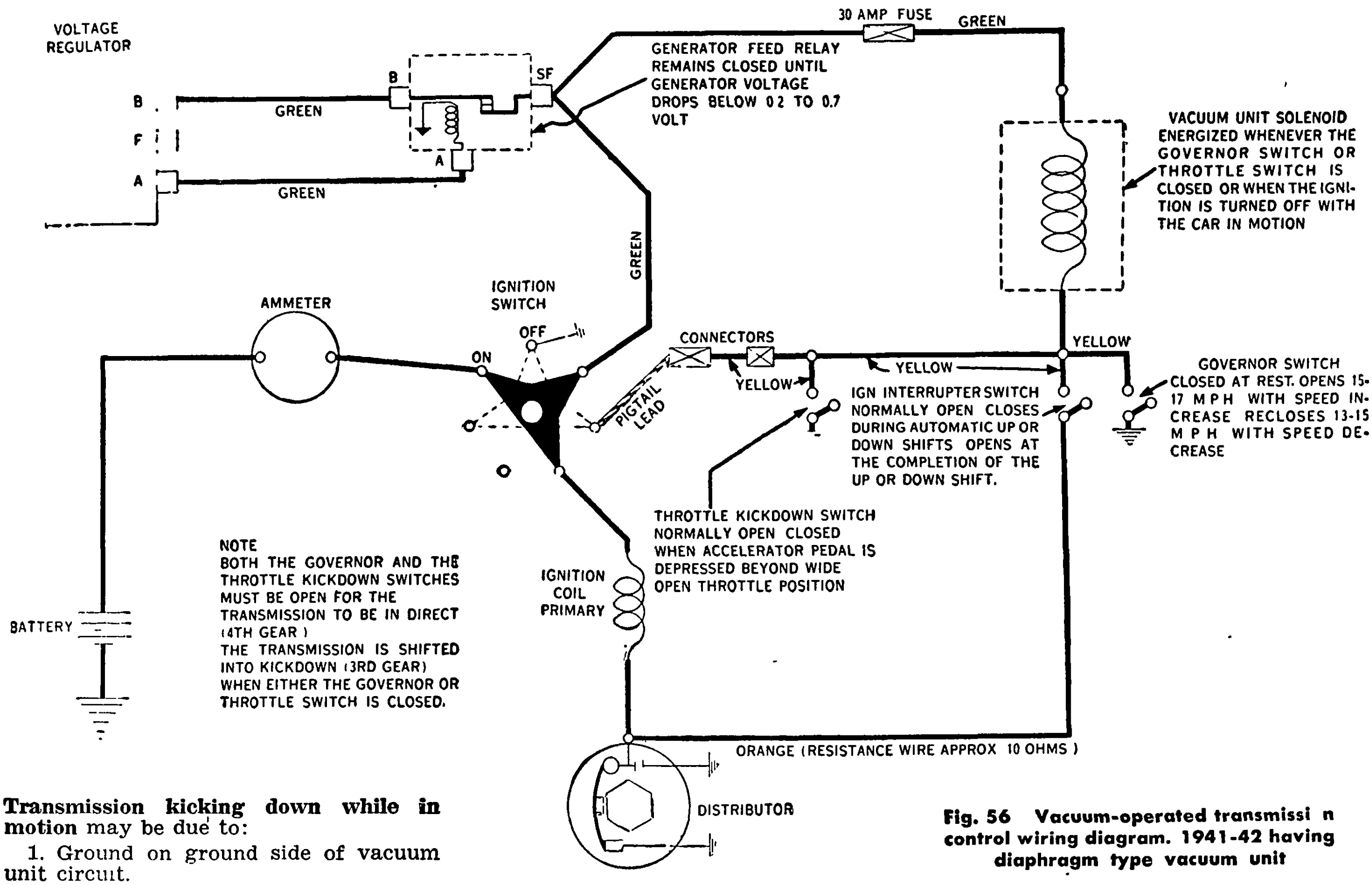


Fig. 56 Vacuum-operated transmissi n control wiring diagram. 1941-42 having diaphragm type vacuum unit

Transmission kicking down while in motion may be due to:

1. Ground on ground side of vacuum unit circuit.
2. Damaged wiring.
3. Defective throttle or governor switch.
4. Linkage at choke striking throttle switch connection at carburetor (six-cylinder cars only).
5. Vacuum limit switch rubber valve disc damaged on 8-cylinder models.

Noise in transmission in neutral with clutch engaged can be the result of a damaged main drive gear bearing or noisy countershaft gears.

Battery discharging may be traceable to a defective feed relay on six-cylinder cars with diaphragm type vacuum unit.

If car fails to move while in gear, the free wheeling rollers may be sticking due to a gum condition or weak cage springs. To correct, set the brake, put the car in low and run the engine for a few minutes—which should release the rollers. If this is the cause, install a quart of solvent and run the transmission for a few hours, then drain and install proper lubricant.

Sluggish vacuum cylinder action may be caused by gasoline getting into the cylinder, in which case, it is advisable to dismantle cylinder, clean and lubricate.

VACAMATIC TRANSMISSION REMOVE & REPLACE

1941-42 Chrysler Six & De Soto — After taking out floor board:

1. Disconnect speedometer cable at transmission.
2. Remove wires from solenoid, interrupter switch and governor switch.

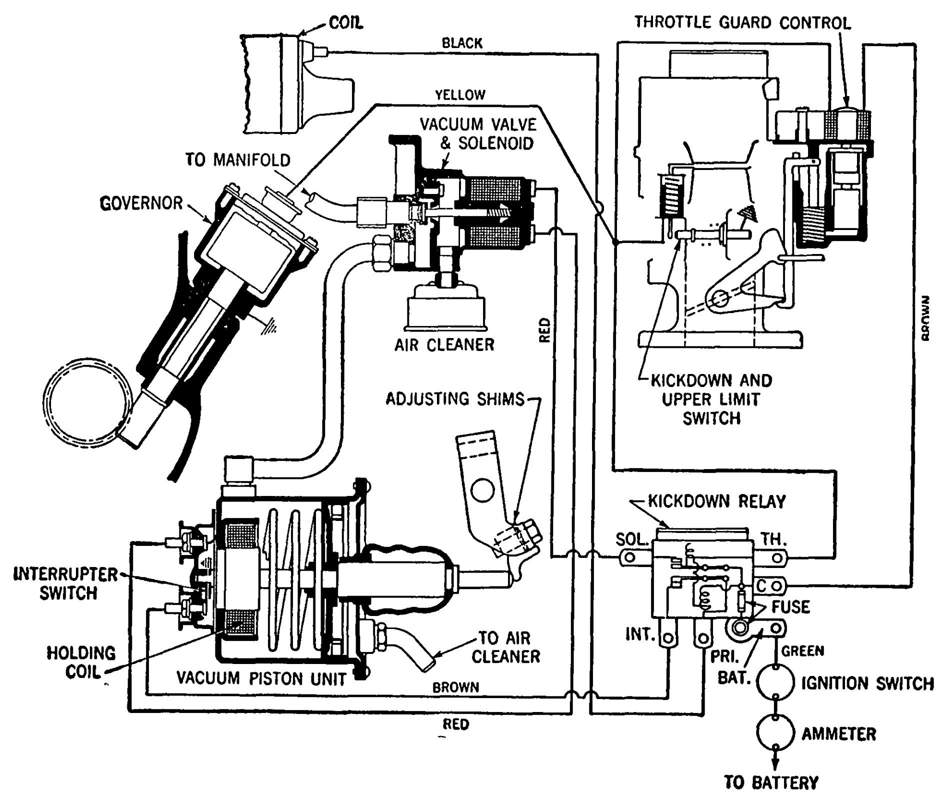


Fig. 55 Vacuum- perated transmissi n c ntrols, empl ying a pist n typ vacuum unit. Lat 1942 Chrysler six and D Sot

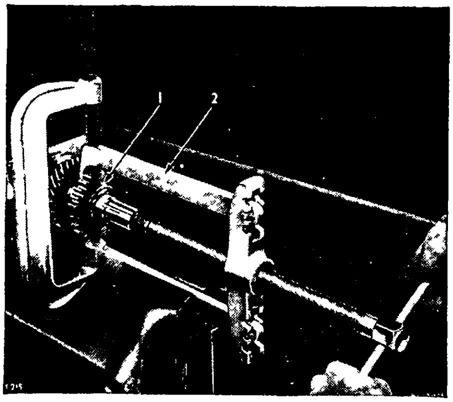


Fig. 58 R moving mainshaft reverse gear (1) with puller (2). 1941-42 vacuum-op rated transmission

3. Disconnect vacuum unit hose.
4. Disconnect vacuum unit pullout cable and return spring.
5. Take out vacuum unit.
6. Disconnect hand brake cable at band.
7. Unfasten propeller shaft at front.
8. Disconnect shift linkage at transmission.
9. Unfasten transmission from clutch housing and pull transmission back, down and out.

When installing the transmission, be sure it is filled with the proper lubricant and check clutch pedal adjustment Pilot studs should be used to install the transmission to avoid springing the clutch disc.

VACAMATIC TRANSMISSION, OVERHAUL

1941-42 Chrysler Six & De Soto — To disassemble, proceed as follows, taking the units out in the following order: (1) Vacuum unit. (2) Governor. (3) Speedometer drive pinion. (4) Hand brake drum. (5) Shift rails. (6) Reverse idler gear and shaft. (7) Countershaft. (8) Mainshaft. (9) Main drive gear. (10) Countershaft gear.

To disassemble the countershaft, remove successively the front snap ring, free wheeling gear, thrust washer, roller bearings, free wheeling rollers, roller cage and springs, being careful not to lose the two springs under the cage.

To disassemble the mainshaft:

1. Remove blocker ring and spreader spring.
2. Remove third speed gear snap ring and gear.
3. Remove third gear stop ring, thrust washer, clutch sleeve and shifting plates.
4. Rap the rear end of the shaft with a lead hammer and remove the brake support housing.
5. Press the mainshaft out of the reverse gear. If an arbor press is not available, a puller of the type shown in Fig. 58 may be used.

ASSEMBLY NOTES — Clean all parts and wipe dry. Clean the case inside and out. Oil all bearings and other moving parts as they are being assembled.

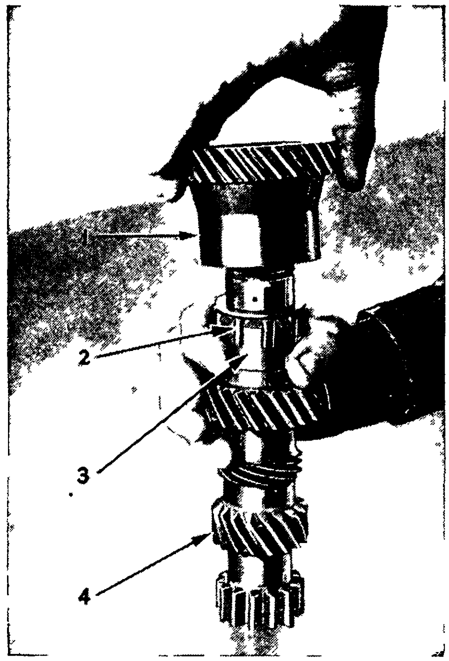


Fig. 59 Assembling countershaft free wheeling gear. 1941-42 vacuum-operated transmission. 1. Free wheeling gear. 2. Rollers. 3. Roller retainer. 4. Countershaft gear

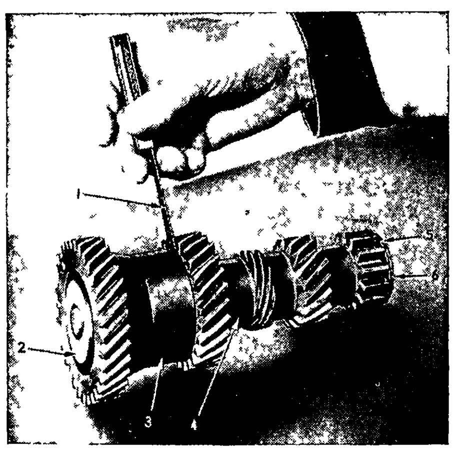


Fig. 60 Checking free wheeling gear end play. 1941-42 vacuum-operated transmission. 1. Feeler gauge. 2. Thrust washer. 3. Free wheeling gear. 4. Countershaft gear. 5. Steel washer. 6. Bronze washer

If the synchro-clutch shaft and fork have been removed, install the fork with its stop block on the right hand side of the case. Then install the lower shaft, oil seal, set screw, lever, lockwasher and nut.

Assemble the countershaft gear as shown in Figs. 59 and 60, checking the end play of the free wheeling gear. If not within from .003 to .009 inch, install the correct thickness snap ring, these being available in .084, .087 and .090 inch thicknesses. The cluster gear end play should be from .005 to .011

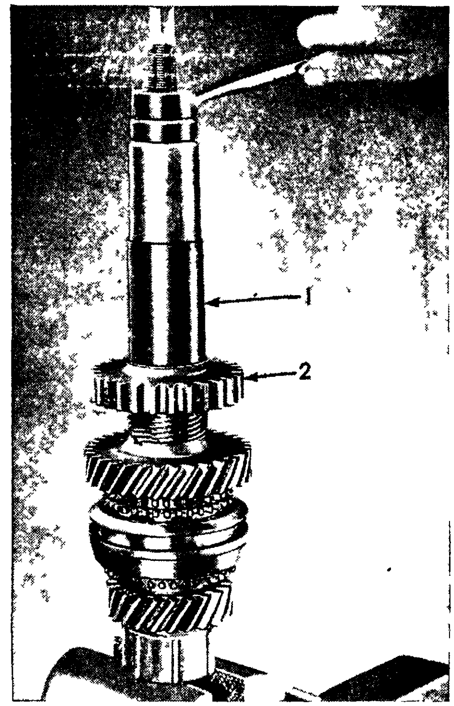


Fig. 61 Installing reverse gear (2) with special tool and sleeve (1). 1941-42 vacuum-operated transmissi n

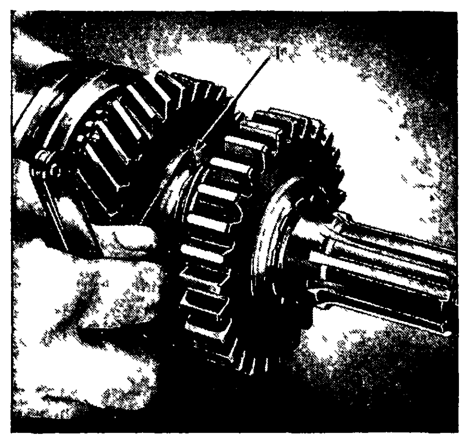


Fig. 62 Checking low sp ed gear nd play with feeler gauge (1). 1941-42 vacuum-operated transmissi n

inch, measured with feeler stock inserted between the thrust washer and the case at the rear. Different thickness bronze washers (.087, .091, .095, .098 inch) for the rear end of the cluster gear are available for obtaining proper end play.

To assemble the mainshaft gears, proceed as follows:

1. Install a new snap ring in the forward end of the mainshaft spline.
2. Place the synchronizer hub on the shaft with the long portion of the hub toward the rear of the transmission.
3. Install the springs for the synchronizer shifting plates in the hub One of the hooks of the springs should be inserted in a shifting plate groove. Then

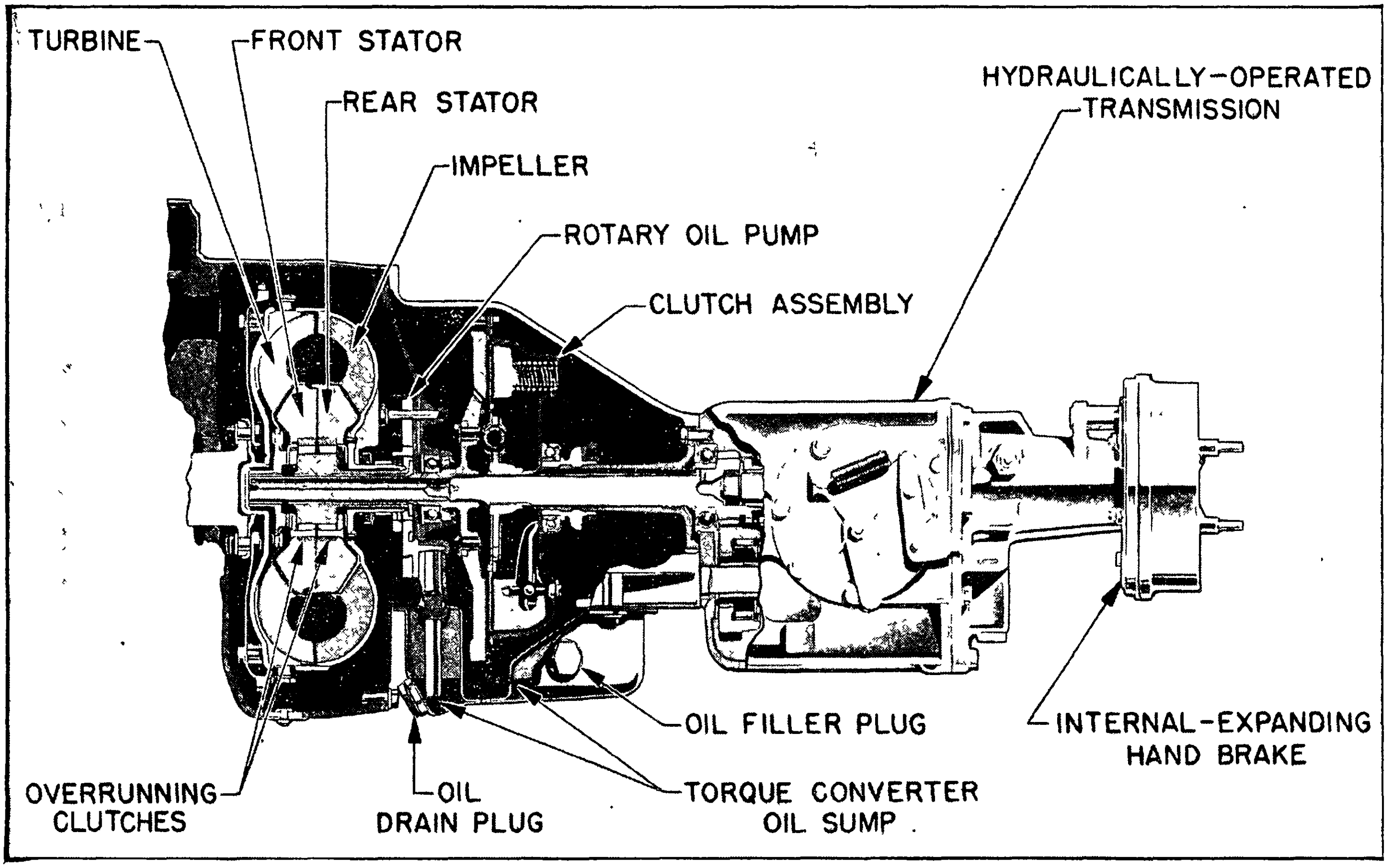


Fig. 63A 1951-52 Chrysler and De Soto V8. Torque converter

install the rear spring with its hook in the same groove.

4. Install the rear stop ring.

5. Install the low speed gear, speedometer drive gear and the reverse gear on the mainshaft with the long end of the hubs of the low speed and reverse gears toward the rear of the transmission.

6. Install the washer on the rear end of the mainshaft.

7. Press the reverse gears on the mainshaft, Fig. 61, being sure to keep the spacer in proper position so that it will slide over the splines of the mainshaft without binding.

8. Check the end play between the shoulders of the low speed gear and speedometer drive gear, Fig. 62. End play should be from .003 to .009 inch and can be obtained by installing the proper thickness spacer. These spacers are furnished in thicknesses of .041, .045, .050 and .055 inch.

NOTE—In the absence of the special tools shown in Fig. 61, the reverse gear may be pressed on the mainshaft in an arbor press. Then the brake support and drum should be temporarily installed so that the reverse gear can be pressed back against the bearing in the brake support. Measure the end play and remove the brake drum, continuing to assemble the transmission as follows:

9. Install the synchronizer shifting plates and the synchronizer sleeve with the taper of the sleeve to the front of the transmission.

10. Install the forward stop ring.

11. Install the steel thrust washer so that it indexes with the splines on the mainshaft.

12. Assemble the roller bearings in the third speed gear. Install the set of 36 rollers in the forward end, then insert the spacer with its holes and groove toward the rear of the transmission so that the oil holes are lined up. Then install the set of 36 rollers in the rear of the third speed gear. Use cup grease to hold the rollers in place. Install the small steel thrust washer next to the rollers, then the bronze thrust washer.

13. Install the third speed gear and bearing assembly on the mainshaft.

14. Place the forward bronze washer on the mainshaft with its oil groove to the rear.

15. Install the steel thrust washer with its tapered face to the front of the transmission.

16. Install a new snap ring. Then measure the end play between the steel thrust washer and the snap ring. End play should be from .003 to .009 inch and may be obtained by installing the proper thickness snap ring, these being available in thicknesses of .087, .092, .097 and .101 inch.

17. Press on the brake support and brake assembly. Do not drive on as it will upset the end play between the speedometer drive gear and low speed gear.

NOTE—The various units of the transmission should be installed in the case in the following order: (1) Place the countershaft gear in the bottom of the case. (2). Then install mainshaft and main drive gear. (3) Raise countershaft gear and install countershaft through rear. (4) Install reverse idler gear and shaft. (5) Install shift rails and forks.

TORQUE CONVERTER

1951-52 V8 ENGINES—Fig 63A. Supplied as standard equipment on eight-passenger sedan and limousine and special equipment on other models, the fluid torque converter replaces the fluid coupling used formerly. The automatic transmission remains the same as 1950 models.

The torque converter has a maximum torque multiplication of 2.34 to 1. With it, a 1.61 to 1 third speed ratio is used in the transmission. This gives a 3.77 to 1 breakaway torque ratio for a start in high range, as compared to 1.75 to 1 third speed ratio and 3.57 first speed ratio with fluid coupling and automatic transmission. Thus, a much greater percentage of driving is done in the high range and the accelerator "kickdown" is required less frequently because the torque multiplication of the converter is available in direct drive up to approximately 45 mph.

SERVICING THE CONVERTER

Except for the oil pump and parts of the support plate, the torque converter,

being a welded assembly is serviced only as a unit.

TORQUE CONVERTER, REMOVE

1. Remove plug from converter oil reservoir and drain reservoir.
2. Remove capscrews and oil reservoir from bottom of clutch housing.
3. Remove starting motor.
4. Remove lower half of flywheel housing pan.
5. Remove drain plug from bottom of converter and let oil run out. Then turn converter around 180 degrees and remove opposite drain plug so that the rest of the oil trapped in the converter can drain out.
6. Disconnect oil lines from rear support plate.
7. Remove transmission as outlined further on.
8. Unhook clutch release fork pull-back spring.
9. Disconnect one end of clutch fork rod assembly from fork by removing cotter key, pin and washers. Disconnect the other end from the clutch release bearing torque shaft.
10. As soon as rod assembly is removed, push clutch pedal until over-center spring brings it to the floorboard. This will avoid danger of injury should the pedal be pushed in while linkage is disconnected.
11. To remove release bearing from clutch fork, do not force bearing and pull-back springs straight off from fork prongs. Pivot the release bearing away from the fork. Assembly and springs will then slide off easily.
12. Remove two capscrews that hold torque shaft pivot bracket to clutch housing. Remove opposite end of pivot bracket from torque shaft.
13. Since the rear engine mounts are located on the clutch housing, be sure to support engine before removing clutch housing.
14. Remove clutch housing-to-cross member bolts, then the cross member-to-frame bolts and drop cross member from frame.
15. Jack engine down approximately three inches so that clutch housing is far enough away from floorboard to permit removal of housing capscrews. Then remove capscrews and housing.
16. Remove clutch from clutch driving plate. Use care to avoid spilling oil on the clutch disc.
17. Pull clutch driving plate and converter support plate from converter and flywheel housing.
18. Remove six screws attaching drive plate to converter and remove converter.

TORQUE CONVERTER, INSTALL

1. Mount converter to converter drive plate, taking care to match the offset screw hole in the converter with the offset hole in the drive plate. Install the six attaching screws *finger tight*.
2. Line up the two slots in the pump pinion gear so that they will index with the two oil pump drive lugs on converter when converter support plate and driving plate are assembled to converter.
3. Assemble support plate and clutch driving plate to the converter so that the external splines on the turbine shaft will index with the internal splines of the turbine in the converter, and so that the external splines on the stator shaft will index with the internal splines of the stators in the converter.
4. If difficulty is experienced in indexing these parts, rotate the converter while pushing in on support and clutch driving plates. Under no circumstances should the clutch housing-to-flywheel housing capscrews be installed until after the face of the support plate is flush with the flywheel housing; otherwise damage will result.
5. Hold converter support plate and clutch driving plate up in proper position and tighten the converter-to-drive plate capscrews.
6. Complete the installation in the reverse order of removal.

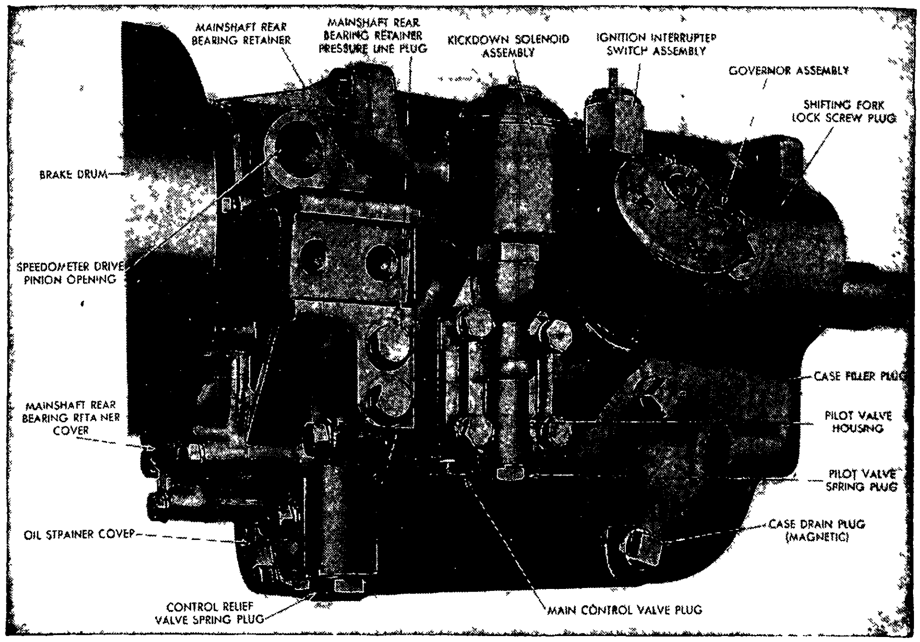


Fig. 63 Hydraulic-operated transmission, showing external controls. 1946-48 Chrysler and De Soto

HYDRAULIC-OPERATED TRANSMISSION

CHRYSLER & DE SOTO 1946-52, DODGE 1949-52

Known as the Prestomatic Fluid Drive on Chrysler, Tip Toe Shift on De Soto and Gyromatic Drive on Dodge, the actual transmission and hook-up are identical on all three cars.

All these units use a manual control (shift lever) for reversing and for the selection of forward speed ranges. Two forward automatic speed ranges are provided. Shifts are automatic between first and second and between third and fourth ratios, but requires manual shifting between low and high ranges.

The gearshift lever has four positions: namely, High Range, Low Range, Reverse and Neutral. Reverse and neutral positions are conventional, while high and low-range positions occupy the places of high and second in conventional three-speed gearboxes. All designs use a fluid coupling in conjunction with a conventional pedal-operated clutch. Normally, 98 per cent of the driving, including starting, can be accomplished with the shift lever in high range.

With the shift lever in "high" or driving range, the car starts in third, and at approximately 14 mph or more, momentary release (about one second) of the accelerator allows the transmission to shift automatically into high, or fourth, speed. An automatic downshift from fourth to third occurs when the car speed drops to about 12 mph or less.

Shifting is accomplished by springs and hydraulic pressure. Supplementary automatic controls include a speed-sensitive governor, kickdown and ignition interrupter switches, and a transmission-operated oil pump.

The 1949-52 transmission is fundamentally the same type as the 1946-48 unit but its design and electrical circuit has been simplified. Mechanical changes include the use of a combination of a ball check valve, a shuttle valve and relief ports in the shift cylinder to replace the main valve, pilot valve, and pressure relief valve used in 1946-48 models. In addition, a "gerotor" type pump, mounted directly on the mainshaft, replaces the gear-driven pump used formerly.

Changes to simplify the wiring circuit include the elimination of the kickdown relay and the use of an automatic resetting circuit breaker instead of a fuse.

Mechanical aspects of these transmissions differ from conventional transmis-

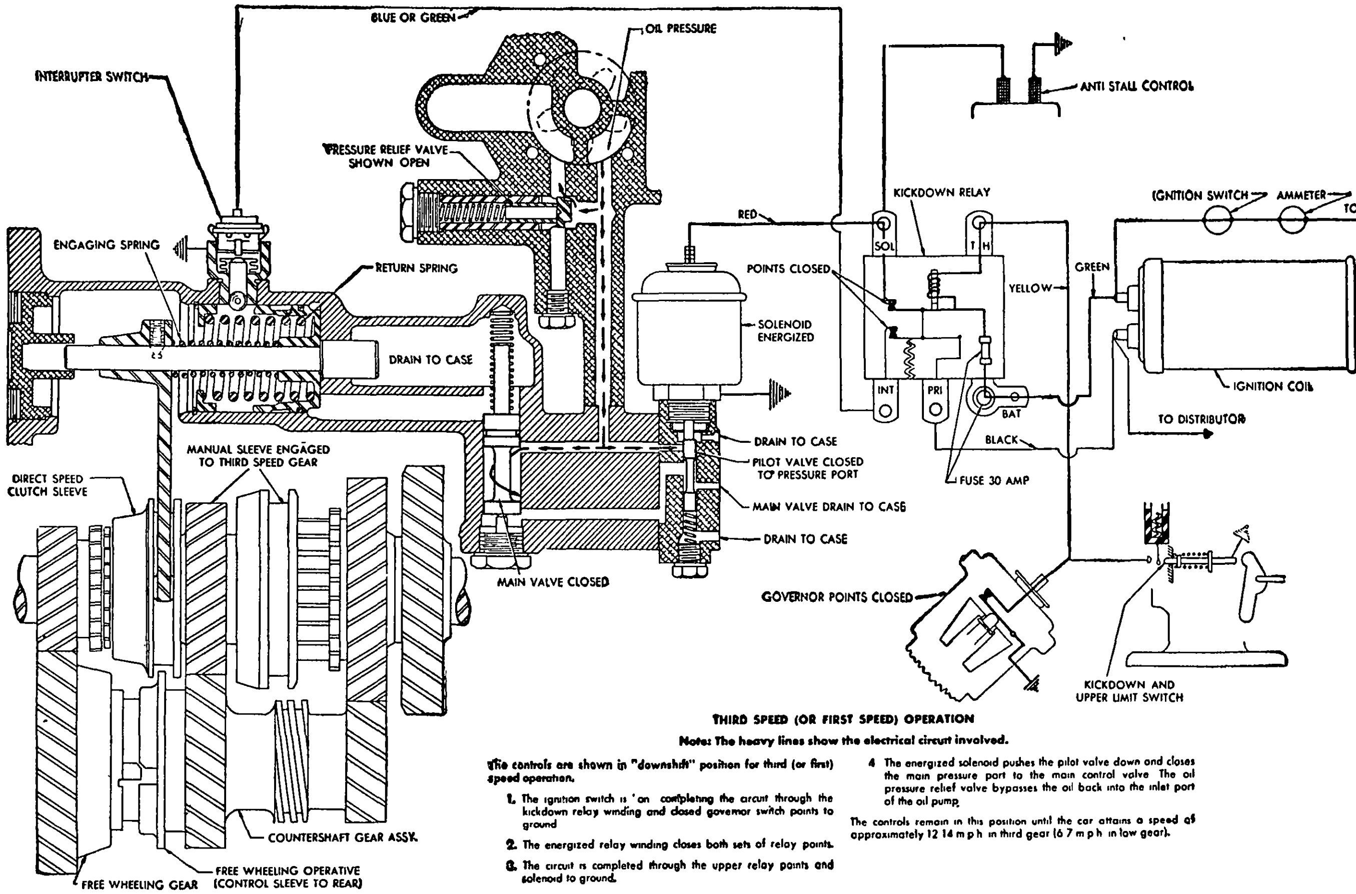


Fig. 64 Showing low range operation of hydraulic-operated transmission. 1946-48 Chrysler and De S t

sions in the fact that a free-wheeling feature is built into the front gear of the countershaft. The free-wheeling rollers cannot engage when the direct-speed clutch sleeve is moved forward or engaged with the main drive gear.

CONTROL SYSTEM

In describing the control system, the terms "upshift" and "downshift" are used to indicate the automatic engagement or disengagement of the direct speed clutch sleeve and main drive gear.

The force which actually moves the direct speed sleeve is supplied by the pressure of two springs. Hydraulic pressure is used to compress these springs.

Enclosed within the transmission is a chamber containing a piston and two springs. The piston slides on the direct speed shift rail which also moves and actuates the shift fork. When hydraulic pressure is applied, the piston moves forward on the shift rail until it is stopped by a retainer ring. The return spring is compressed and remains energized; it has no part whatever in the upshift.

The engaging spring is also compressed against the shift fork which causes the shift rail, fork and direct speed sleeve to move forward until the blocker ring contacts the main drive gear. As the accelerator is released and synchronization occurs, the continued pressure of the spring completes the engagement.

When the hydraulic pressure is relieved back of the piston, the return spring pushes the piston, shift rail and direct speed sleeve back to the downshift position.

The hydraulic pressure to operate the piston is provided by an oil pump inside the transmission, and the pressure is controlled by valves.

On 1946-48 units, an electric solenoid operates the pilot valve and the solenoid circuit is controlled by a relay and automatically-operated governor switch (see Figs. 63, 64, 65, 66).

On 1949-52 units, an electric solenoid operates a ball-type check valve to regulate hydraulic pressure and effect shifts (see Figs. 67, 68, 69).

Figs. 68 and 69 illustrate the relative position of the gears in the gearbox. Although these illustrations are specifically the 1949-52 design the same arrangement holds true for 1946-48 units. The mainshaft carries the main drive gear, direct-speed clutch sleeve, mainshaft third speed gear, manual clutch sleeve, first speed gear and a reverse gear. The countershaft carries a free-wheeling gear, a free-wheeling gear control sleeve, countershaft third gear, governor gear and countershaft first gear.

It should be borne in mind that the direct-speed clutch sleeve is the only unit that shifts back and forth automatically. When it is moved forward, as in second and high, a collar on the direct speed sleeve forces the free wheel control sleeve on the countershaft forward to effect free wheeling. Movement of the clutch sleeve and free wheel sleeve rearward, as in third and first speeds, results in the cam and roller type free wheel unit engaging its rollers to drive the countershaft.

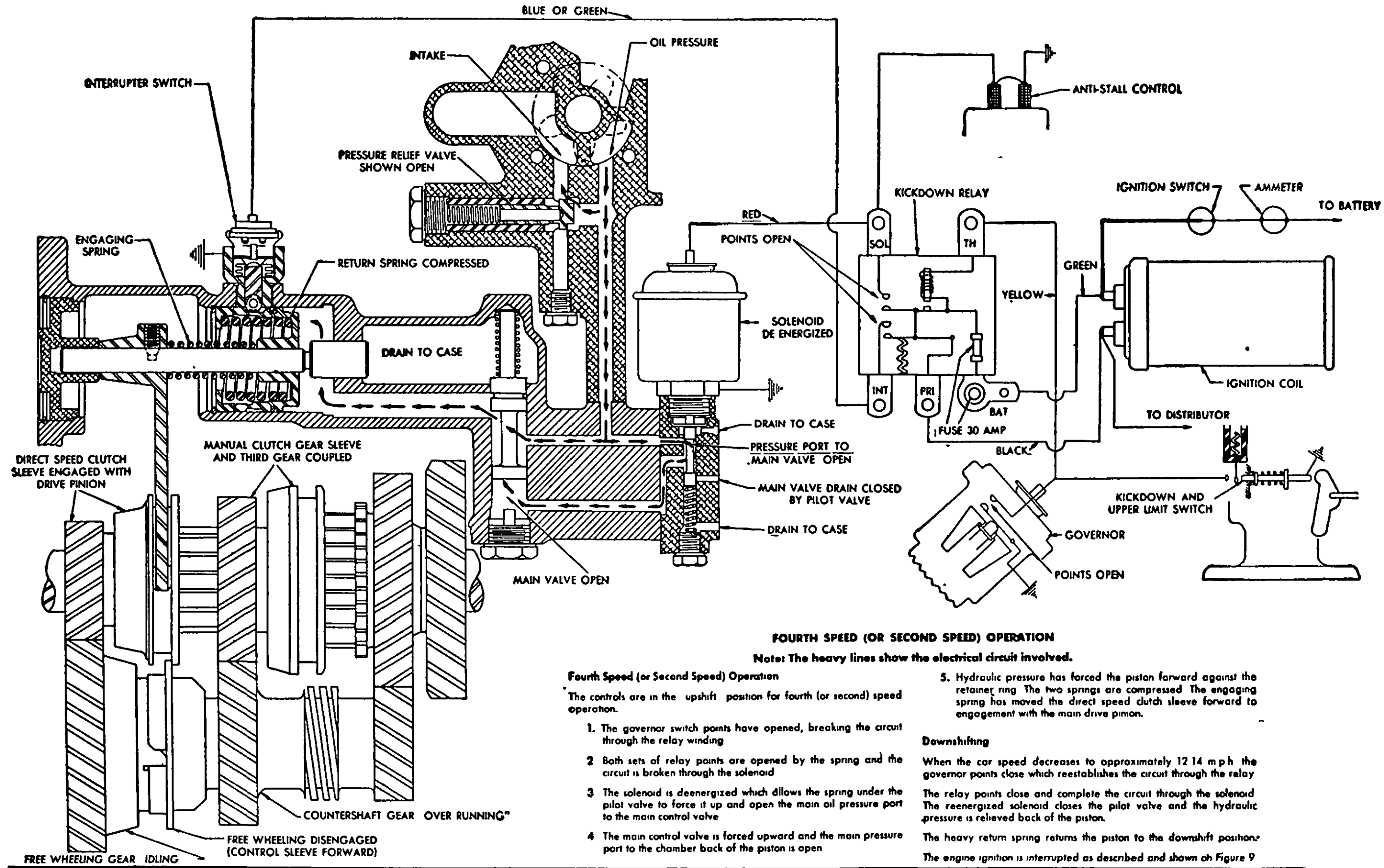
The manual clutch sleeve is controlled by movement of the gearshift lever and selects either low or high-range operation.

DIAGNOSIS & TESTS

Owing to the closely coordinated action of controls, a complete check of the entire system is recommended. Any condition which may develop can usually be segregated into one of three classifications: Electrical, hydraulic, or mechanical.

Before attempting any diagnosis or tests, be sure the transmission has the correct quantity of No. 10-W engine oil, which is the recommended all-season lubricant. Since the oil pump is driven by the transmission mainshaft, there is hydraulic pressure only when the mainshaft is turning, such as when driving or running the car on a free-wheel lift with the transmission in a forward speed. There is no oil pressure in reverse gear.

For proper synchronization and shifting, it is also essential that the engine idle smoothly at approximately 450 to 475 rpm with the shift in neutral and the throttle linkage working smoothly. Each test should be repeated several



FOURTH SPEED (OR SECOND SPEED) OPERATION

Note: The heavy lines show the electrical circuit involved.

Fourth Speed (or Second Speed) Operation

The controls are in the upshift position for fourth (or second) speed operation.

1. The governor switch points have opened, breaking the circuit through the relay winding
2. Both sets of relay points are opened by the spring and the circuit is broken through the solenoid
3. The solenoid is deenergized which allows the spring under the pilot valve to force it up and open the main oil pressure port to the main control valve
4. The main control valve is forced upward and the main pressure port to the chamber back of the piston is open
5. Hydraulic pressure has forced the piston forward against the retainer ring The two springs are compressed The engaging spring has moved the direct speed clutch sleeve forward to engagement with the main drive pinion.

Downshifting

When the car speed decreases to approximately 12 14 m p h the governor points close which reestablishes the circuit through the relay

The relay points close and complete the circuit through the solenoid The reenergized solenoid closes the pilot valve and the hydraulic pressure is relieved back of the piston.

The heavy return spring returns the piston to the downshift position.

The engine ignition is interrupted as described and shown on Figure 9

Fig. 65 Showing high range operation of hydraulic-operated transmission. 1946-48 Chrysler and De S t

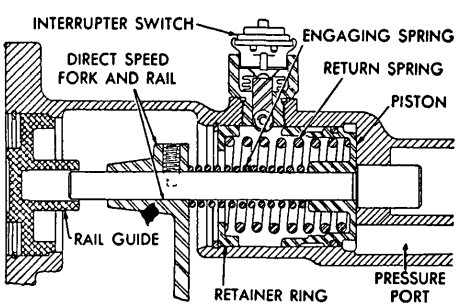


Fig. 66 Shifting mechanism for direct driv n hydraulic-operated transmission. 1946-48 Chrysler and De Soto

times to make sure the result is consistent.

ELECTRICAL TESTS

All electrical tests should be made with a double-lead test light and insulated socket. The lead should, of course, be long enough to reach from the engine compartment to the driver's seat to allow observation of results while road testing. Then raise the right side front floor mat and remove floor-panel access cover over the transmission and inspect wiring and tighten connections.

The tests on the semi-automatic transmission electrical circuit are much the same as those on other circuits. There are about 13 or 14 steps. First check the wire or circuit from the ignition switch to circuit-breaker coil. To do this, connect the test light to the coil side of the circuit breaker, ground the other wire of test light and turn on ignition key. The test bulb should light. If it fails to light, the wire or connections are faulty.

CHECKING CIRCUIT BREAKER, 1949-52 ONLY—The circuit breaker can be tested by connecting the test lamp to the solenoid side of the circuit breaker and grounding other lead while ignition switch is on. Failure of the lamp to light indicates a fault in the circuit breaker. However, if the circuit breaker clicks when test lamp is placed in circuit, it indicates a short in red solenoid or brown anti-stall wire or a short in circuit breaker, solenoid or anti-stall unit. Check cause and correct condition.

The next step is to check from the circuit breaker to solenoid. Here the test light is connected to the red wire terminal of the solenoid, the other lead grounded and the ignition switch on. If the bulb fails to light, the wire or connections are at fault.

The circuit is further traced from circuit breaker to anti-stall device. Hook test lamp to brown wire terminal of anti-stall control and ground second lead. Here again failure of the test lamp to light points to faulty wire or connections.

Anti-stall control is then checked by turning on ignition and placing a steel screwdriver on peened rivet head on top of the anti-stall cover of carburetor. In this instance, a magnetic pull should be felt on the screwdriver. (Be sure the screwdriver has not been previously magnetized.) Failure to feel magnetic pull indicates a faulty anti-stall control which should be replaced.

KICKDOWN RELAY, 1946-48 ONLY—To check the current supply to the relay, connect the test lamp leads to the "BAT" terminal and to ground. The lamp should light when the ignition is switched on. If it does not, inspect the wire and connections from the ignition coil terminal to the relay, and correct as necessary.

To check the operation of the relay, switch on the ignition and connect the test lamp between the "SOL" terminal and ground. The lamp should light. It should stay lighted also when the engine is idling at proper speed. If the lamp does not light, look for a blown fuse or poor fuse connection. If these are found satisfactory, ground the "TH" terminal at the relay. If the lamp still fails to light, the relay should be replaced.

With the test lamp connected between the "SOL" terminal and ground, increase the engine speed. If the light remains on, the relay points are not opening. Remove the wire from the "TH" terminal; if the lamp still fails to go out, the relay points are sticking.

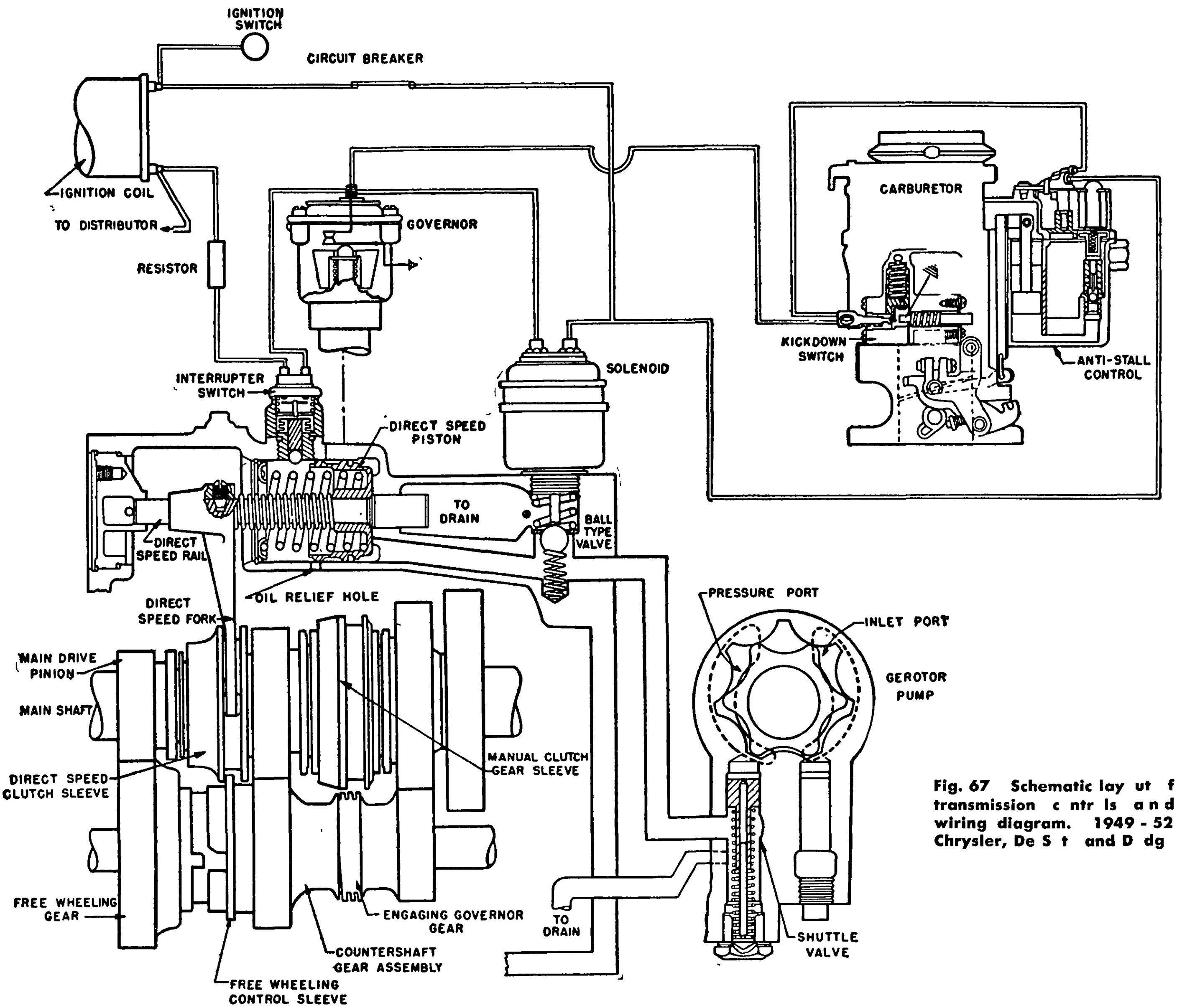


Fig. 67 Schematic lay ut f transmission c ntr ls a n d wiring diagram. 1949 - 52 Chrysler, De S t and D dg

In the remaining tests of the relay, no test lamp is needed although it may be left connected between the "SOL" terminal and ground. Now, with the engine idling, ground the "INT" terminal, at which time, the engine should stall. If it does not, the interrupter circuit points in the relay are not functioning. Start the engine again and ground the "PRI" terminal. If the engine now stalls, the relay point operation is faulty. If the engine will not stall with the "PRI" terminal grounded, the interrupter circuit is open between this terminal and the ignition coil.

SOLENOID CHECKS—Solenoid checks include connecting the test light across solenoid terminals with ignition on. If test lamp lights, it indicates that the circuit to and from the solenoid is complete and operating. Next hold a soft steel tool to the solenoid body and turn the ignition switch on and off. A definite magnetic pull should be felt when the ignition switch is on. Here again make sure the tool has not been previously magnetized. The solenoid should be removed if no pull is felt when the switch is on. When the unit is off, it should be energized by connecting it to a battery independent of the circuit being tested. If functioning properly, the solenoid plunger when energized should move outward and require a 25-lb. push to force it back into the solenoid.

GOVERNOR & KICKDOWN SWITCH—The governor and kickdown switch should be the next units tested. Attach test lamp to terminal on top of governor and hook other test lead to red wire terminal of solenoid. If the ignition is on, the lamp should light to indicate the governor points are closed.

Additional governor and kickdown tests require that both rear wheels be off the ground, engine running and transmission in high gear. Then accelerate car speed to approximately 14 mph. At this point, the light should go out and light again when speed is dropped to about 12 mph. This will indicate a satisfactory operating governor. While the wheels are still off the floor accelerate to between 15 and 40 mph and push in the kickdown switch by hand. Here again, the light will go on if the switch is operating satisfactorily.

ADDITIONAL TESTS — While the wheels are off the ground, the engine running and transmission in high range, make these additional tests as required: First check interrupter switch. To do this remove the blue or green (whichever is present) wire from the interrupter switch and connect one wire of the test lamp to the switch. Attach the other wire of lamp to red wire terminal of solenoid. Then accelerate and decelerate between 8 and 15 mph. During deceleration from about 12 to 10 mph, the test lamp should glow faintly. This can best be seen by hooding test bulb with the hand.

The final electrical check is that of testing the ignition interrupter resistor. While the engine is running, ground the blue wire on the resistor or at the in-

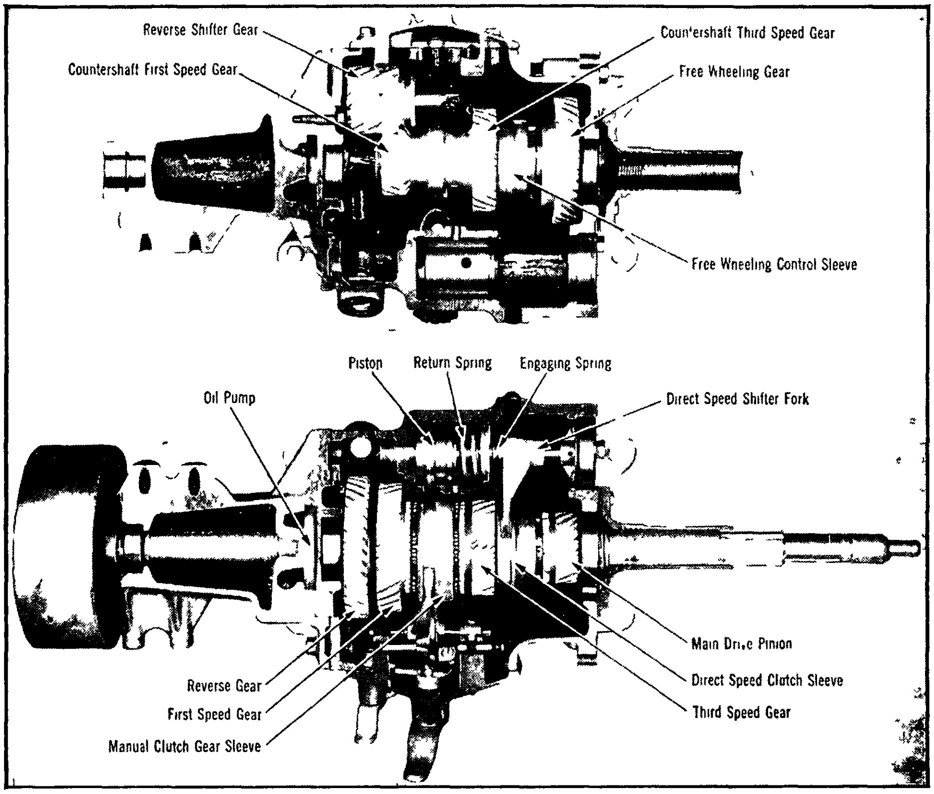


Fig. 68 1949-52 automatic transmission sliced in half. Top half of gearbox shown at bottom

terrupter switch. This should stall the engine. If the engine continues to run, the blue wire from interrupter switch to resistor, the resistor itself or the blue wire from the resistor to the coil is at fault.

If the test light check of the circuit has shown correct indications and the electrical functions have proved satisfactory proceed to test hydraulic system.

HYDRAULIC TESTS

It should again be pointed out that it is necessary to make certain the transmission has the correct amount of 10-W oil before testing action of hydraulic piston.

To check hydraulic pressure, remove floorboard access cover and disconnect the two wires at the interrupter switch. Take off the interrupter switch and jack up the car so that both rear wheels are off the floor. Then start the engine and engage the transmission in the low range.

Accelerate the engine to about 8 mph and watch the piston through the interrupter-switch hole. The piston should move forward just enough to cover the hole completely at 8 mph in low range, indicating the correct 38 to 40 lb. per sq. in. hydraulic pressure. Failure of the piston to move forward at 8 mph in low range, indicates that the piston is either stuck or worn or that the pump is faulty.

TRANSMISSION SERVICE, 1946-52

REMOVE & INSTALL TRANSMISSION

1. Remove floorboard access cover.
2. Remove wires from governor, solenoid and interrupter switch.
3. Remove governor, solenoid and interrupter switch and install plugs in the holes to prevent dirt entering transmission case.
4. Disconnect speedometer cable at transmission.
5. Disconnect hand brake cable at brake band and remove cable anchor bracket.
6. Disconnect front universal joint and push back yoke.
7. Remove brake support, brake band, brake adjusting bolt bracket and lever as a unit.
8. Disconnect gearshift operating and selector rods at transmission.
9. Drain oil from transmission. Be sure to reinstall plug.

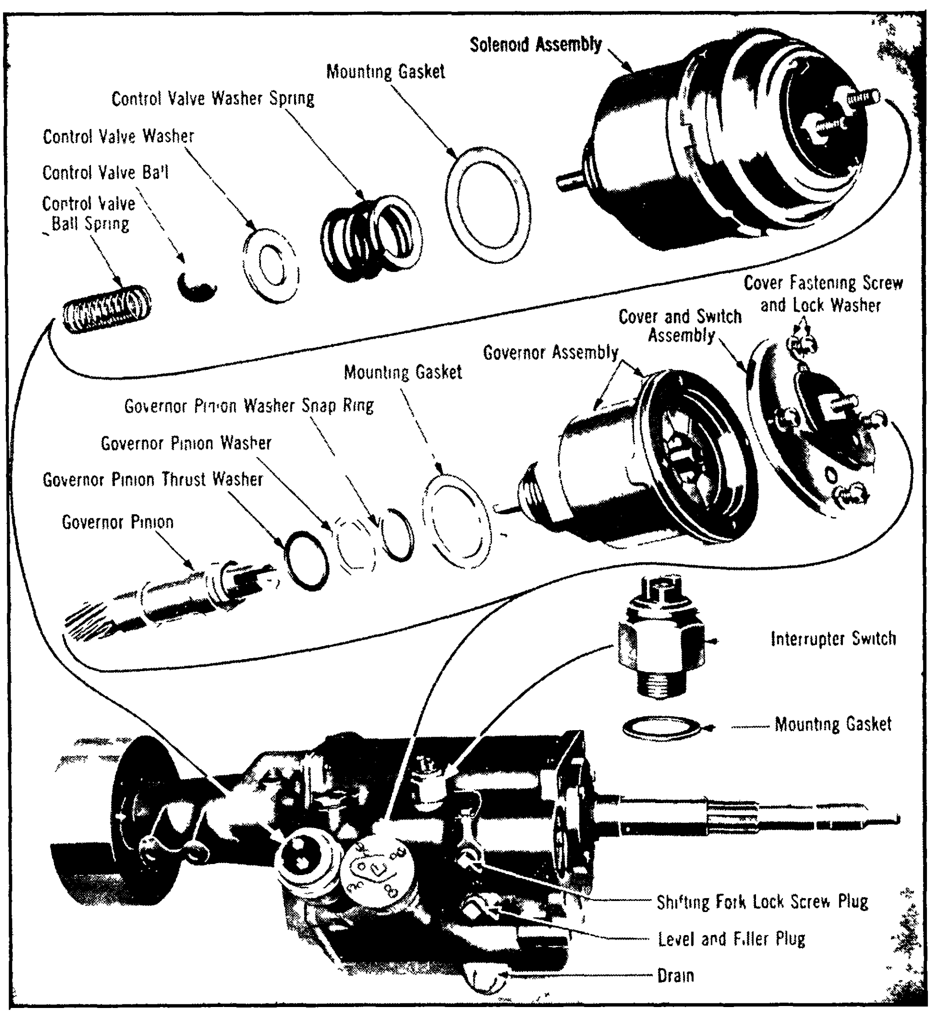


Fig. 69 1949-52 automatic transmissi n c ntrols. Transmission-driven, speed-sensitiv g vern r and accelerat r p dal manipulati n det rmines speed at which shifts ccur up r d wn. S lenoid perat s hydraulic valve that controls acti n f shift cylind r. Int rrupter switch m m ntarily sh rts igniti n to facilitate shifts d wn t a lower gear.

10. Remove transmission-to-clutch housing attaching stud nuts.

11. Remove transmission from car.

12. With long nose pliers, remove governor drive pinion gear.

13. Reverse the order of the above procedure to install the transmission.

REMOVE & INSTALL GEARSHIFT HOUSING—

1. Position gearshift controls in neutral and remove capscrews and housing assembly.

2. To install, slide reverse idler gear forward and position main clutch gear sleeve in neutral. Install cover and gasket. Tighten capscrews with a torque wrench to 10-15 lbs. ft.

REMOVE & INSTALL BRAKE DRUM AND PROPELLER SHAFT FLANGE—

1. Remove gearshift control cover as outlined above.

2. Slide reverse idler gear and manual clutch gear sleeve back. This will lock mainshaft so it cannot be turned.

3. Remove nut, external tooth lock washer and flat washer from hand brake drum and propeller shaft flange.

4. Using a suitable puller, remove propeller shaft flange and brake drum as shown in Fig. 70.

5. To install, first see that reverse idler gear and manual clutch gear sleeve is back. Install brake drum and flange on mainshaft. Install flat washer, lock washer and nut. Torque tighten nut to 95-105 lbs. ft.

6. Install gearshift cover as already outlined.

REMOVE & INSTALL MAINSHAFT—

1. Remove brake drum as outlined above.

2. Unfasten extension housing from transmission case and remove housing and mainshaft as a unit, Fig. 71.

3. Remove extension housing-to-case gasket.

4. To install, first be certain that free wheeling control sleeve is back toward rear of case, Fig. 71.

5. Position blocker ring in direct speed clutch sleeve with large end of taper forward and anchor lugs back.

6. Apply a light coating of grease to both the direct speed blocker spring and spring washer, Fig. 71; this will assist

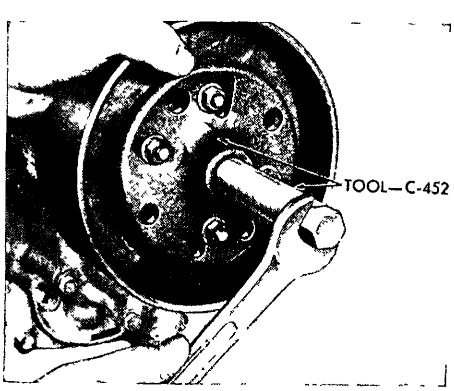


Fig. 70 Rem ving pr peller shaft flange. 1946-52 aut matic transmissi n

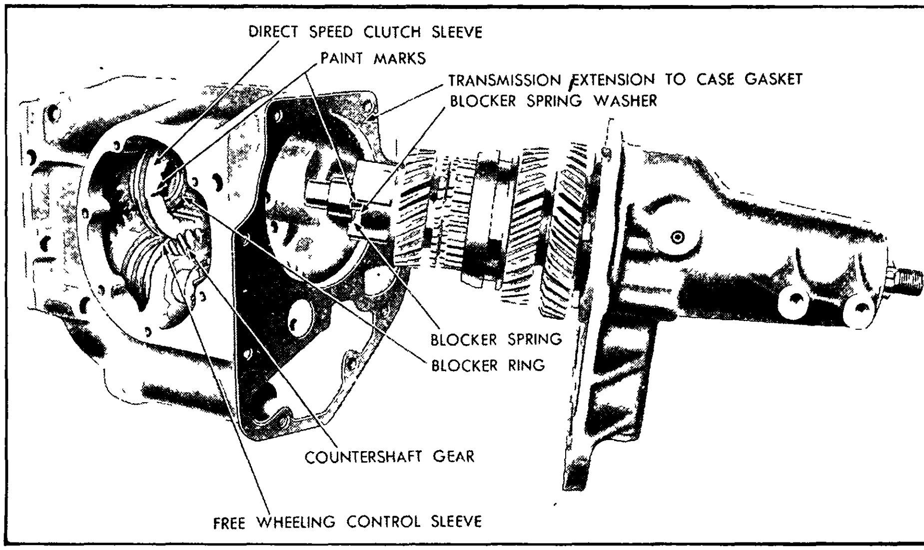


Fig. 71 Mainshaft and extension housing removed. 1946-52 automatic transmission

in holding both in place when installing mainshaft.

CAUTION—It will be noted in Fig. 71 that the direct speed blocker sleeve and third and direct speed gear each have a dye or paint mark. Should it be necessary to replace one or both of these gears, the gears should be marked with paint after selecting the proper position that will allow approximately .005" minimum backlash and install as shown in Fig. 71. Be sure that the teeth of the third speed gear are indexed in the center tooth of the speed clutch sleeve.

7. After mainshaft and extension housing have been installed, torque tighten capscrews to 30-35 lbs. ft.

8. Install remaining component parts.

REMOVE & INSTALL REVERSE IDLER GEAR—

1. Remove mainshaft and extension housing as outlined above.

2. Using a suitable puller, Fig. 72, remove reverse idler gear shaft and gear, being careful not to lose shaft key.

3. To install, position reverse idler gear in case. Align shaft and key with cutout in case and drive shaft in place, using a soft mallet.

4. Reinstall mainshaft as already outlined.

NOTE—Reverse idler gear shaft may be removed any time after the mainshaft has been removed.

DISASSEMBLY OF MAINSHAFT—Figs. 73, 74.

1. Remove speedometer driven gear.

2. Press mainshaft out of extension housing.

3. Remove direct speed blocker spring and washer.

4. Clamp mainshaft upright in a vise, holding it by the rear and just below the speedometer drive gear.

5. Remove third and direct speed gear snap ring.

6. Remove third and direct speed gear, being careful not to lose third speed gear bearing rollers, spacer, bearing front thrust washer and third speed gear needle bearing washer.

7. Remove third and direct speed gear rear thrust washer and clutch gear synchronizer snap ring.

8. Remove clutch gear synchronizer stop ring.

9. Remove clutch gear sleeve as a unit.

10. Remove clutch gear rear synchronizer stop ring.

11. Remove first speed gear front thrust washer, first gear and rear thrust washer.

12. Reverse mainshaft in the vise and remove inner oil pump rotor pin (1949-51 units) and rear bearing snap ring.

13. Press rear bearing and reverse gear off mainshaft.

ASSEMBLY OF MAINSHAFT—Figs. 73, 74.

1. Install reverse gear and press on rear mainshaft bearing. The rear bearing snap ring should be the thickest that can be used to obtain minimum end play. These snap rings are available in thicknesses of .087", .093" and .098".

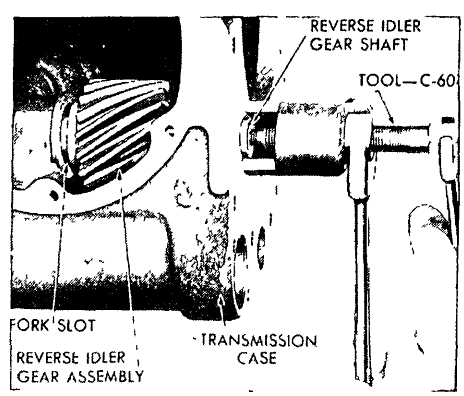


Fig. 72 R moving r verse idler gear shaft. 1946-52 aut matic transmissi n

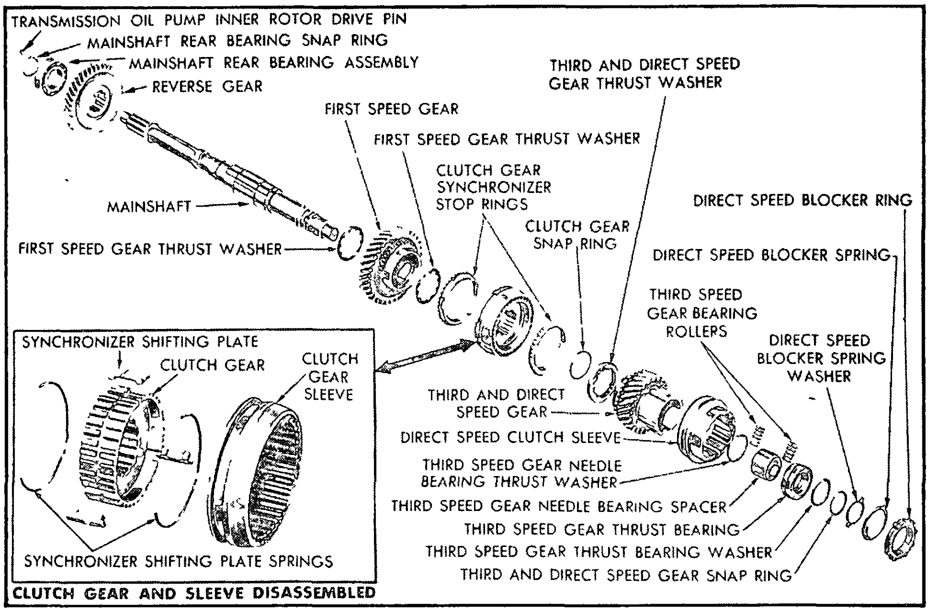


Fig. 73 Layout of mainshaft parts. 1949-52 automatic transmission

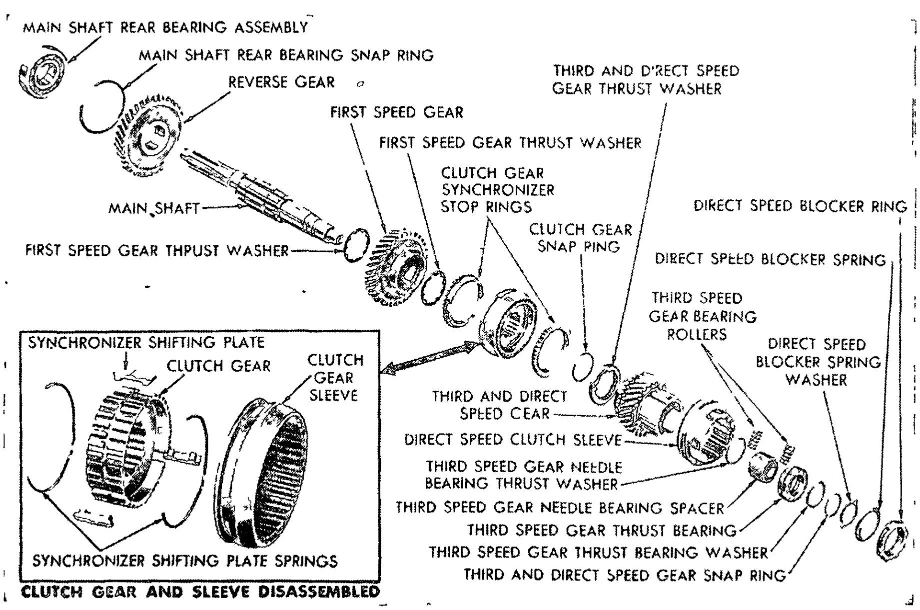


Fig. 74 Layout of mainshaft parts. 1946-48 automatic transmission

2. Place mainshaft in vise, front end up, and assemble mainshaft parts in the reverse order of removal, referring to Figs. 73 and 74. Measure end play between third speed gear bearing thrust washer and snap ring. The end play should be .003-.008" and is controlled by snap rings of various thicknesses (.087", .092", .097", .101").

DISASSEMBLY & ASSEMBLY OF OIL PUMP, 1946-48—

1. Remove rear bearing retainer cover.
2. Bend ears of nut lock back and remove oil pump driven gear and key and washer.
3. Remove oil pump drive gear and speedometer drive gear, Fig. 75.
4. Remove oil pump assembly.
5. Reassemble oil pump and mainshaft rear bearing retainer, referring to Fig. 76.

DISASSEMBLY & ASSEMBLY OF OIL PUMP, 1949-52—

1. Remove capscrews attaching rear bearing retainer.
2. Remove bearing retainer and oil pump inner and outer rotors, Fig. 77.
3. Remove shuttle valve retainer plug and valve assembly from transmission extension.

NOTE—The mainshaft rear bearing and snap ring may be removed from the extension housing at this time.

4. To assemble, reverse the order of the above procedure, first making sure that the small hole in the top of the shuttle valve is open.

CAUTION—When assembling the mainshaft in the extension housing, extreme care must be exercised to see that the mainshaft rotor pump drive pin is properly aligned with the slot in the oil pump inner rotor. When properly assembled, press the bearing on the mainshaft in the extension housing bearing retainer.

REMOVE & INSTALL DIRECT SPEED GEARSHIFT RAIL & PISTON—

1. Remove mainshaft as already described.
2. Remove direct speed blocker ring.
3. Remove plug from upper right hand side of transmission. Insert a screwdriver in the hole and pry the fork back just far enough to remove direct speed clutch sleeve.
4. Loosen direct speed gearshift fork locking screw until fork is forced ahead by the engaging spring. Gock fork on shaft and pull fork toward rear of case; this will work direct speed gearshift rail back.
5. Holding rear of shaft, move fork forward again, cock it and pull toward rear of case again.
6. Repeat until fork, spring and rail can be removed from case.
7. Remove direct speed gearshift rail guide snap ring and guide from front of case.
8. Using a suitable compressing tool, Fig. 78, compress direct speed rail piston return spring and remove snap ring with long nosed pliers.
9. Remove tool, releasing slowly, and remove return spring retainer, spring, piston and rail ring from front of case.
10. Install in reverse manner. It should be noted that the screwdriver slot in rear of direct speed shift rail is off center. This slot must be horizontal in the case with the smallest shoulder toward the side of case. In this way, it is possible to locate the set screw hole in the gearshift rail with the hole in the case.

REMOVE & INSTALL DRIVE PINION

1. Remove mainshaft as already described.
2. Remove governor drive pinion gear.
3. Drive countershaft out through rear of case, using arbor C-716, and drop gear set to bottom of case.
4. Remove drive pinion bearing retainer and gasket.

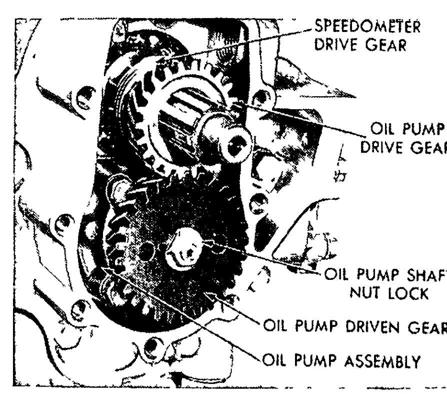
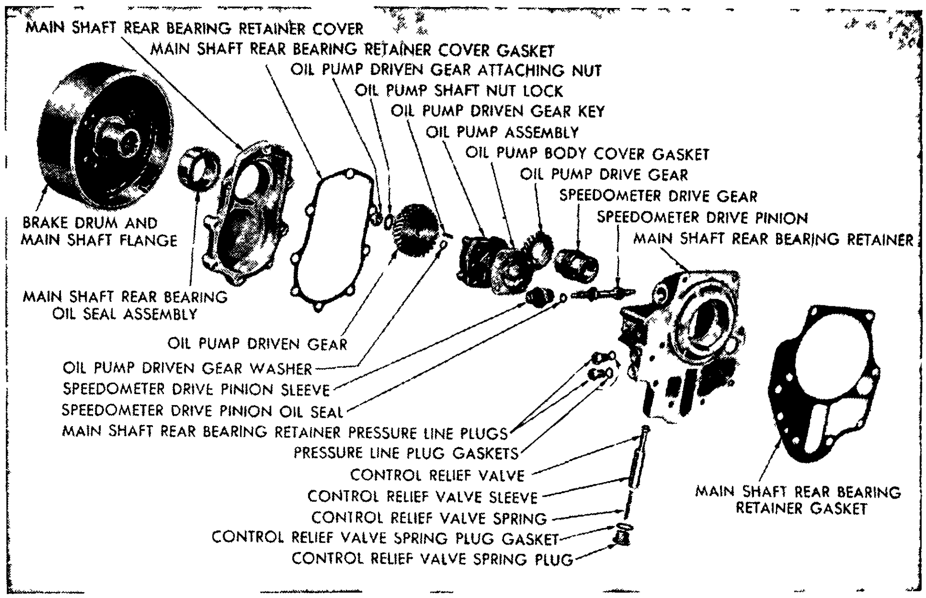


Fig. 75 1946-48 transmissi n il pump

Fig. 76 Mainshaft r ar bearing retainer and il pump parts. 1946-48 automatic transmissi n



5 Pull drive pinion and bearing assembly out of case

6 To install, assemble driven pinion if it has been disassembled, and position it in transmission case

7 Install bearing retainer (without gasket) and secure with capscrews

8 Insert feeler gauge between bearing retainer flange and case to determine clearance at this point

9 Select a gasket of same thickness as indicated by feeler gauge (or nearest oversize), remove retainer, install gasket and reinstall retainer

NOTE—Use rubber gaskets on bearing retainer bolts and tighten securely to prevent oil leaks at this point

REMOVE & INSTALL COUNTERSHAFT—

1 Before removal of the countershaft gear set is possible, the drive pinion must be removed as outlined above

2 The countershaft gear set and arbor can now be removed by lifting the complete assembly straight up and out through opening in rear of case Care must be exercised so as not to lose the bronze washers on either end

3 Install countershaft gear set in bottom of case Then after inserting the drive pinion and bearing, position countershaft assembly, Fig 79, and install shaft in same manner as when removed

4 Measure end play between thrust washer and rear end of case This end play should be 005- 011 and is controlled by various thickness bronze washers for the rear end of the assembly Washers of 087', 090 , 093" and .097" thicknesses are available

5 Secure drive pinion as outlined previously

DISASSEMBLE COUNTERSHAFT—Fig. 80.

1 Place countershaft gear set on end in a clean pan, constant mesh free wheeling gear up

2 Remove bronze thrust washer and bearing washer

3 Slide free wheeling control sleeve up and remove constant mesh free wheeling gear

4 Remove free wheeling cam roller thrust washer

5 Remove free wheeling gear bearing rollers and cam rollers

6 Remove cam roller retainer and springs Use extreme care when removing springs so as not to distort them

7 Remove free wheeling control sleeve and key

8 Remove arbor (C-716), front and rear roller bearings and spacer from countershaft gear

ASSEMBLE COUNTERSHAFT—Fig. 80.

1 Install key and free wheeling control sleeve.

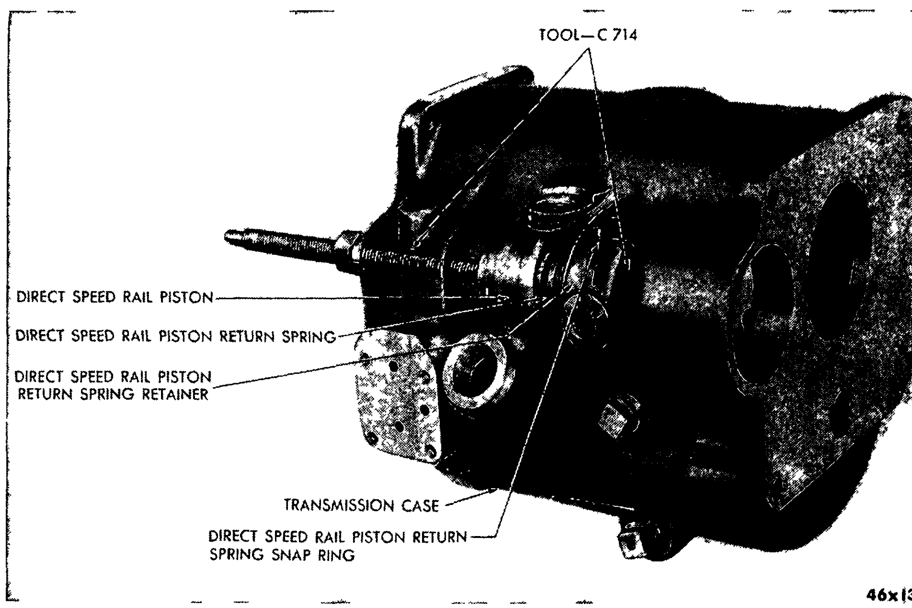


Fig. 78 Compressing tool installed to remove direct speed gearshift rail and piston Typical of all 1946-52 automatic transmissions

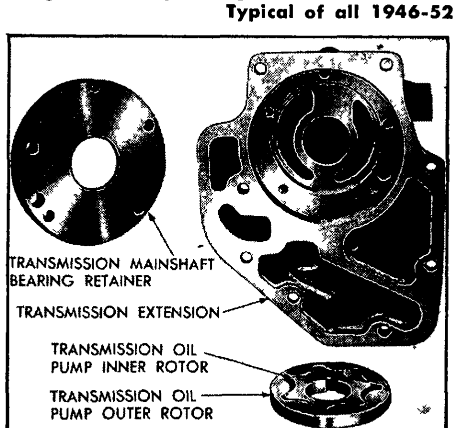


Fig. 77 Oil pump r t rs and mainshaft rear b aring r tain r. 1949-52 aut matic transmissi n

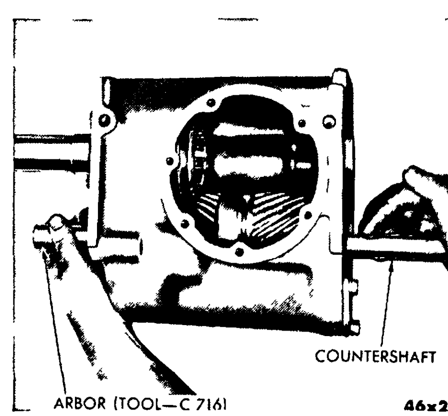


Fig. 79 Sp cial arb r in use f r rem ving and installing c unt rshaft. 1946-52 aut matic transmissi n

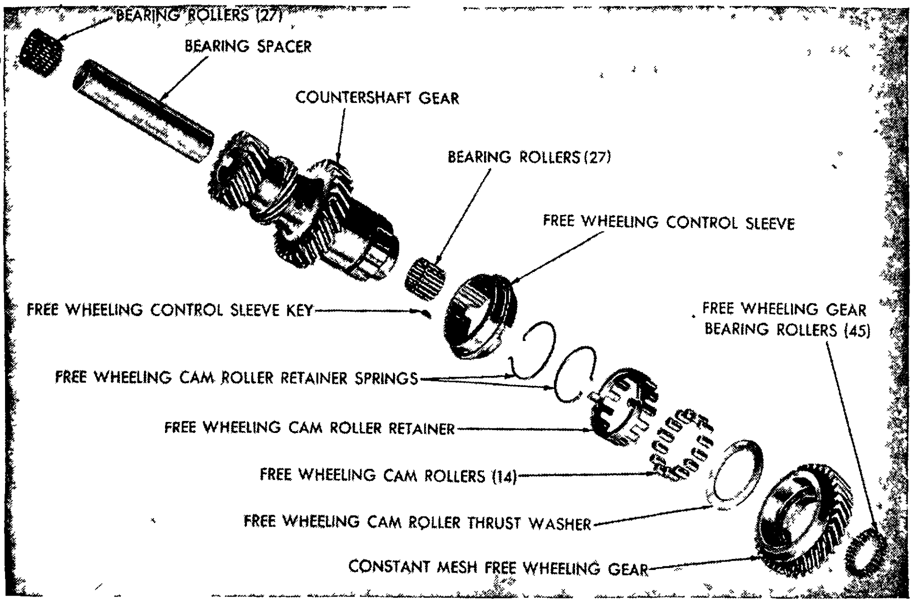


Fig. 80 Layout of countershaft gear and free wheeling parts. 1946-52 automatic transmission

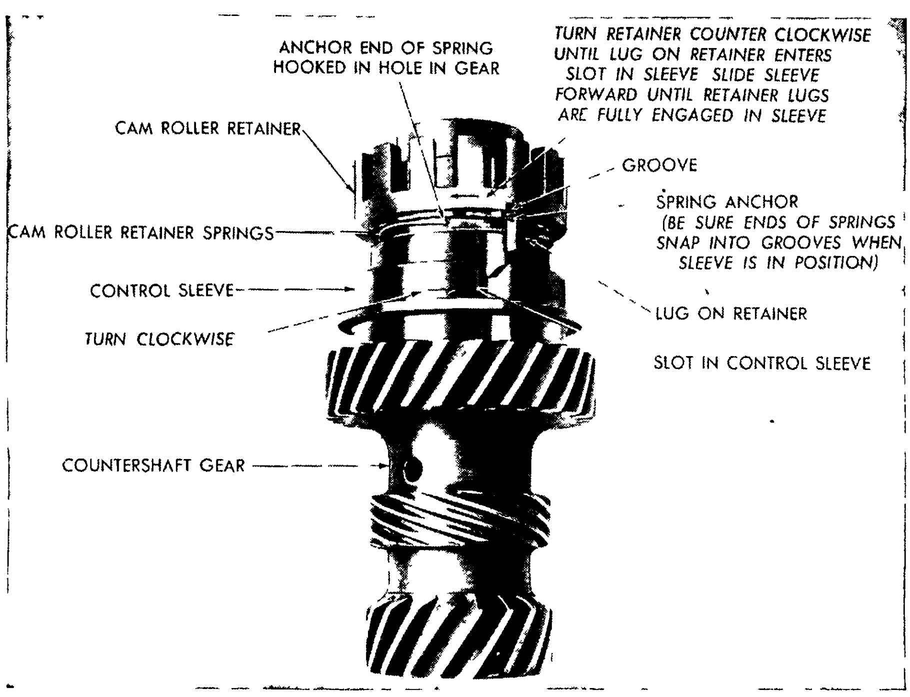


Fig. 81 Installing free wheeling cam roller springs. 1946-52 automatic transmission

2. Hook anchor end of two springs in holes in cluster gear so they wrap in a right-hand direction from anchor end, Fig. 81.

3. Place roller cage over gear with lugs over spring anchors and rotate clockwise until cage lugs are over slots in control sleeve. Be sure ends of springs have snapped into grooves in cage.

4. Slide control sleeve forward until cage lugs are fully engaged in sleeve.

5. Place free wheeling rollers in place, using cup grease to hold them in position, and install thrust washer over rollers.

6. Place free wheeling gear on countershaft gear.

7. Install set of 45 roller bearings between free wheeling and countershaft gear.

8. If countershaft roller bearings have been removed, place special arbor through countershaft gear set and stand assembly on bench with free wheeling gear up.

9. Place 3 or 4 rollers in bottom of the hole. Install countershaft bearing spacer and set of 27 roller bearings in front end of countershaft. Then install countershaft gear bearing washer and front

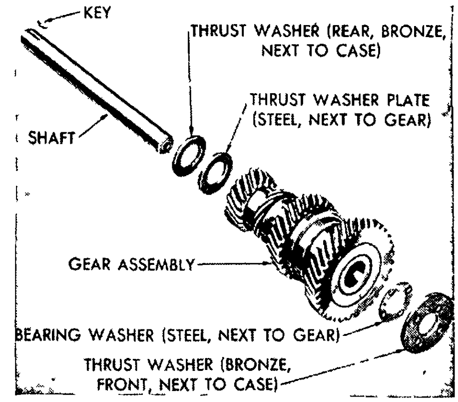


Fig. 82 Countershaft gear assembly and thrust washers. 1946-52 automatic transmissi n

thrust washer.

10. Turn countershaft assembly over and stand it on its forward end.

11. Install set of 27 rollers in rear end of gear. Then place steel thrust plate next to cluster gear.

12. Place countershaft assembly in bottom of case, being sure to keep thrust washers in place, Fig. 82.

NOTE—Do not install countershaft until drive pinion has been installed in case.

13. Allow arbor to enter front hole, Fig. 79, and slide rear bronze thrust washer between steel washer and case.

NOTE—The cluster gear end play should be .002" to .008", measured with a feeler gauge between thrust washer and case at the rear. Different thickness bronze washers are available (.087", .090", .093" and .096") for obtaining proper end play.

LUBRICATION—Drain and refill to the bottom of the filler plug hole every 10,000 miles or once a year. Use No. 10-W engine oil regardless of climatic conditions.

The capacity of the transmission for an oil change is 3 pints. However, if the transmission extension housing has been removed and drained for any reason, add an additional ½ pint to the 3 pints previously specified. The additional ½ pint will work its way back to the extension housing after the transmission has been in operation for approximately 5 minutes.

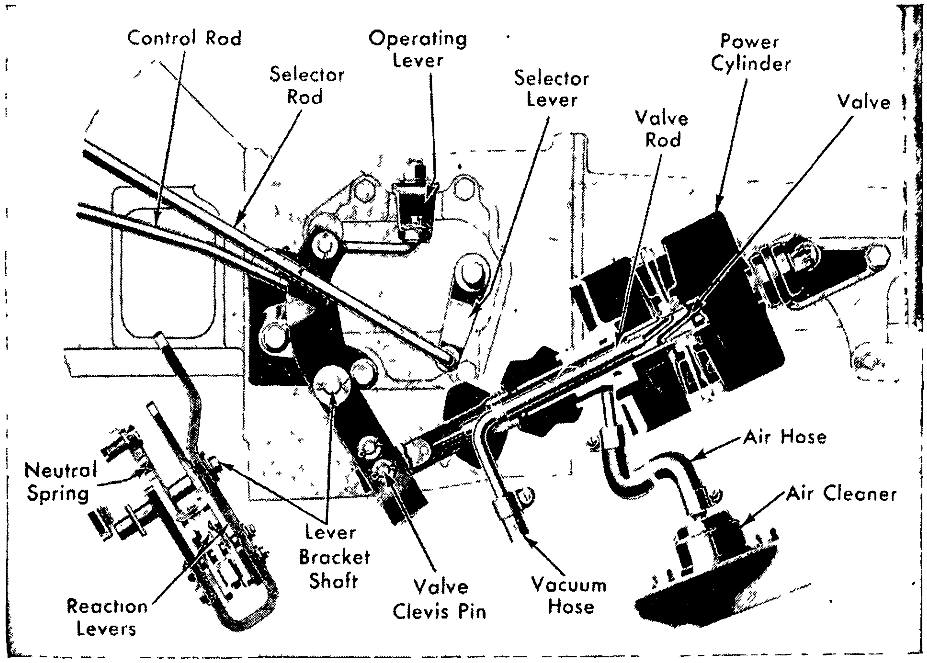
GEARSHIFT

SHIFT CONTROL ROD, ADJUST

1939 Chrysler, De Soto, Dodge, Plymouth—Disconnect the control rod from the shift lever at the transmission Set the hand control lever and transmission gears in neutral. Adjust the length of the rod by turning its threaded end up or down into the adjustable joint until the rod slips freely into the lever when the lever is held toward the rear of the transmission.

1940 Chrysler, D Soto, Dodge, Plymouth — To adjust the control rod on these models, loosen the lock bolt which fastens the lever on the lower end of the steering column. Set the transmission gears in neutral and position the

Fig. 85 1941 vacuum p wer shift. Typical f 1942



hand control lever 10 degrees above the horizontal and tighten the lock nut.

1941-52 With Manual Shift—To adjust the control rod on cars with standard three-speed transmission, loosen the lock bolt at the upper level on the lower end of the steering column. Set the transmission gears in neutral and the hand control lever in a horizontal position and tighten the lock bolt.

SHIFT SELECTOR, ADJUST

1939 Chrysler, De Soto, Dodge, Plymouth — Loosen the clamp screw at the steering column end of the cable. Set the hand control lever in neutral and loosen the ferrule screw (just below clamp screw) 'until end play develops between the plunger end of the cable and the clover-leaf plate. Then tighten the screw just enough to eliminate end play. Tighten the clamp screw.

1940 Chrysler, De Soto, Dodge, Plymouth — With the transmission gears in neutral, loosen the lock nut at the transmission end of the cable. Tighten the acorn nut until all play is removed from the cable, then back off ½ turn for clearance, and tighten.

1941-51 With Manual Shift — On cars with standard three-speed transmission, set the transmission gears in neutral and loosen the lock nut on the selector rod at the transmission end. Tighten the nut until all play is removed and back off ½ turn for clearance, and tighten.

POWER SHIFT

VALVE ACTION, ADJUST

1941-42—Fig. 85. To adjust the vacuum cylinder valve, remove the boot and valve clevis pin. Then, if the shift is sluggish into second or reverse, screw the clevis out on the valve rod. If sluggish in first or third speeds, screw the clevis in on the rod.

NEUTRAL POSITION, ADJUST

1941-42 — Remove the selector rod and slacken the detent spring screw in the reaction levers. With engine running to provide a source of vacuum, and with wheels off the ground, move the power lever and links back and forth a very small amount. At the same time, move the selector arm until a clean and positive cross-over is felt in this position. Then move the detent spring so that the boss indexes with the notch in the lever, and tighten the bracket clamp bolt. Finally, connect and adjust the selector rod as described under that heading.

REAR AXLE

1935-52 Chrysler, De Soto, Dodge, Plymouth—Fig. 86 pictures in cross section a typical differential driving unit used on all cars except 1940-50 Chrysler Crown Imperial and all 1951-52 V8 models.

The drive pinion is held in position by the shoulders in the differential carrier

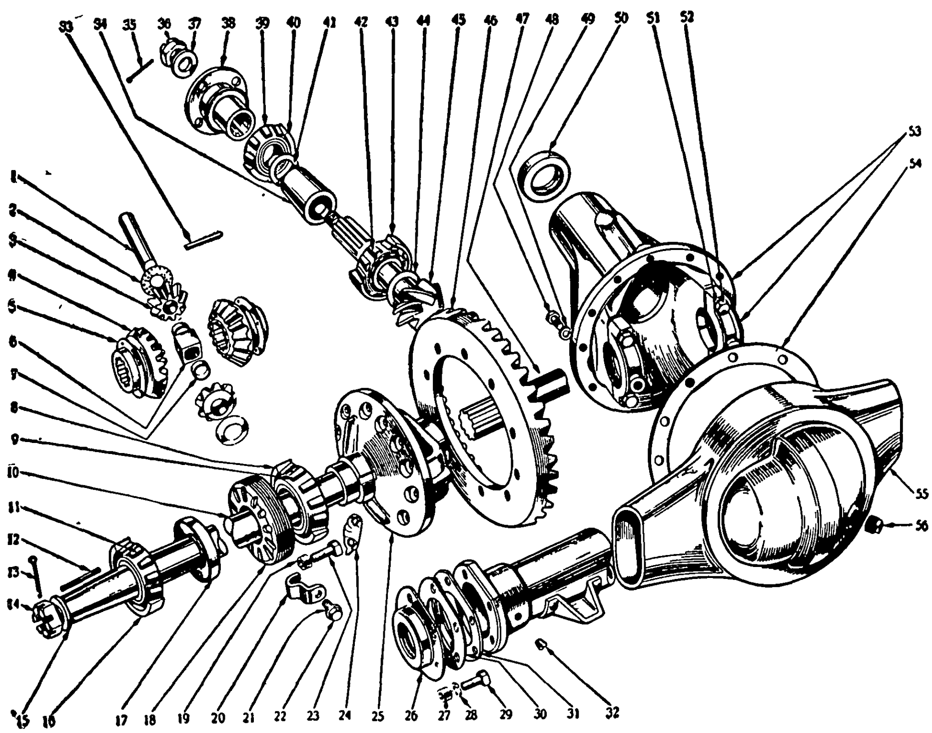


Fig. 87 Rear axle exploded. Typical of all 1935-52 exc pt 1940-50 Chrysler Crown Imperial and all 1951-52 V8 mod ls

1—Pinion shaft
2—Thrust washer
3—Pinion
4—Gear
5—Thrust washer
6—Thrust block
7—Spacer
8—Bearing cup
9—Bearing cone
10—Axle shaft
11—Bearing cone
12—Key
13—Cotter pin
14—Nut
15—Washer
16—Bearing cup
17—Oil seal
18—Bearing adjuster
19—Nut
20—Adjuster lock
21—Lockwasher
22—Lock screw
23—Bolt
24—Nut lock
25—Differential case
26—Oil seal
27—Nut
28—Nut
29—Bolt
30—Gasket
31—Shim
32—Plug
33—Lock pin
34—Spacer
35—Cotter pin
36—Nut
37—Washer
38—Flange
39—Bearing cone
40—Bearing cup
41—Shims
42—Bearing cone
43—Bearing cup
44—Shims
45—Drive pinion
46—Ring gear
47—Axle shaft
48—Screw
49—Lockwasher
50—Oil seal
51—Lockwasher
52—Cap screw
53—Carrier
54—Gasket
55—Housing
56—Plug

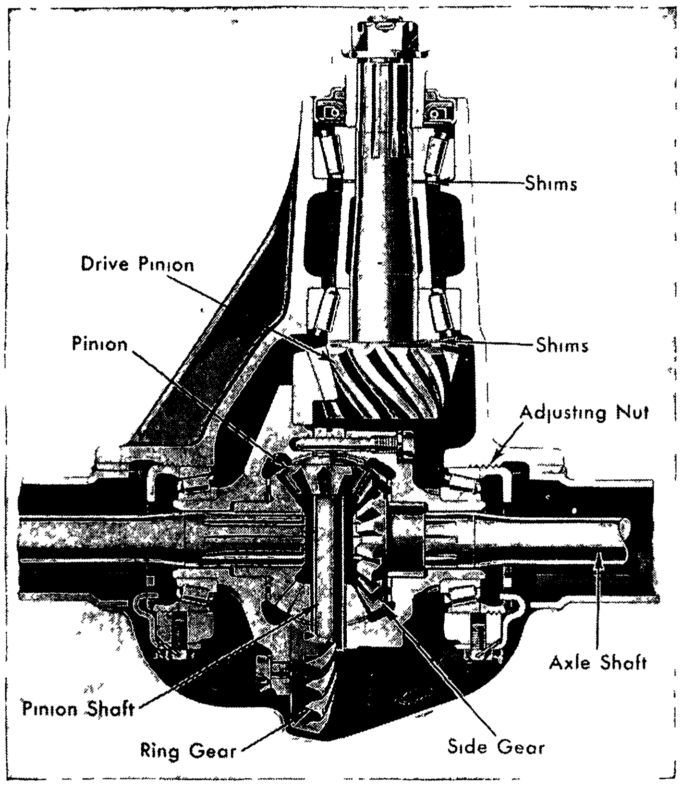


Fig. 86 Rear axle. Typical of all 1935-51 except 1940-50 Chrysler Crown Imperial and 1951-52 V8 models

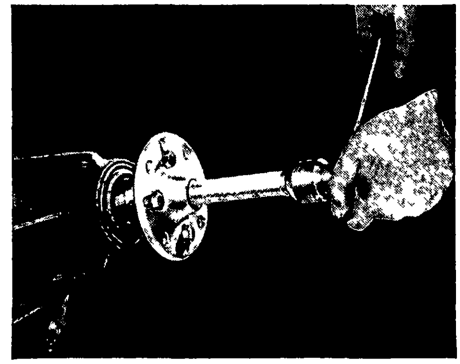


Fig. 88 Removing drive pinion flange, 1935-52

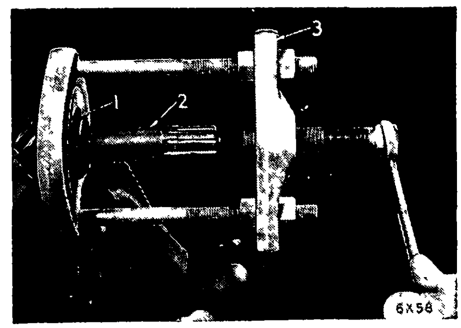


Fig. 89 Removing drive pinion rear bearing, 1935-52. 1. Bearing 2. Pinion shaft. 3. Puller

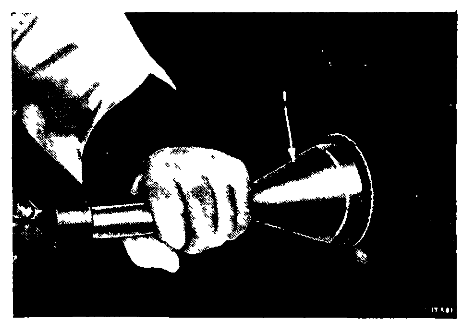


Fig. 90 Installing drive pinion bearing oil seal with special driver (1), 1935-52

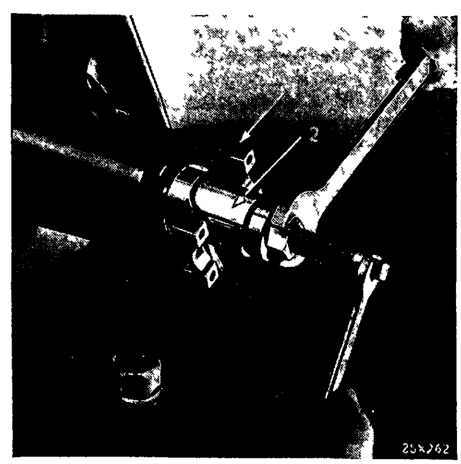


Fig. 91 Installing drive pinion flange (1) with special driver (2), 1935-52

upon which the pinion bearing cups seat. The pinion position is maintained by a washer or shims located between the pinion head and the rear bearing cone. Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

PINION & BEARINGS, REPLACE—The differential unit must be removed before the drive pinion can be taken out, but it is not necessary to remove the drive pinion or differential unit if only the drive pinion bearing oil seal is to be replaced.

To remove the oil seal, take off the pinion flange retaining nut and use a suitable tool, Fig. 88, to remove the flange. The oil seal may then be pulled out of the carrier.

Pull the drive pinion through the gear end of the differential carrier. The bearing spacer, front bearing and shims may then be taken out. Using a bearing puller, Fig. 89, remove the rear bearing cone from the pinion shaft and, unless the ring gear and pinion are to be replaced with new parts, use care not to allow the front and rear shim packs to become mixed.

If the differential unit was satisfactory from the standpoint of noise before the unit was dismantled, the drive pinion may be assembled with the original shims (or washer) behind the rear bearing. If new parts are used or if an adjustment was necessary, change the shims until the correct combination is obtained to locate the pinion properly.

To assemble, place the front bearing in position in its cup and install the pinion shaft oil seal, using a suitable tool, Fig. 90. Place the washer or shims on the pinion shaft against the pinion head and press on the rear bearing. Slip the bearing spacer against the rear bearing, then place the front bearing shims ahead of the spacer. Install the pinion and assembled parts in the carrier, passing the forward end of the pinion through the front bearing. Replace the pinion flange, Fig. 91, slip on the washer, screw on the retaining nut and tighten it securely.

PINION BEARINGS, ADJUST — The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

On 1935-36 models, the bearings should be pre-loaded .004 inch, while on 1937-52, the pre-load should be .0015 to .0025 inch. To check and adjust this pre-load (tension) mount a dial indicator on the carrier with the stem of the indicator contacting the pinion flange. Then if the indicator, for example, shows .004 inch end play, remove the parts including .006 inch of shimming to give the necessary .002 inch draw tension or pre-load on the bearings.

PINION, ADJUST—After adjusting the pinion bearings, the position of the pinion should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle*

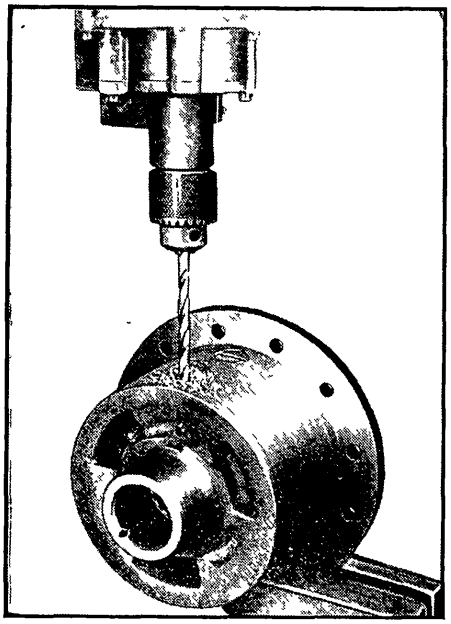
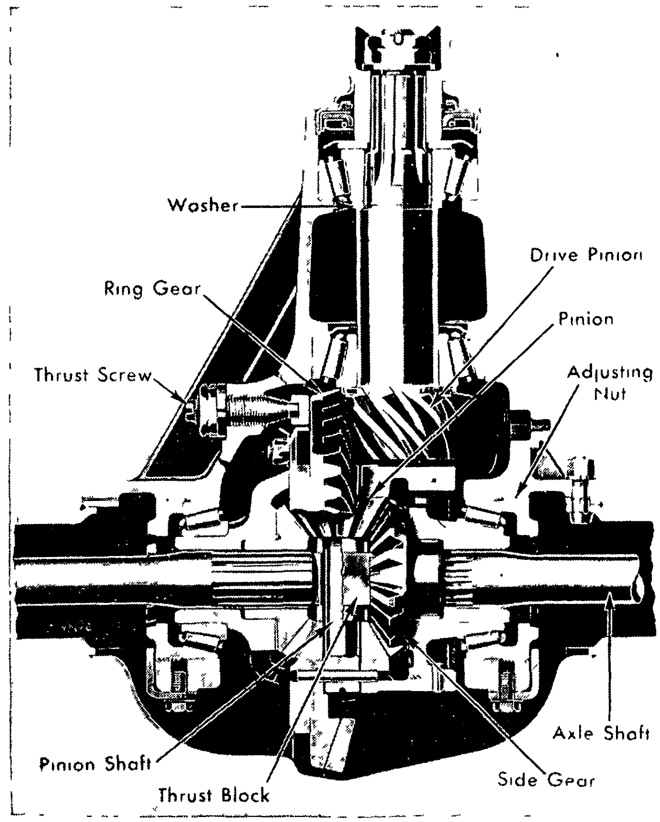


Fig. 93 R moving differential case l ck pin. 1940-50 Chrysler Imperial and all 1951-52 V8 models

Fig. 92 Differential carrier assembly, 1940-50 Chrysler Imperial and all 1951-52 V8s



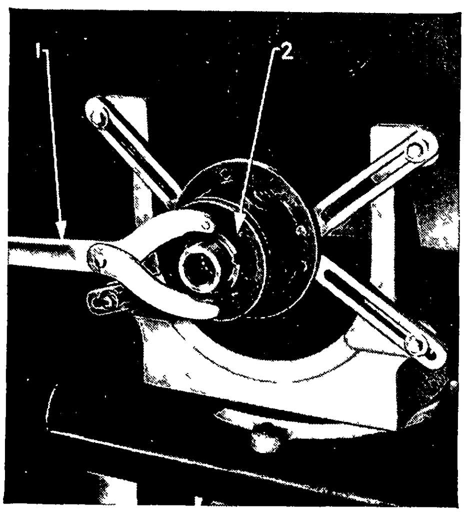


Fig. 94 R m ving differential case cap (2) with spanner wrench (1). 1940-50 Chrysler Imp rial and all 1951-52 V8s

chapter. If a correction is necessary, disassemble the parts and, if the pinion is to be moved toward the center of the axle, add shims or install a thicker washer (whichever is used) between the pinion head and the rear bearing cone. If the pinion has to be moved away from the center of the axle, remove shims or install a thinner washer.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle* chapter. When the adjustment is correct, install a new cotter pin in the pinion retaining nut.

DIFFERENTIAL CARRIER

1940-50 Crown Imperial & All 1951-52 V8s—Fig. 92 shows the differential driving unit employed on the above models. The drive pinion is held in place by the shoulders in the differential carrier, upon which the pinion bearing cups seat. A washer between the shoulder on the pinion shaft and the front bearing cone controls end play in the pinion bearings.

The ring gear and pinion are precision machined when manufactured so that no shims or washers are needed to make adjustments for pinion position.

A thrust pad, which presses against the back face of the ring gear, together with the rigid differential case design, maintain accuracy of mesh between the ring gear and pinion.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as replacing the ring gear and checking ring gear and pinion backlash, is given in the *Rear Axle* chapter.

NOTE—Except for the differential case. all service work is the same as described for the unit used on other Chrysler models.

Differential Case, Overhaul—Mount the differential case ring gear flange in a vise using copper jaws. Remove the bearing from the differential case cap side only. Remove differential case cap locking pins, Fig. 93, by center punching and drilling. Remove shell of pins left in hole with a punch.

Since the cap is a thousandth or two larger than the hole in the case which it fits into, case must be expanded for removal of cap or damage will result.

Heat the case (not cap) by playing a torch around the outside. Keep the flame moving to assure even heating. Try a piece of ordinary solder on case from time to time and when solder just starts to melt, the case is as hot as it can get without damaging inside washers.

When the case is just hot enough to melt soft solder, remove the cap, using a blunt drift and heavy hammer. If the special wrench shown in Fig. 94 is available, jar the cover loose by means of a smart blow on the wrench handle and then unscrew the cap. The parts now can be immersed in oil to cool them for subsequent handling.

Remove the differential pinion shaft lock pin by driving it out of the case with a hammer and punch, Fig. 95. When installing this pin, be sure to peen over the outside edge of the hole to lock the pin in place.

Push the differential shaft out of the differential case. The gears, thrust washers and axle shaft thrust block will then be loose and fall out of the case.

When assembling, coat all parts with differential lubricant to facilitate holding them in place until the thrust block and differential pinion shaft are installed. Heat the case as outlined above and install the case cap, tightening it rigidly with the spanner wrench, Fig. 94, if available, or else with a punch and hammer. Drill new 1/4 in. holes in the cap and install new (unused) lock pins.

RING GEAR THRUST PAD—This pad, Fig. 92, assists in maintaining the mesh of the ring gear and pinion. After all other adjustments have been made, turn the pad adjusting screw in until it just contacts the back face of the ring gear and then back it off about 1/8 turn, locking the adjustment with the lock nut.

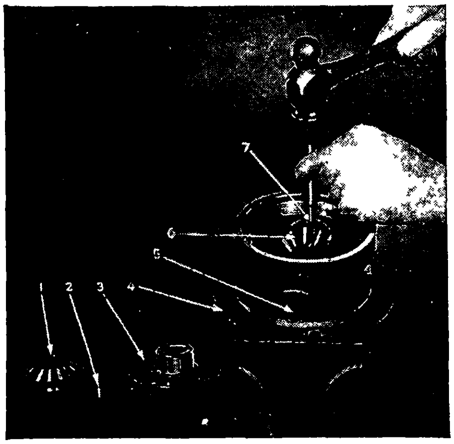


Fig. 95 R m ving differential pinion shaft l ck pin, 1940-50 Chrysler Imperial and all 1951-52 V8s
1. Diff rential gear. 2. Lock pin. 3. Cas cap. 4. Case. 5. Shaft. 6. Pini n. 7. Lock pin

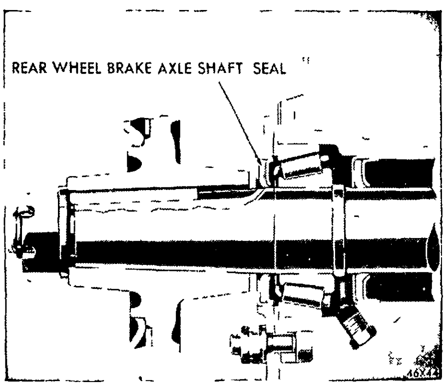


Fig. 98 Wh el bearing and axle shaft details, 1946-52

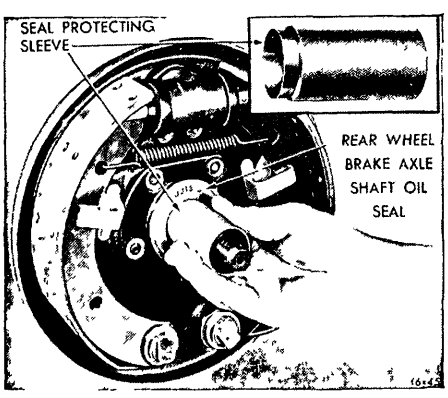


Fig. 99 Installing axle shaft outer il s al with sp cial sleeve, 1946-52

AXLE SHAFT, BEARINGS & OIL SEALS

1935-42 Chrysler, De Soto, Dodge, Plymouth—To remove the axle shaft and oil seal, disconnect the brake tube and remove the outer oil seal and brake support. If both axle shafts are to be removed, be sure to keep the shims separate and assembled to their respective ends of the axle housing so as to maintain the bearing adjustment and locate the axle shafts centrally in the axle housing. Use a suitable puller to remove the axle shaft and bearing from the housing. Then pull the inner oil seal from the housing.

To adjust axle shaft end play, add or remove shims to obtain the desired end play of .003 to .008 inch. When adjusting these bearings, remove and install an equal thickness of shims on the right and left sides of the axle housing so as to retain the central position of the axle shafts.

1946-52 Chrysler, De Soto, Dodge, Plymouth—Fig. 98 shows the details of the new type outer oil seal employed on these models. To remove, take off the wheel, hub and drum. Then disconnect the brake tube at the wheel cylinder, and remove the brake support. Drive out the old seal and remove the burrs from the support plate to prevent damaging the new seal.

With the brake support removed, install the new seal from the outer side of the brake support plate. Then stake the plate in three places with a center punch to hold the seal in position. Install the special tool, Fig. 99, in the seal or use other suitable means to protect the leather portion of the seal from being damaged by the axle shaft keyway and install the brake support as shown. Remove the tool and complete the installation of the brake support, hub and drum and wheel.

NOTE—Except for the above instructions, removal of the axle shaft, bearing and inner oil seal, as well as the end play adjustment, is the same as described for previous models.

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1935-38 With Rigid Axle—Caster up to about 2 degrees can be adjusted by inserting tapered caster plates between the spring seat and spring. To increase caster, place the thick side of the caster plate toward the rear, and vice versa. If caster is out more than 2 degrees, the axle should be replaced, as this type axle cannot be straightened successfully, inasmuch as it is made of seamless steel tubing. Likewise, if camber is out, replace the axle.

1935-36 Chrysler & De Soto Airstream Models—To increase camber, install washers between the upper control arm yoke and upper control arm. To decrease camber, remove washers from between these parts and place them on the inside face of the upper control arm, under the yoke nut.

To adjust caster, loosen the nuts holding the yokes to the upper and lower knuckle supports and remove the grease fitting from the front bushing to the upper knuckle support yoke. Insert a wrench in the bushing and turn clockwise to increase caster and vice versa.

1937-40 Chrysler & De Soto; 1939-40 Dodge & Plymouth—Fig. 101. Caster is not adjustable but the proper setting is obtained when assembling the camber eccentric bushing.

Fig. 101 Caster and camb r adjustment, 1937-40 Chrysler and D S to, 1939-40 Dodge and Plym uth

To adjust camber, loosen the eccentric clamp screw and turn the bushing to obtain the correct setting. The camber adjustment must be made within a half revolution from the point where the caster setting is correct. On 1937-39 cars, at least a thread or two should be exposed beyond the face of the bushing after the setting is made.

On 1940 cars, the distance between the rear face of the steering knuckle support and the shoulder of the upper control arm should be about ⅝ inch after the camber setting is made.

1941-52 Chrysler, De Soto, Dodge, Plymouth—Fig. 102. Caster is not adjustable but the proper setting is obtained when assembling the camber eccentric bushing. To adjust camber, loosen the clamp screw and turn the bushing to obtain the correct setting within a half revolution from the point where the correct caster setting is obtained. Do not turn the bushing until it binds against the upper control arm. Keep the steering knuckle support as nearly central as possible.

TOE-IN, ADJUST

1935-38 Cars with Rigid Axle—Toe-in is adjusted by loosening the clamps at each end of the tie rod and turning the rod. Lengthening the tie rod increases toe-in and vice versa.

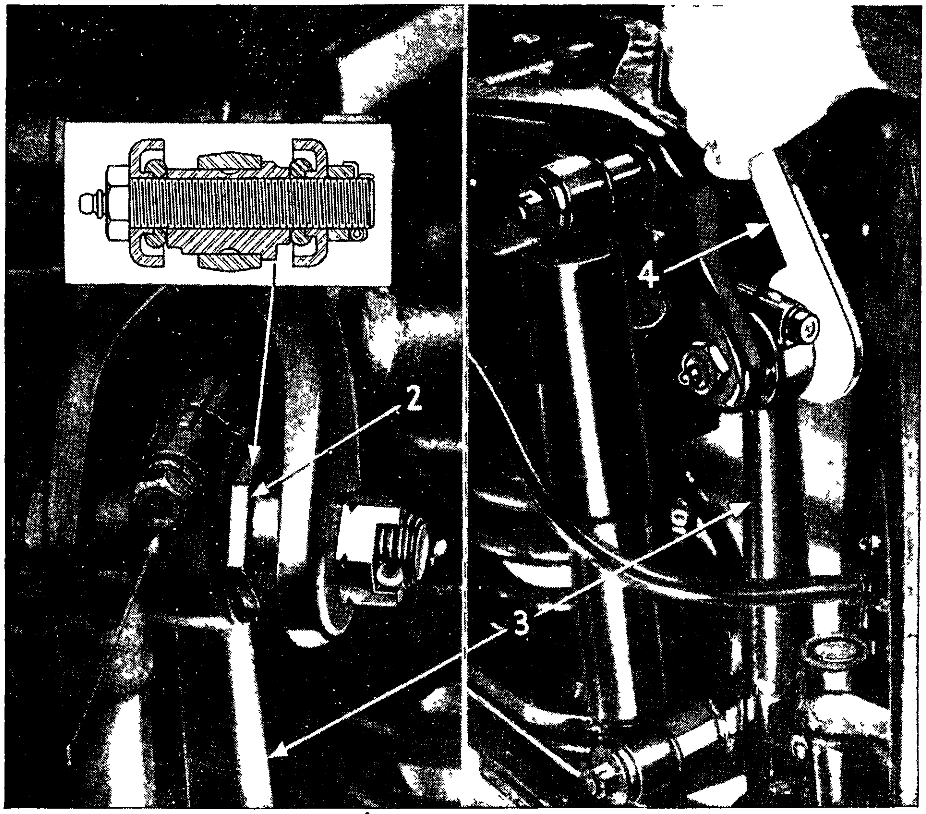


Fig. 102 Caster and camber adjustment, 1941-52
1. L ck screw. 2. Eccentric bushing. 3. Knuckle support. 4. Adjusting tool

1935 Chrysler & De Soto Airstream—Toe-in must be made on both tie rods. With the front wheels straight ahead, set the intermediate steering arm parallel to the center line of the car. Loosen the clamp bolt on both ends of each tie rod and turn both rods equal amounts until toe-in is correct.

1936-39 Chrysler (Except C-20, C-24), De Soto, Dodge, Plymouth—To adjust toe-in on these cars, first adjust the long tie rod to the following dimensions, taking the measurement between the center of the tie rod balls, and with the front wheels straight ahead.

C7, C8, S1	31 13/32″
C14	30 15/16″
C16, S3	31 7/32″
C18, C22, S5	31 5/8″
C19, C23	30 25/32″
1939 Dodge & Plymouth	31 11/16″

After setting the long tie rod to the above dimension, tighten the clamp bolts. Then set the short tie rod to the correct toe-in.

1938-39 Chrysler C20, C24: 1940-48 Chrysler & De Soto; 1940-52 Dodge & Plymouth—Fig. 103. With the steering wheel in mid-position, loosen the clamps on the end of both the rods and turn both ends until the wheels are straight ahead. Then, without disturbing the steering wheel, turn both tie rods an equal amount until the toe-in is correct and equal at each wheel.

1949-52 Chrysler & De Soto—With the steering wheel in its mid-position, and the center spoke of the steering wheel horizontal, turn both tie rods an equal amount until the toe-in is correct.

FRONT END SERVICE

1935-36 Chrysler & De Soto with Yoke Type—To assemble the control arm yoke pins, screw the threaded pin into the steering knuckle support until it is centered. Start screwing in the plain bushing, but before running it all the way in, slip a .040″ gauge between the yoke and the bushing shoulder, then screw the bushing in until it contacts the gauge. Now screw the threaded bushing in place, remove the gauge and tighten the threaded bushing securely. Lock the plain bushing by tightening the clamp screw. Lock the threaded yoke stud by tightening the cap screw in the steering knuckle support after it is assembled to the car and the caster adjusted according to the instructions given under that heading.

To assemble the lower control arm yoke pin, install the plain bushing in the yoke with a .040″ gauge between the yoke and bushing shoulder; or assemble the bushing so that its inner end is flush with the inside of the yoke. Place the yoke in position, with the clamp bolt up and the support centered in the yoke. Screw the threaded yoke pin through the knuckle support and into the plain bushing, keeping the yoke centered. Drive in the tapered locking pin and peen it in place. Screw in the threaded bushing, remove the feeler gauge, and tighten the threaded bushing securely. Clamp the plain bushing by tightening the clamp screw.

NOTE—For service on 1935-36 cars not having the yoke type of suspension described above, follow the instructions given for 1937 models.

FRONT END SERVICE

1937-39 Chrysler & De Soto; 1939 Dodge & Plymouth—To remove the kingpins and bushings, take off the wheel and hub assembly, block the brake pedal up so it cannot be depressed, and remove the nuts which fasten the brake support to the steering knuckle. Detach the knuckle arm from the knuckle and lift the complete brake support and brake shoe assembly off the knuckle support without disconnecting the brake tube. A suitable clamp should be used to prevent the brake shoes from spreading.

Remove the kingpin oil seal (steel disc) by driving a punch down into it and prying the seal up and out of the steering knuckle. Remove the kingpin lock pin, drive the kingpin downward, forcing out the lower oil seal, and use suitable pulling equipment to remove the kingpin bushings.

UPPER CONTROL ARM—To disassemble, remove the shock absorber and unscrew the upper control arm pivot bracket fastening bolts. Loosen the clamp screw which holds the eccentric bushing from turning and unscrew the eccentric bushing until the threaded portion of the upper control arm is turned out. Assemble in the reverse order and check the wheel alignment as described under Caster, Camber and Toe-in.

LOWER CONTROL ARM—To assemble the lower control arm, install the lower control arm pin centrally in the lower end of the knuckle support and drive in the tapered locking pin and peen it in place. Assemble the knuckle support, spring seat, control arm bumper and

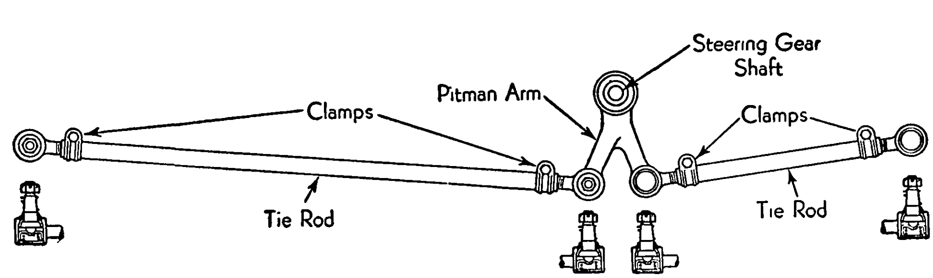


Fig. 103 St ring linkage, 1939-52 xc pt 1949-52 Chrysl r and De S t

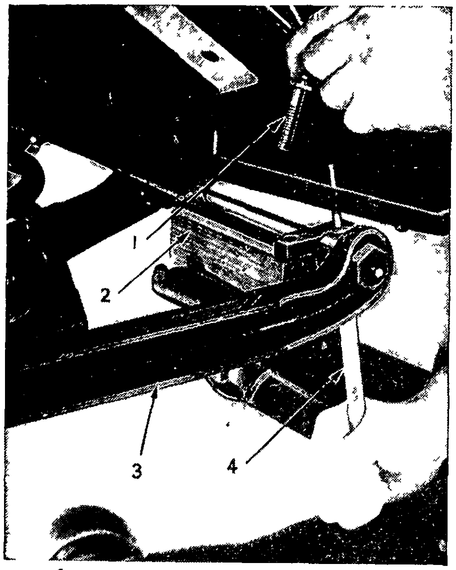


Fig. 104 Removing or installing lower control arm, 1940-52. 1. Bolt. 2. Block. 3. Lower control arm. 4. Aligning drift

control arm bar to the control arms loosely. Tighten the lower control arm pin bushings with a force equivalent to about 100 pounds on a 2-foot wrench. Tighten the spring seat bolts, striking the bolt heads with a 2-pound hammer to seat the serrated washers during the tightening process. Check the assembly to see that the knuckle support and control arm bar rotate properly.

FRONT END SERVICE

1940 Chrysler, De Soto, Dodge, Plymouth — The procedure for removing kingpins on these models is the same as described for 1939 models except that on Chrysler eights, the flexible brake tube must be disconnected before the brake support and shoe assembly can be removed.

NOTE—When installing the kingpin upper bearing, replace it from the top of the steering knuckle with the trademark at the top, and the oil hole in the bearing in line with the oil hole in the steering knuckle. The lower bushing should be line-reamed, using a suitable tool with a pilot in place of the upper bearing.

UPPER CONTROL ARM—To disassemble, remove the shock absorber, and the eccentric bushing clamp screw, then unscrew the eccentric bushing. Disconnect the upper control arm pivot bar from the frame and take off the arm. On Chrysler eights, the lower fender engine inspection shield must be taken off before these screws are removed.

When assembling the eccentric bushing, thread it over the upper control arm until the distance between the rear face of the steering knuckle support and the shoulder on the upper control arm is $\frac{9}{16}$" to ¾", with ⅝" preferred. When the assembly is completed, check the wheel alignment as described under *Caster, Camber and Toe-In.*

LOWER CONTROL ARM—To remove the lower control arm, raise the front end of the car off the floor and place a support under the frame side member behind the suspension unit. After removing the wheel, disconnect the shock absorber and the sway eliminator at the lower shock absorber mounting stud. Place a jack under the control arm pivot bar where it is attached to the frame cross member. Use a block of wood, Fig. 104, cut to receive the lower control arm bar between the jack and the bar, which will prevent the jack from slipping. Now raise the jack just enough to relieve the pressure on the pivot bar fastening bolts. Remove the bolts, placing tapered drifts in each hole, to prevent binding of the last bolt removed. Lower the jack slowly, allowing the lower control arm to come down, then lift out the spring. Remove the lower control arm pin from the knuckle support and take out the lower control arm assembly.

NOTE—Reverse the above operations to assemble, being sure to install the flattened end of the spring at the top, with the lower end resting in the recessed part of the spring seat, otherwise the car frame will be too high at that corner. However, on the C25 7-passenger sedan and on all the Eights, both ends of the springs are flat and the spring seat recess is flat.

LOWER CONTROL ARM BUSHINGS—To assemble the lower control arm bushings, insert the pivot bar in the control arm and place a suitable tool between the legs of the control arm, Fig. 105. Start the bushings on both ends of the pivot bar, using a suitable lubricant, such as tapping compound, to cut the threads into the arm bosses without scoring. Thread the bushings into the control arm until the shoulders of the bushings contact the machined surface of the control arm, and tighten them with a force of 180 pounds feet.

Remove the tool from between the legs of the control arm and check the operation of the pivot bar for free movement in the bushings, but do not rotate it. The distance from the machined surface of the control arm to the center of the pivot bar mounting holes should be 2$\frac{3}{32}$", which would be altered if the pivot bar was rotated. Lubricate the control arm bushings with semi-fluid chassis lubricant.

FRONT END SERVICE, 1941-52

Front Wheel Bearings, Adjust—Turn the bearing adjustment nut up tight. Then back it off one slot and the additional amount necessary to line up the slot with the hole in the spindle.

Kingpins & Bushings—

1. Remove wheel and hub assembly.
2. Block brake pedal so it cannot be depressed.
3. Unfasten brake support plate from knuckle.
4. Remove steering arm from knuckle.
5. Remove brake hose and connection and lift off brake support.
6. Remove kingpin lock pin.
7. Drive a punch into upper steering knuckle welch plug and pry out plug.
8. Drive kingpin downward, forcing out lower welch plug. A soft brass drift should be used in driving against top of kingpin.
9. If needle bearings are used in the knuckle they should be removed with a suitable puller. A puller should also be used when pressed-in bushings are employed.

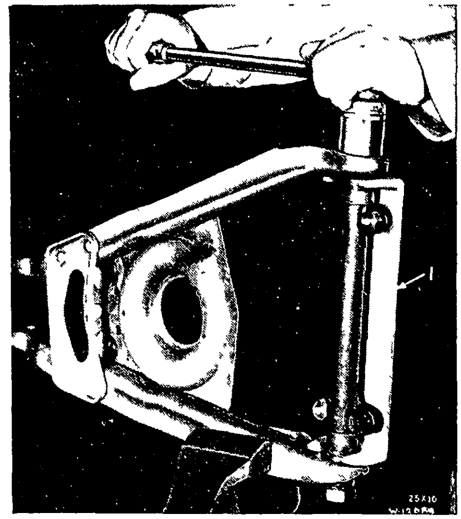


Fig. 105 Installing lower control arm bushings, using spreader tool (1), 1940-52

When installing needle bearings they must be installed from the top of the knuckle with the trade mark on top and the oil hole lined up with the oil hole in the steering knuckle.

Pressed-in type bushings must be line reamed.

After installing the steering knuckle, make sure it is free in the support as binding at this point may cause sensitive steering and car wander. There should be .008 in. clearance between the knuckle and knuckle support. This clearance can be adjusted by the use of shims between the knuckle and thrust bearing.

After their installation, welch plugs should be staked in place.

Upper Control Arm, Remove—Fig. 106.

1. With a jack under the lower control arm spring seat, raise the car and remove the wheel.
2. Remove shock absorber.
3. Unscrew bolt from outer end of control arm.
4. Unfasten and remove control arm pivot bar.

Upper Control Arm, Assemble—

1. Position the pivot bar with seals installed in the control arm and install Tool C-608 on the pivot bar, Fig. 107. This tool has two sets of bolt holes to accommodate both sizes of upper control arm pivot bars. Be sure tool is securely fastened to pivot bar.
2. Expand the two jaws of the tool by tightening the expander wedge screw until the jaws of the tool are just snug against inside of web of control arm. Do not bring screw down more than is necessary to place jaws firmly against control arm; if tool is properly fastened

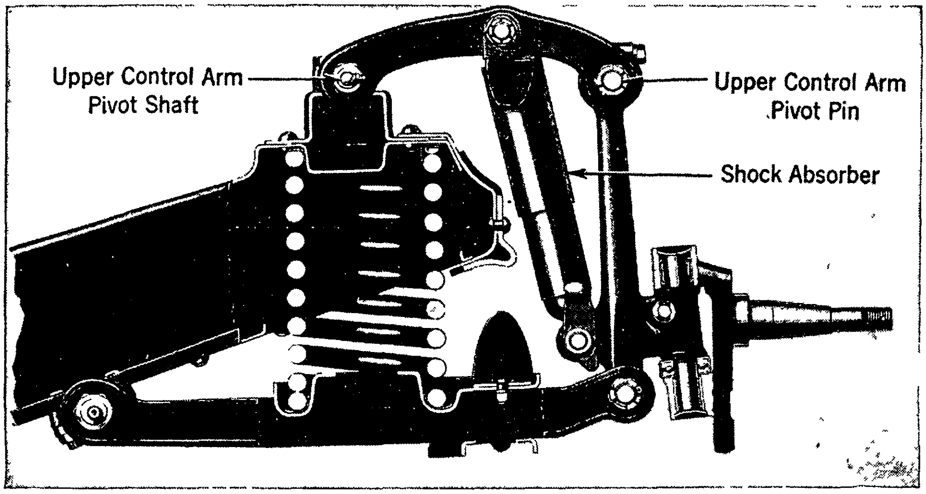


Fig. 106 Front suspension, 1941-52

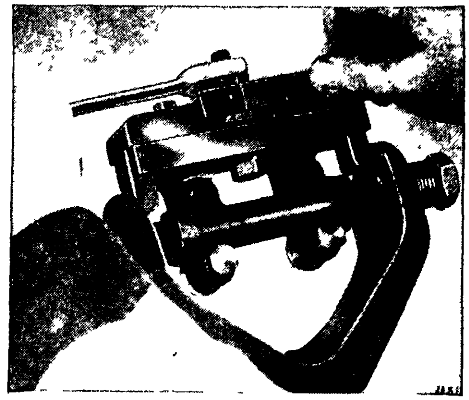


Fig. 107 Spreading upper c ntr l arm with tool C-608, 1941-52

Fig. 108 Installing upper c ntr l arm bushings, 1941-52

to pivot bar, jaws will make proper contact on inside faces.

3. Lay a steel scale across base of expander, noting the distance between the two lines, Fig. 107. Tighten expander wedge screw until control arm has been spread $1/16$ in. from its original "at rest" position.

4. Start bushings on both ends of pivot bar. Lubricate them with light engine oil or cutting oil to allow them to cut their own threads in the control arm without scoring, Fig. 108.

5. Thread bushings into control arm until shoulders of bushings contact surface of control arm. Tighten with a torque wrench to at least 120-140 lbs. ft. torque.

6. Remove tool and check operation of pivot bar for freedom of movement. Only a moderate grip should be required to turn the pivot bar. Note—The pivot bar should not be rotated as this would throw it off center with the control arm and affect the caster adjustment.

7. Lubricate control arm bushings with chassis lubricant before installing on the car.

Upper Control Arm Eccentric Bushing, Install—First, install the upper control arm to the steering knuckle support as follows:

1. Install a new eccentric bushing in the steering knuckle support and place one oil seal on the bushing at the hexagon end. Oil or grease the other seal slightly and place it on the opposite boss of the control arm.

2. Slide the control arm and seal onto the steering knuckle support until the seals fit properly over the bushing and the pin hole is in proper alignment. Install pin, nut and cotter pin.

3. Using a drift, line up pivot bar holes in frame cross member. Install attaching bolts and tighten securely.

4. Install shock absorber, wheel and tire assembly.

Lower Control Arm & Front Spring—Follow the same procedure outlined for 1940 models.

STEERING GEAR

STEERING GEAR REMOVAL

1935-37—

1. Disconnect horn wire at connector between bottom of steering gear and horn.

2. Press firmly on horn button and rotate it to right as far as possible; relieve pressure and horn button will pop out.

3. Remove steering wheel nut and use puller to remove wheel.

4. Loosen steering column jacket clamp bolt.

5. Use puller to remove pitman arm.

6. Unfasten steering gear from frame and lift gear out of car.

1938—

1. Disconnect horn wire at connector between bottom of steering gear and horn.

2. Remove floor mat and loosen screws in rubber around steering column.

3. Remove horn button and related parts, and pull horn wire out through top of steering column.

4. Remove steering wheel nut and use a puller to remove wheel.

5. Take off engine splash pan.

6. Use a puller to remove pitman arm.

7. Unfasten steering gear from frame and lift gear out of car.

1939—

1. Remove horn blowing ring and wire or horn button.

2. Use puller to remove steering wheel.

3. Remove front seat cushion and floor boards.

4. Remove screws which hold draft pad to dash and pull pad upward on column jacket about 6".

5. If car is equipped with overdrive, unfasten overdrive control bracket from steering column.

6. Remove screws holding steering column clamp to instrument panel bracket.

7. Remove hood lower left side panel.

8. Raise front end of car about 6".

9. Use a puller to remove pitman arm.

10. Unfasten hand brake and overdrive cables from steering column.

11. Loosen clamping bolt and remove gear selector cable adjusting screw from bracket on steering column (above gear housing).

12. Disconnect gearshift control rod from lever at steering gear.

13. Remove capscrews holding upper and lower sections of steering column together.

14. Pull upper section of column jacket and gearshift tube off steering tube (pull into inside of car).

15. Unfasten steering gear from frame.

16. Lift steering gear out of car, up beside engine and over top of fender.

1940—

1. Remove seat cushion, floor mat and floor board.

2. Remove horn button, wire and steering wheel.

3. Disconnect gearshift selector cable,

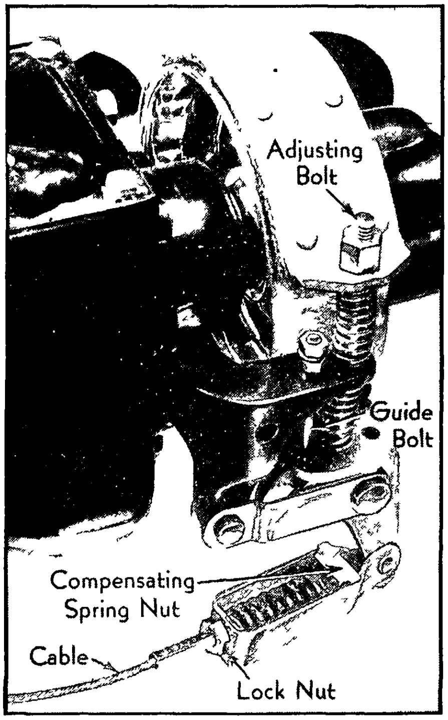


Fig. 109 External band type emer- g ncy brake. Typical of all 1935-50 m d ls and 1951-52 Plymouth and D dg with standard transmission

control rod and hand brake cable bracket from control column.

4. Disconnect pitman arm.
5. Remove bolts which fasten upper and lower column together.
6. Unfasten steering gear from frame.
7. Remove column jacket clamp at instrument panel and lower steering assembly and pull upper column jacket off steering tube.
8. Remove steering gear housing and tube by raising the housing end up, out and over hood lower side panel.

1941-52—Following data applies to all models unless otherwise indicated.

1. Disconnect battery (1949-52).
2. Disconnect horn wire at connector between steering gear and horn.
3. Remove four screws from underside of steering wheel and lift off cover and horn ring.
4. Remove attaching screws from contact plate and spring retainer.
5. Pull horn wire from steering tube.
6. Use puller to remove steering wheel.
7. Disconnect direction signal control wires at instrument panel; two wires connected through connectors, the third to flasher unit terminal.
8. Remove cover plate from bottom of direction signal control housing and remove clamp screw from inside of housing; this allows control unit to be removed directly while pulling wires up through jacket tube (1941-48).
9. Remove screws at bracket holding column to instrument panel (1949-52).
10. Remove screws from rubber draft pad.
11. Remove foot accelerator (1949-52).
12. Remove toe board plate (1949-52).
13. Unfasten steering gear from frame.
14. Disconnect and remove gearshift rods.
15. Remove steering gear away from starter to permit removal of pitman arm (1949-51).
16. Lift steering gear through toe board opening (1949-52).
17. Remove left engine splash pan (1941-48).
18. Remove steering gear from car by lowering housing out through opening between engine and frame (1941-48).

EMERGENCY BRAKE

EXTERNAL BAND TYPE

1935-52—Fig. 109. Before adjusting the hand brake, be sure that the free play between the anchor bracket on the band and the anchor does not exceed .005"; otherwise band distortion may result upon application of the brake. If free play exceeds .005", it may be reduced by compressing the anchor bracket in a vise or tapping gently with a hammer against a block or anvil.

To adjust the brake, set hand brake lever in fully released position. Using a feeler gauge, adjust the anchor bolt so that the clearance between the lining and drum is from .015" to .020".

The adjustment of the guide bolt controls the lower half of the band; adjusting nut controls the upper half of the band.

Turn the adjusting nut until there is a slight drag on the drum, with the upper and lower half having an equal amount of clearance.

The lock wire which retains the anchor bolt must not be drawn up tight as this restriction will cause uneven wear and a poor brake.

Adjust the hand brake cable by loosening the lock nut and removing the clevis pin from the yoke. Then turn the yoke until all slack is removed from the cable.

SHOE TYPE BRAKE

1951-52—Fig. 110. This type brake is fully enclosed to keep out dirt and oil.

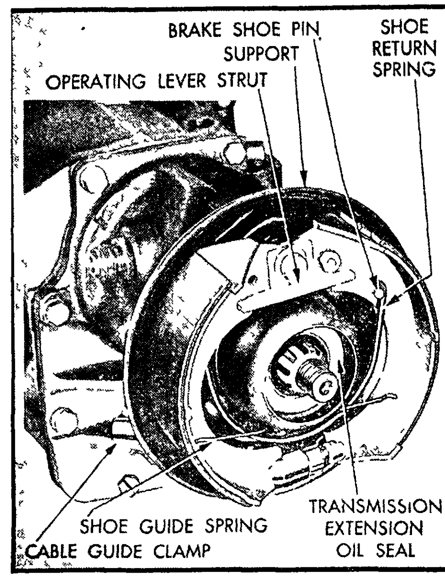


Fig. 110 Internal shoe typ mer- gency brake. Typical f all 1951-52 Chrysler and De S t , and Dodge with automatic transmissi n

Bear in mind that an improperly adjusted hand brake will affect shifting of the automatic transmission.

ADJUSTMENT—Place the transmission shifting lever in neutral position and be sure the hand brake is released. Then proceed as follows:

1. Disconnect front end of propeller shaft to permit turning the brake drum by hand.
2. Remove adjusting screw cover plate.
3. Loosen brake cable guide clamp bolt and back off cable adjusting nut.
4. Turn the brake shoe adjusting nut to decrease shoe-to-drum clearance until a slight drag is felt on the drum.
5. Back off adjusting nut at least one notch to give approximately .010" clearance. Be sure the two raised shoulders on the adjusting nut are seated in the grooves on the adjusting sleeve.
6. The cable length adjusting nut should be positioned against the cable housing so that there is at least .005" but not more than .010" clearance between the operating lever and brake shoe cable.
7. To lock the adjustment, tighten the cable housing clamp securely and then tighten the cable adjusting nut against the housing.
8. When properly adjusted, 4 to 6 clicks of the ratchet should be obtained to hold the car.
9. Install the adjusting screw cover plate and connect the propeller shaft.

CROSLEY

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore	Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Taxable Horse-Power	Maximum Brake H.P. @ R.P.M.	TIRES Size	Inflation Pressure Front	Rear
1939	Two-cylinder	2	80	In Block	3	2¾	38.87	5.6	7.20	15 @ 4200	4.25 x 12	25	25
1940	Two-cylinder	2A	80	In Block	3	2½	35.3	5.6	7.20	12 @ 4000	4.25 x 12	25	25
1941	Two-cylinder	CB41	80	In Block	3	2½	35.3	5.6	7.20	12 @ 4000	4.25 x 12	25	25
1942	Two-cylinder	CB42	80	In Block	3	2½	35.3	5.6	7.20	12 @ 4000	4.25 x 12	25	25
1946-48	Four-cylinder	CC47	80	In Head	2½	2¼	44.0	7.5	10.00	26.5 @ 5400	4.50 x 12	25	25
1949-52	Four-cylinder	CD	80	In Head	2½	2¼	44.0	7.8	10.00	26.5 @ 5400	4.50 x 12	25	25
	Hotshot	VC	85	In Head	2½	2¼	44.0	7.8	10.00	26.5 @ 5400	4.50 x 12	25	25

ENGINE

ENGINE REMOVAL

1939-42 — The engine may be lifted through the hood opening with a crane. If a crane is not available, it will be necessary to remove the front axle assembly and lower the engine to the floor. To remove the engine, proceed as follows:

Disconnect: battery ground cable, fuel line at carburetor (coupes) or fuel pump, choke, oil line at engine, clutch cable from bracket at transmission, clutch cable from yoke and speedometer cable at transmission.

Remove: distributor wires, exhaust tube connecting manifold to muffler, accelerator bracket, generator and starting motor.

Take out the front axle assembly, drain the engine oil and remove the pan. Remove the engine hold-down bolts, support the engine and unfasten the transmission from the clutch housing and pull the engine forward. Remove the transmission and lower the engine to the floor.

1946-52—After removing the hood, proceed as follows:

Disconnect: battery wire from starter, cable between starter and starter switch, distributor wires, fuel line, throttle and choke cable at carburetor, oil pressure gauge line at engine, windshield wiper hose at manifold, generator cutout wire, exhaust pipe from manifold, water hose, battery ground strap, clutch cable under housing, and the temperature indicator bulb from the radiator connection.

Remove the radiator brace rod, radiator core, hood latch cable, fan and belt and bolts connecting clutch housing to transmission.

Support the engine with a jack and remove the nut from the right front motor mount stud which goes through the frame. On the left motor mount, remove the bolt which goes into the crankcase.

Loop a sling around the engine and under the oil pan, move the engine forward slightly and lift it out.

CYLINDER BLOCK

1946-52—With the engine out of the chassis and accessories and manifolds removed, disassemble the block as follows:

1. Remove camshaft cover.
2. Remove camshaft bearing caps. Caps are numerically marked on the distributor side of the engine for identification of position.
3. Lift out camshaft and oil metering housing, being careful not to damage the latter.
4. Remove tower shaft adjuster and upper tower shaft gear in that order.
5. Remove oil pan.
6. Remove connecting rod caps and turn engine so two pistons are at top center position.
7. Remove oil pump, being careful not to damage oil intake pipe.
8. Unfasten block from crankcase and lift off block with pistons.
9. Remove pistons from block.

To install the cylinder block, reverse the above procedure. However, the tower shaft gear must be timed as given under *Gear Adjustment*.

VALVE DATA

Valve seat angle, 1939-52 . 45°
Valve stem clearance:
- 1939-42 intake .... .001 -003"
- 1939-42 exhaust .... .002 -004"
- 1936-52 (both) .0025-004"

Valve tappet clearance (cold):
- 1939-42 intake .... .007"
- 1939-42 exhaust .... .009"
- 1946-52 intake .... .005"
- 1946-52 exhaust . ... .007"

Cam follower clearance:
- 1946-52 . ..... .005-.0013"

Valve timing, 1946-52:
- Intake opens .... 5°BTC
- Exhaust closes .... 5°ATC

VALVES, ADJUST

1946-52—Turn the camshaft until the high point on the cam is straight up over the valve being adjusted. Insert the valve and firmly hold it against the valve seat. With the valve held against its seat, measure the clearance between the cam follower and cam with a feeler gauge, Fig. 2.

For engines CC-46-100 to CC-46-3625, grind the valve tip to obtain the desired clearance.

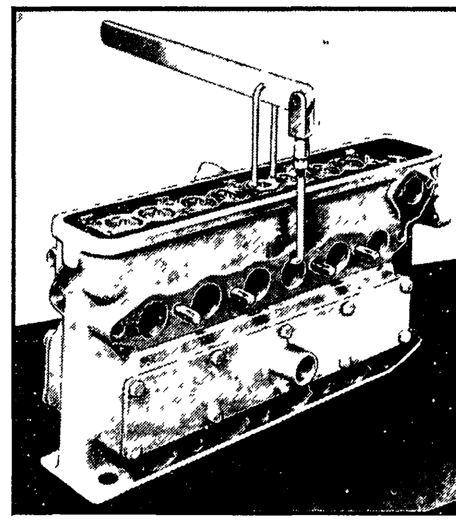


Fig. 1 Special valve spring compressor. 1946-52

Incorporated in engines after CC-46-3625 are cam followers adjusted by shims of various thicknesses. When installing these shims, Fig. 3, be sure to bend up the ends and lock in place.

VALVE STEM GUIDES, RENEW

1939-42—Remove the engine, manifold, cylinder head shrouds, cylinder heads, and valve cover. Disconnect the valve springs from the valve stems and pull

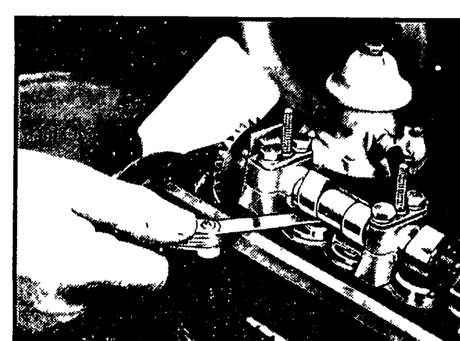


Fig. 2 Checking valve clearance with f ler gaug . 1946-52

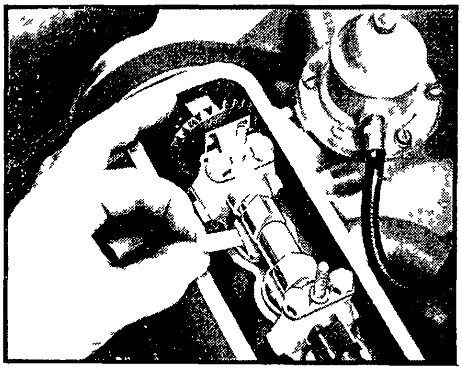


Fig. 3 Inserting valve adjusting shims. 1947-52

out the valves. The worn valve guides may then be removed and new ones installed

After the new guides have been installed, they must be reamed to provide the proper clearance.

1946-52—To remove the guides, use a shoulder drift pin having an outside diameter of $\frac{11}{32}$ inch and an arbor press. With the cylinder block removed and inverted, place the drift pin in the valve guide and force it out.

To replace, force the guide in place from the top side of the cylinder block. Be sure the shoulder of the guide is firmly in place Then ream the guide to provide the proper clearance.

VALVE TIMING

1939-42—For correct valve timing, gears should be installed so that the letter "C" on the camshaft gear and the punch-mark on the crankshaft gear meet in line with each other.

1946-52—The valve mechanism is timed with a tower shaft operating at three-quarter speed To time the engine, proceed as follows, Figs 4 and 5.

With the camshaft out of the engine, turn the engine over slowly until three conditions occur simultaneously: (a) the top dead center mark on the flywheel is in the center of the timing hole in the flywheel housing; (b) the distributor rotor is in position to fire No 1 cylinder; (c) the punch-marked tooth of the upper tower shaft gear points directly back and is in line with the centerline of the camshaft bearings.

Assemble the camshaft, pushing the oil metering housing into the upper tower shaft gear and straddling the one punch-marked tooth of the upper tower shaft gear with the two punch-marked teeth of the camshaft gear.

After completing the operation, turn the engine over slowly at least two complete revolutions by hand to make sure the marks are in alignment.

TIMING GEARS

1939-42—To remove the gears, take off the manifold and valve cover. Block up the valves by placing the head of a $\frac{5}{16}$ inch cap screw between the crankcase and the valve spring washer under each valve. Remove the gear cover (oil pump comes out with cover) and pull the cam-

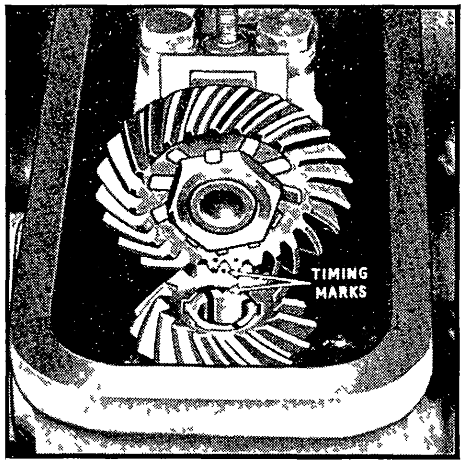


Fig. 4 Camshaft timing marks. 1946-52

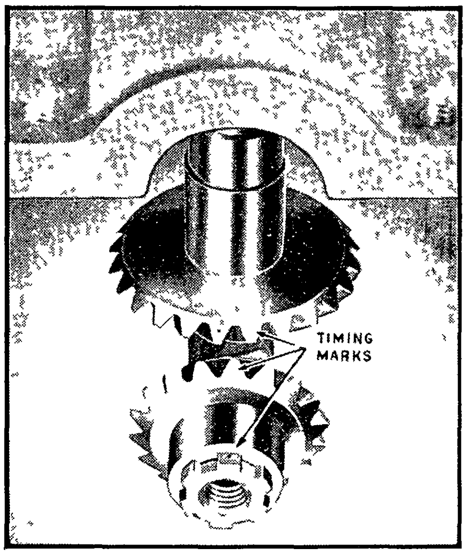


Fig. 5 Lower tower shaft timing gear marks. 1946-52

shaft and camshaft gear out as a unit Use a suitable puller to remove the timing gears from their respective shafts

The gear sizes are marked on the inner side and the timing marks on the front side of the gear Install the gears according to the instructions given under *Valve Timing*

After the gears are installed, replace the cover, remove the blocking screws from under the valves and install the valve cover and manifold After the job is done, check the ignition timing as given under that heading.

TIMING GEARS, 1946-52

Lower Tower Shaft Gear—To adjust the lower tower gear backlash on engines before 29880, proceed as follows:

1. With engine in car, remove the crankshaft pulley attaching screw and remove the pulley.
2. Insert a .005 in. shim on the crankshaft and over the hub of the gear.
3. Replace pulley and tighten.
4. Start the engine and if it is still noisy, repeat the above operations.

Be sure the copper gasket is in place

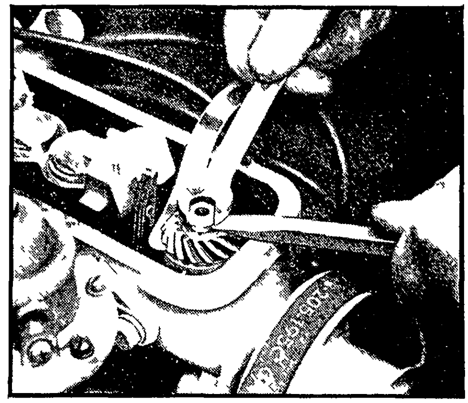


Fig. 6 Adjusting tower shaft end play. 1946-52

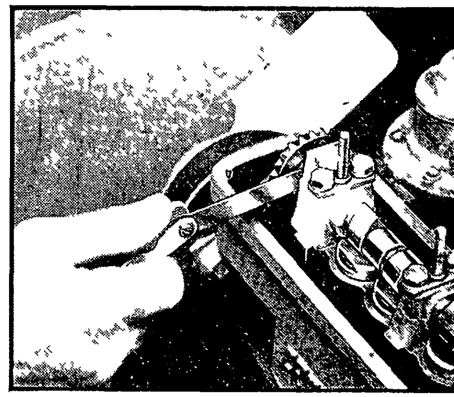


Fig. 7 Adjusting camshaft end play. 1946-52

on the pulley hub when installing the pulley If the leading edge of the pulley hub is sharp, bevel it before reinstalling to avoid damage to the oil seal.

On engines after 29880:

1 Hold the slotted lower gear adjuster and loosen attaching nut.

2 Turn slotted adjuster approximately ⅛ turn to the right.

3 Hold the slotted adjuster and tighten the attaching nut.

4 Start the engine and if it is still noisy, repeat the operation.

Upper Tower Shaft Gear—To remove the upper tower shaft gear, remove the camshaft cover, camshaft and oil metering housing Remove the tower shaft adjuster and lift upper tower shaft gear upward

When assembling the gear to the shaft, care should be taken that the punch marked tooth of the upper tower shaft gear coincides with the punch mark on upper end of tower shaft.

To adjust tower shaft and play, insert a .004 in feeler gauge between the shoulder of the upper tower shaft gear and the shaft bushing, Fig. 6. Insert a screwdriver under the head of the tower shaft adjuster and pry upwards while tightening the adjuster. Remove feeler gauge.

Replace the oil metering housing, camshaft assembly and camshaft cover.

Camshaft End Play—Check the camshaft and play as shown in Fig. 7 with

a feeler gauge. Adjust the end play from .003 to .005 in. by removing or installing thrust washers between the camshaft gear and front bearing.

Incorporated in engines after CC-24199 are horseshoe-shaped thrust washers to eliminate the necessity of removing the camshaft gear when making the end play adjustment. To install these washers, loosen the front camshaft bearing bolts, slip the bearing strap up on the bolts and remove the thrust washer and replace with a washer of the correct thickness.

CAMSHAFT BEARINGS

1939-42—Remove the cap screws in the cover and the screws in the oil pan that fasten the gear cover to the oil pan flange. After taking off the cover, the front camshaft bearing may then be pressed or driven from the gear cover and a new one installed. The rear camshaft bearing is integral with the crankcase and cannot be renewed.

1946-52 — There are three split-type camshaft bearings and their removal and replacement is obvious. The camshaft bearing caps and bearings are numerically marked on the distributor side for identification of position. Camshaft bearing clearance should be .0015 to .0027 inch.

PISTON & RING DATA

Piston clearance:	
1939-42	.004″ max.
1946-52	.002 -.0035″
Ring end gap:	
1939-42	.010″ max.
1946-52	.007 -.017″
Ring side clearance, 1939-42:	
Outer compression ring	.003 -.0045″
Inner compression ring	.0015-.003″
Oil ring	.0015-.003″

PISTONS & RODS, REMOVE

1939-42—Remove the engine and take off successively the cylinder head shrouds, cylinder heads, oil pan and oil baffle. Unfasten the connecting rod caps and push the piston and rod assemblies out of the cylinder bores.

1946-52—With the engine removed, take off successively the valve cover, camshaft bearings and lift out camshaft. Remove the upper tower shaft gear and unfasten the block from the crankcase. Lift off the block. Unfasten the rods from the crankshaft and remove the piston and rod assemblies.

PISTON RINGS, RENEW

1939-52—Always use standard size rings in cylinder bores that are standard at the bottom, regardless of the amount of taper. Always see that the end gap is within specifications at the bottom of the cylinder. When fitting rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side when installed in the piston.

New rings should be fitted according to the instructions given with the ring package. Ring grooves must be free from carbon and must show no perceptible wear. Oversizes ordered must be determined by the measurement of the smallest portion of the bore.

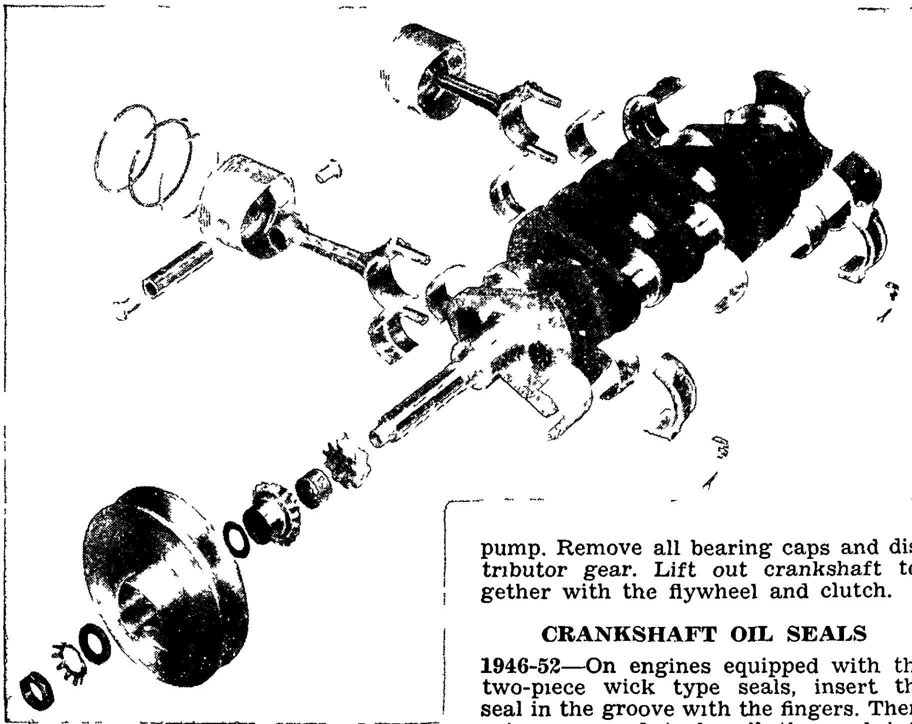


Fig. 8 Piston system on four-cylinder engine, 1946-52

CONNECTING RODS

1939-42—To remove connecting rod bearings, remove the oil pan and baffle. Take off the connecting rod caps. Remove the old bearing inserts and install new ones, being sure the bearing locating lugs are fitted into the notches machined in the rod and cap. Connecting rod bearing clearance should be maintained at from .0015 to .003 inch.

1946-52—As shown in Fig. 8, the connecting rod bearings are the replaceable shell type and no fitting is required. The oil clearance should be .0015-.003 inch.

On assembly to the crankshaft, the numerical marking on both the rod and cap should be on the same side of the engine as the similar numerical marking on the bottom of the crankcase.

MAIN BEARINGS

1946-52—To replace the main bearings, it is advisable to remove the crankshaft from the engine.

The three center main bearing shells are alike and interchangeable but the top half of each bearing is identified by the oil hole.

The main bearing caps are numerically marked, 1 to 5, on the distributor side of the engine.

Never file caps or use shims because the bearings are made with the proper "crush" fit.

CRANKSHAFT

1946-52—The crankshaft has five main bearings and is drilled for oil distribution from main to connecting rod bearings under pressure.

To remove the crankshaft (engine out of car), detach the oil pan and oil pump. Remove all bearing caps and distributor gear. Lift out crankshaft together with the flywheel and clutch.

CRANKSHAFT OIL SEALS

1946-52—On engines equipped with the two-piece wick type seals, insert the seal in the groove with the fingers. Then, using a round tool, roll the seal into the groove. Start at one end and roll the seal to the center of the groove. Then, starting at the other end, again roll towards the center. This procedure presses the seal firmly into the bottom of the groove. The groove must be entirely filled otherwise leaks will occur.

After installation the rear seal must be cut off flush with the face of the main bearing cap and crankcase. The ends of the front seal should be cut off so that they protrude $\frac{1}{32}$ in. from both the crankcase and oil pan.

Engines after No. 60929 are equipped with a one-piece metal enclosed, Neoprene front oil seal. To replace this seal, remove the oil pan and crankshaft pulley and remove the seal by sliding it forward.

To install, coat the outside of the new seal with Permatex No. 2 and slide into position. Install the pulley and carefully adjust the lower gear backlash. Be sure the seal is against the shoulder at the rear of its groove and install the oil pan.

On engines equipped with the one-piece rear oil seal, the installation procedure is as follows: With the crankshaft removed from the engine, spiral the new seal onto the crankshaft with the edge of the internal lip toward the front. Use Permatex No. 3 or equivalent in the seal groove and carefully install the crankshaft so that the seal gap will be in the center of the rear bearing cap.

FUEL SYSTEM

CARBURETOR ADJUSTMENTS

1939-52 — The Tillotson carburetor is used and has an idle and high-speed adjustment. Before starting the engine to make the adjustments, screw the main adjustment (lower T-handle) to the

right (clockwise) until it just seats, then back off two complete turns. Now screw the idle adjustment (upper screw) to the right (clockwise) until it just contacts its seat, then open one complete turn.

Start the engine and allow it to run until it is thoroughly warmed up. Then, with the engine running, hold the throttle open to run the engine at a speed approximately 30 to 35 MPH, then turn the main adjustment clockwise (¼ turn at a time) until the engine loses speed for want of fuel. Next, turn the adjustment in the opposite direction (⅛ turn at a time) until the maximum speed of the engine is obtained, which will be the approximate high speed adjustment.

To adjust idling speed, close the throttle and set the idling speed regulating screw so that the engine runs slightly faster than normal idling speed. Slowly turn the idling adjustment screw (upper) to the right, or in, until the engine misses, then turn in the reverse direction until the engine fires evenly. Run the engine at a faster speed for a few seconds, then recheck the idling adjustments. If satisfactory, set the idle speed regulating screw to operate the car at 7 MPH when pulling it in high gear.

NOTE—The approximate correct adjustments of the carburetor below 5,000 feet altitude are: idle adjustment, ¾ to 1¼ turns open; main adjustment, 1½ to 1¾ turns open.

GASOLINE LEVEL—Before separating the upper body from the lower body, the idle adjusting screw, spring and idle tube must first be removed.

To set the gasoline level in the float chamber, remove the upper body assembly containing the float mechanism. Turn the assembly upside down and, with the float resting on the inlet needle, carefully bend each lever arm, if necessary, to give a distance of $1\frac{3}{64}$" from the body gasket to the raised seam encircling each float.

NOTE—As a guide, the gasoline level can be checked after the carburetor is re-assembled by measuring just below the lowest portion of the float bowl inspection hole. When inspection indicates the level continues to rise beyond the setting point, remove the inlet needle and seat and clean their seating surfaces with a clean, soft cloth. Then replace the inlet needle and tap very lightly, turning the needle with the thumb and forefinger several times to re-seat the needle. Re-install the needle and seat and if the proper level is not maintained, install a new inlet needle and seat assembly.

ENGINE OILING

OIL PRESSURE

1939-52—Normal oil pressure for two-cylinder engines is 50 lbs. and 35 lbs. for four-cylinder engines at normal driving speeds. If high or low oil pressure is indicated on the dash gauge, with the proper amount of the correct grade of oil in the crankcase, the cause of the incorrect oil pressure should be located and corrected. The following are some of the causes of incorrect oil pressure:

1. Oil pressure relief valve piston sticking or not seating.
2. Worn oil pump gears.
3. Clogged oil pump inlet screen.
4. Leaking connection at oil inlet tube.
5. Loose oil pump on engine block.
6. Loose engine bearings.
7. Pump cover gasket too thick.

OIL PUMP, RENEW

1939-42—Remove the screws that pass through the pump body and into the timing gear cover. Install a new gasket and a new pump, tightening the mounting screws securely.

1946-52—The pump is driven by a spiral gear on the front of the crankshaft. To dismantle the pump, remove the center bolt that holds the pump base to the pump bottom. Take out the screen and gasket. Detach the pump bottom from the body. Remove the idler gear. File off the end of the pin holding the spiral drive gear to the pump shaft and drive out the pin, which will permit the removal of the driven gear.

COOLING SYSTEM

WATER PUMP

1946-52—To remove the pump, disconnect the rubber coupling from the generator and water pump. Unscrew the plug from the water pump and drain the cooling system. Disconnect the two water hoses. Remove the attaching bolts and lift off the pump.

To dismantle the pump, remove the cover plate and pull out the shaft, seal and washer, noting the arrangement of the parts so that no difficulty will be encountered upon reassembly.

NOTE — Before attaching the cover plate, feel for a slight spring resistance to hold the cover plate in place. This is important because with no spring resistance, there is no seal and the pump will leak at the shaft. On the other hand, excessive spring resistance builds up excessive thrust and will cause premature wear of the carbon thrust button on the cover plate.

The seal assembly, when new, when compressed with a load from 8 to 12 pounds should be ½ inch long, plus or minus .015 inch. Seals that do not come reasonably close to these figures should be replaced.

WATER PUMP ALIGNMENT

1946-52—The water pump must be correctly aligned with the generator or excessive and rapid wear of the pump bushing will result. Correct alignment can be obtained with the use of the special fixture shown in Fig 8A (part No. 206293), and is done in the following manner:

1. Attach the water pump to the crankcase, tightening the bolts only finger tight. 2. Take the special fixture and, sliding the water pump shaft into the recessed hole in the end, hold the fixture in the generator attaching bracket with the generator strap loose. 3. Tighten the generator bracket attaching bolts through the slots in the aligning fixture. 4. Tighten the water pump bolts. 5. Remove the fixture. 6. Assemble the rubber coupling. 7. Assemble the generator into the bracket but do not loosen the generator bracket attaching bolts.

ELECTRIC SYSTEM

IGNITION TIMING

1939-42—To set the timing, crank the engine until the mark on the front rim of the flywheel is at the top position. Loosen the distributor clamp screw and shift the distributor so that the points are just ready to open, then tighten the clamp. When high octane fuels are used, the spark should be advanced from the above setting until a slight "ping" is heard when on a hard pull.

NOTE—Number one cylinder is the left-hand cylinder when viewed from the driver's position. The dead center mark on the flywheel is a half-round notch in the rim of the wheel; the mark that it must line up with for Top Dead Center timing is a small rib cast on top of the center of the crankcase.

1946-52—To remove the distributor, take off the oil pan and remove the distributor drive gear. Unfasten the distributor from the crankcase and lift it out. To install the unit and set the timing proceed as follows:

Crank the engine to bring No. 1 piston on its compression stroke and until the first timing mark is in the center of the flywheel housing timing hole. Place the gear on the distributor shaft so the rotor points to No. 1 cylinder contact, which is toward the radiator. Turn the distributor counter-clockwise until the points are closed, then turn it clockwise until the points are about to break. Tighten the lock screw under the distributor body.

TUNE UP DATA

Spark plug gap, 1939-52	.025"
Breaker cap, 1939-52	.020"
Firing Order, 1946-52	1342
Ignition timing, 1946-52 .	12° BTDC

CLUTCH

CLUTCH, REMOVE & REPLACE

1939-42—Raise the rear of the car until the weight is removed from the rear springs. Disconnect the springs from the rear axle, and the brake cables and conduit from the brake backing plates. Block up the rear end of the engine to support it while the transmission is removed. Remove the clevis at the bottom of the clutch yoke, and the clutch cable clamp from the bottom of the transmission. Disconnect the transmission from the flywheel housing, then pull the rear axle, propeller shaft and transmission assembly to the rear which will permit the throwout bearing to be removed from the top of the yoke. The clutch may now be removed after disconnecting the fulcrum brackets from the flywheel.

Reverse the order of the above procedure to install the clutch and check

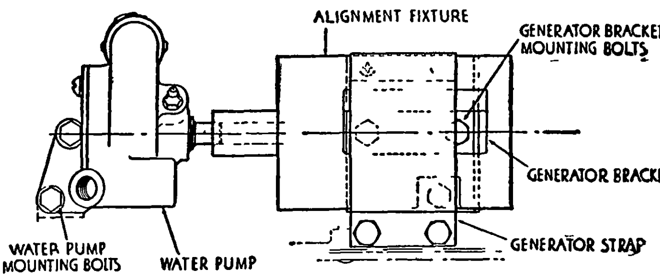


Fig 8A Water pump alignment, 1946-52

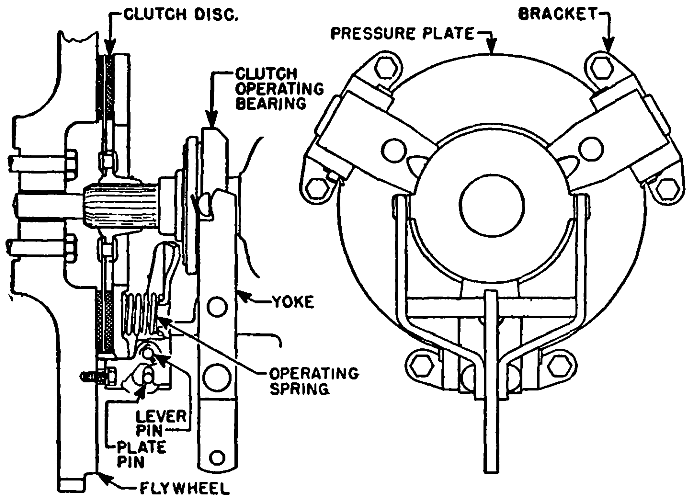


Fig. 9 Clutch and flywheel, 1939-52

its operation Should the clutch fail to disengage when the clutch pedal is pushed down to the floor, the clevis which attaches to the bottom of the yoke can be adjusted to correct this condition

1946-52—The clutch is more easily removed by first taking the engine out of the car If this procedure is not desirable, proceed in a similar manner to that described for previous models

CLUTCH, OVERHAUL

1939-52—To replace clutch springs, remove the clutch from the car as described above, then pull out the pin which connects the fulcrum bracket to the pressure lever, after which, remove the pressure lever

Installation is made in the reverse order If the clutch facings become worn, the complete disc assembly may be changed

TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1939-52—To remove the transmission, raise the rear end of the car until its weight is relieved from the rear springs Disconnect the springs from the rear axle and the brake cables and conduits from the brake backing plate Block up the rear of the engine to support it while the transmission is removed Remove the clutch cable clamp from the bottom of the transmission, and take off the control housing and shift lever assembly Disconnect the torque tube from the transmission adapter and pull the rear axle and propeller shaft to the rear, being careful not to lose the propeller shaft spring and washer which are located between the propeller shaft and speedometer gear Unfasten the transmission case from the flywheel housing and pull the transmission to the rear and out of the car.

Reverse the order of the above procedure to install the transmission and check its operation in all speeds, being sure the clutch disengages when the pedal is pushed down to the floor If it does not, adjust the clevis which attaches to the bottom of the yoke until the desired result is obtained

TRANSMISSION, OVERHAUL

1939-52 — To disassemble, remove the speedometer gear snap ring, speedometer gear and woodruff key, the rear ball bearing snap rings and take out the ball bearing and oil retainer washer Pull the mainshaft out through the rear of the case, pulling it through the second and low gears

Remove the main drive gear bearing snap ring and bearing retainer, then take out the bearing, oil retaining washer and main drive gear

Remove the idler and countershaft lock plate, drive out the reverse idler shaft and lift the cluster gear out through the top

Reverse the operations to assemble and check the operation in all speeds

REAR AXLE

REAR AXLE & TORQUE TUBE, REMOVE

1939-52 — Disconnect the brake cable clevis from the brake cam lever Unfasten the brake cable conduit from the clamp on the brake backing plate. Raise the rear of the car until the weight is removed from the rear springs, then disconnect the springs from the rear axle Block up the transmission to support it while the rear axle is removed Disconnect the torque tube from the transmission adapter and pull the rear axle, propeller shaft and torque tube assembly rearward, being sure not to lose the spring and washer which are located between the universal and transmission The propeller shaft may now be removed from the torque tube

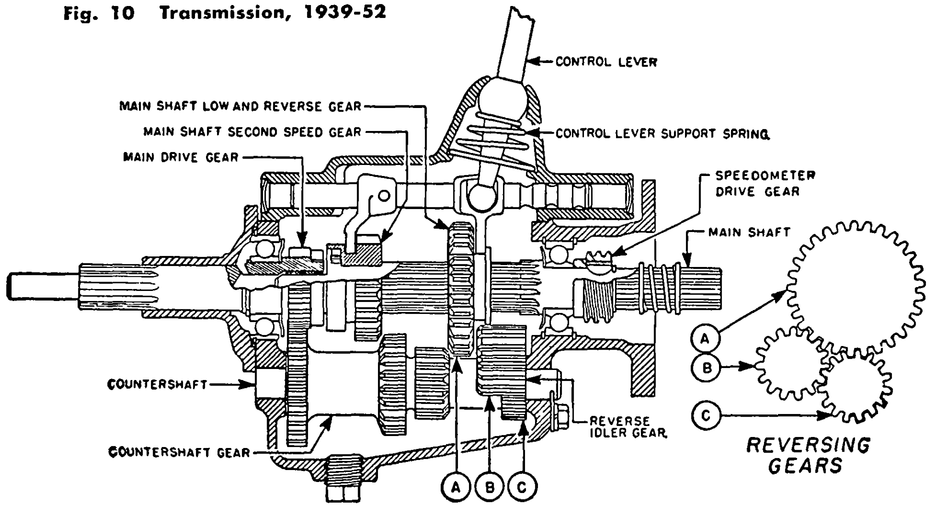
REAR AXLE, OVERHAUL

1939-52—Fig 11 pictures the type of driving axle used The drive pinion is held in position by the shoulders in the differential carrier, upon which the pinion bearing cups seat The pinion position is maintained by shims located between the rear bearing and the rear shoulder in the differential carrier Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings

The shimmed type of differential bearing adjustment is employed The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter

The axle tubes are pressed into the differential carrier to form a one-piece housing To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

Fig. 10 Transmission, 1939-52



PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, remove the pinion retaining nut. The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and press the rear bearing cone from the shaft. When replacing the cone, select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when being pressed on the shaft.

Drive out the front bearing cup. If the rear bearing cup is to be replaced or if the pinion setting is to be changed, drive out the rear bearing cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used (see *Rear Axle* chapter). After the required shims have been added or subtracted, the rear bearing cup may be replaced.

When making a pinion adjustment, the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to obtain the proper pinion bearing adjustment.

PINION BEARINGS, ADJUST—The only occasion for adjusting the drive pinion bearings is when a new differential carrier or new pinion is installed. To make the adjustment, install sufficient shims between the bearing spacer and the front bearing so that when the pinion retaining nut is tightened, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

PINION, ADJUST—After adjusting the pinion bearings, the position of the pinion should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle* chapter. If a correction is necessary, disassemble the pinion and, if the pinion is to be moved toward the center of the axle, add shims between the rear bearing and the rear shoulder in the carrier. If the pinion has to be moved away from the center of the axle, remove shims from this point.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle* chapter.

AXLE SHAFT & BEARINGS

1939-52—To remove an axle shaft, take off the wheel and use a suitable puller to release the hub. Disconnect the brake cable from the brake cam lever and unfasten the brake cable conduit from the clamp on the brake backing plate. Remove the brake backing plate from the axle housing and pull the axle and bearing out of the housing.

Axle shaft end play and bearing adjustment is controlled by shims located between the brake backing plates and the flanges on the outer ends of the axle housing. A total clearance of from .002" to .007" should be provided between the splined ends of the axle shafts and the thrust block in the differential. To check the end play, the rear wheels must be jacked up and the amount of end play determined with a dial indicator by pushing in and pulling out one wheel. To adjust the end play, remove shims to reduce the end play or add shims to increase it. It is only necessary to do this on one side as this will also take care of adjustment on opposite side.

FRONT SUSPENSION

CAMBER & CASTER, ADJUST

1939-52—The cambler angle is 2 degrees while the caster angle is 6½ degree (10 on 1947-52). Caster up to about 2 degrees can be adjusted by inserting tapered caster plates between the spring seat and spring. To increase caster, place the thick side of the caster plate toward the rear of the axle, and to decrease caster, the thick side should be at the front.

If the caster is out more than two degrees or if the camber is not according to specifications, the axle must be removed and straightened.

TOE-IN, ADJUST

1939-52—Toe-in should be from $\frac{3}{64}$" to $\frac{1}{16}$". To adjust, loosen the clamps on the tie rod adjusting sleeve and turn the sleeve. The sleeve has right-hand threads in one end and left-hand threads in the other. After the proper adjustment is obtained, tighten the clamps securely.

KINGPINS & BUSHINGS, RENEW

1939-52—To remove the kingpins and bushings, jack up the front end of the car, remove the front wheels, brake backing plate and the grease fittings from the spindles. Drive out the tapered lock pin, remove the expansion plug at the top of the kingpin and drive the kingpin down and out through the lower bushing. Use a suitable puller to remove the bushing from the spindle.

To install, press the new bushing in place, being sure the oil holes line up, then ream the bushing to the correct size for the new kingpin. Fit the spindle on the axle and if the clearance between the top of the axle and the spindle is more than .004", install sufficient shims at this point to obtain the desired result.

Install the kingpin from the top, drive in the lock pin, install new expansion plugs at the top and bottom and complete the job by installing the brake backing plate and wheel.

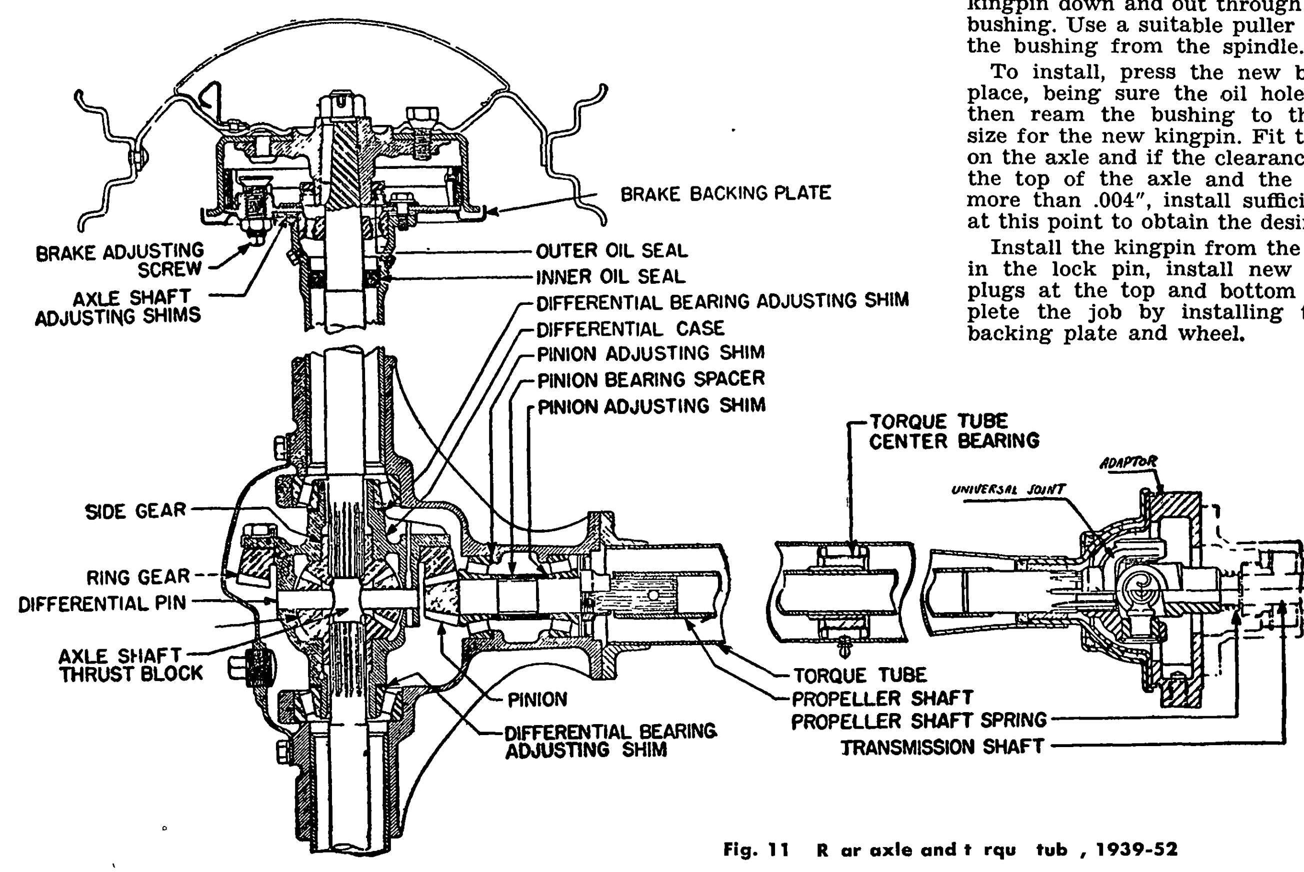


Fig. 11 R ar axle and t rqu tub , 1939-52

DE SOTO

INDEX OF SERVICE OPERATIONS

Specifications are tabulated on the pages immediately following this index. For service procedure, see the Chrysler chapter, using the index below to find the job in which you are interested

NOTE—See appendix at back of book for data on power steering.

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Airstream 6	SF	116	In Block	3 3/8 x 4 1/2	241.5	6.00	93 @ 3400		45 @ 30
	Airflow 6	SG	115 1/2	In Block	3 3/8 x 4 1/2	241.5	6.50	100 @ 3400		45 @ 30
1936	De Luxe 6	S1	117	In Block	3 3/8 x 4 1/2	241.5	6.00	93 @ 3400		45 @ 30
	Custom 6	S1	117	In Block	3 3/8 x 4 1/2	241.5	6.00	93 @ 3400		45 @ 30
	Airflow 6	S2	115 1/2	In Block	3 3/8 x 4 1/2	241.5	6.50	100 @ 3400		45 @ 30
1937	6	S3	116	In Block	3 3/8 x 4 1/4	228.1	6.50	93 @ 3600	172 @ 1200	45 @ 30
1938	Standard 6	S5	119	In Block	3 3/8 x 4 1/4	228.1	6.50	93 @ 3600	172 @ 1200	45 @ 30
	De Luxe 6	S5	119	In Block	3 3/8 x 4 1/4	228.1	6.50	93 @ 3600	172 @ 1200	45 @ 30
1939	6	S6	119	In Block	3 3/8 x 4 1/4	228.1	6.50	93 @ 3600	172 @ 1200	45 @ 30
1940	De Luxe 6	S7S	122 1/2	In Block	3 3/8 x 4 1/4	228.1	6.50	100 @ 3600	176 @ 1200	45 @ 30
	Custom 6	S7C	122 1/2	In Block	3 3/8 x 4 1/4	228.1	6.50	100 @ 3600	176 @ 1200	45 @ 30
1941	De Luxe 6	S8S	121 1/2	In Block	3 3/8 x 4 1/4	228.1	6.80	105 @ 3600	178 @ 1200	45 @ 30
	Custom 6	S8C	121 1/2	In Block	3 3/8 x 4 1/4	228.1	6.80	105 @ 3600	178 @ 1200	45 @ 30
1942	De Luxe 6	S10S	121 1/2	In Block	3 7/16 x 4 1/4	236.6	6.60	115 @ 3800	190 @ 1600	45 @ 30
	Custom 6	S10C	121 1/2	In Block	3 7/16 x 4 1/4	236.6	6.60	115 @ 3800	190 @ 1600	45 @ 30
1946–48	De Luxe 6	S11S	121 1/2	In Block	3 7/16 x 4 1/4	236.6	6.60	109 @ 3600	192 @ 1200	45 @ 30
	Custom 6	S11C	121 1/2	In Block	3 7/16 x 4 1/4	236.6	6.60	109 @ 3600	192 @ 1200	45 @ 30
1949	De Luxe 6	S13S	125 1/2	In Block	3 7/16 x 4 1/4	236.6	7.00	112 @ 3600	195 @ 1600	45 @ 30
	Custom 6	S13C	125 1/2	In Block	3 7/16 x 4 1/4	236.6	7.00	112 @ 3600	195 @ 1600	45 @ 30
1950	De Luxe 6	S14S	125 1/2	In Block	3 7/16 x 4 1/4	236.6	7.00	112 @ 3600	195 @ 1600	45 @ 30
	Custom 6	S14C	125 1/2	In Block	3 7/16 x 4 1/4	236.6	7.00	112 @ 3600	195 @ 1600	45 @ 30
1951	De Luxe	S15-1	125 1/2	In Block	3 7/16 x 4 1/2	250.6	7.00	116 @ 3600	208 @ 1600	50 @ 45
	Custom 6	S15-2	125 1/2	In Block	3 7/16 x 4 1/2	250.6	7.00	116 @ 3600	208 @ 1600	50 @ 45
1952	Six	S15	125 1/2	In Block	3 7/16 x 4 1/2	250.6	7.00	116 @ 3600	208 @ 1600	50 @ 45
	V8....	S17	125 1/2	In Head	3 5/8 x 3 11/32	276.1	7.10	160 @ 4400	250 @ 2000	50 @ 45

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch (Note F)	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935–36	SF, S1	AC-S9	.025	.020	35–38	153624	A	Positive	450–500		65–70
	SG, S2	AC-S9	.025	.020	35–38	153624	B	Positive	450–500		65–70
1937	S3	CH-J8	.025	.020	35–38	153624	B	Positive	450–500		65–70
1938	S5	AL-A7	.025	.020	35–38	153624	C	Positive	450–500		65–70
1939–40	All	AL-A7B	.025	.020	35–38	153624	D	Positive	450–500		65–70
1941	All	AL-A7B	.025	.020	35–38	153624	A	Positive	450–500	450–500	65–70
1942	All	AL-A7B	.025	.020	35–38	153624	E	Positive	450–500	450–500	65–70
1946–48	All	AL-A5	.030	.020	35–38	153624	A	Positive	450–500	450–500	65–70
1949–52	Six	AL-AR8	.035	.020	35–38	153624	D	Positive	450–500	450–500	65–70
1952	V8	AL-4S-140	.035	.017	G	H	J	Positive	450–500	450–500	80–85

A—"O" mark on vibration damper.
B—Fifth line after "O" mark on vibration damper.
C—Third line after "O" mark on vibration damper.
D—Second line before "O" mark on vibration damper.
E—Fourth line after "O" mark on vibration damper for models with cast iron pistons. For models with aluminum pistons, "O" mark.
F—Plus or minus .002".
G—26-28 degrees (one set of points). Total dwell 32-36 degrees.
H—Cylinder numbering as viewed from rear of engine. Right bank, 2-4-6-8; left bank, 1-3-5-7. Firing order: 1-8-4-3-6-5-7-2.
J—Fourth line after "O" mark on vibration damper.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance H-Hot C-Cold Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing (Note A) Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935–36	All	.006H	.008H	.010	45	B	2	46@2 1/32	.001–.003	.002–.004	.3410	.3400
1937	All	.008H	.010H	.014	45	B	2	40@1 3/4	.001–.003	.002–.004	.3410	.3400
1938–39	All	.008H	.010H	.014	45	8	2	40@1 3/4	.001–.003	.002–.004	.3410	.3400
1940–42	All	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
1946–52	Six	.008H	.010H	.014	45	12	6	40@1 3/4	.001–.003	.002–.004	.3410	.3400
1952	V8	Zero	Zero	Zero	45	12	14	38@1 11/16	.001–.003	.002–.004	.3725	.3715

A—BTDC means before top dead center; ATDC means after top dead center.
B—Top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Shim Thickness To Use	Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A) Compression	Ring Gap Oil	Clearance in Groove Compression	Clearance in Groove Oil	Pins Type	Pins Fit
1935–36	All	Above	.002	5 to 7	.007	.007	.002–.003	.002–.003	D	E
1937–38	All	Above	.002	5 to 7	.007	.007	.0015–.003	.0015–.003	D	E
1939	All	Above	.002	5 to 7	.007	.007	.002–.004	.002–.004	D	E
1940–41	All	Above	.002	5 to 7	.007	.007	B	.001–.0025	D	E
1942–52	Six	Above	.002	5 to 7	.007	.007	C	.001–.0025	D	E
1952	V8	Above	.002	9 to 12	.015	.015	.001–.0025	.001–.0025	D	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Top ring .002-004″, second ring .0015-.0035″.
C—Top ring .0025-.004″, second ring .002-0035″.
D—Floating type. Pin retained by snap rings in piston bosses.
E—Thumb push fit in piston and rod but with piston heated.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-36	All	.003–.005	.001–.003	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
1937-41	All	.002–.006	.001–.003	2.124–2.125	.0005–.0025	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
1942-52	Six	.002–.006	.001–.003	2.124–2.125	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.003–.007	75–80
1952	V8	.002–.006	.001–.003	2.0615–2.0625	.0005–.0015	.006–.014	45–50	2.3745–2.3755	.0005–.0015	.002–.007	80–85

A—Thrust taken by rear bearing on sixes; center bearing on V8.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts (Without Heater)	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil Above +32°F.	ENGINE: Grade of Oil Above +10°F.	ENGINE: Grade of Oil Above z −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil Summer	TRANSMISSION: Grade of Oil Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil Summer	DIFFERENTIAL: Grade of Oil Winter
1935	SF	17	15	6	20	20W	10W	2½	140	90	3¼	140	90
	SG	17	16	6	20	20W	10W	3¾ (A)	140 (B)	90 (B)	3¼	140	90
1936	S1	19	15	6	20	20W	10W	2½ (C)	140 (B)	90 (B)	3¼	90H	90H
	S2	19	16	6	20	20W	10W	2½ (C)	140 (B)	90 (B)	3¼	90H	90H
1937-38	S3, S5	20	16	5	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
1939	S6	19	18	5	20	20W	10W	2¼ (D)	140 (B)	90 (B)	3¼	90H	90H
1940	S7	17	17	5	20	20W	10W	2¾ (E)	90 (F)	90 (F)	3¼	90H	90H
1941-42	S8, S10	18	17	5	20	20W	10W	2¾	90 (G)	90 (G)	3¼	90H	90H
1946-48	S11	18	17	5	20	20W	10W	2¾ (J)	90 (G)	90 (G)	3¼	90H	90H
1949-50	S13, S14	18	17	5	30	20W	10W	2¾ (J)	80 (G)	80 (G)	3¼	90H	90H
1951-52	S15	15	17	5	30	20W	10W	2¾ (J)	80 (G)	80 (G)	3¼	90H	90H
1952	S17	22	17	5	30	20W	10W	3 (K)	G	G	3½	90H	90H

A—With overdrive, 6¼ pints.
B—With overdrive, use S.A.E. 70 for summer; S.A.E. 50 for winter.
C—With overdrive, 4½ pints.
D—With overdrive, 3¼ pints.
E—With overdrive, 4 pints.
F—With overdrive, use S.A.E. 50.
G—For semi-automatic transmission, use S.A.E. 10W engine oil.
H—Hypoid gear lubricant.
J—For semi-automatic transmission, 3 pints.
K—For torque converter, approximately 10½ qts.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-52	All	.006–.010	Shims	Shims	.003–.008

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	SF	+2	+ 3/8	3/32	10
	SG	+2	+ ½	3/32	4
1936	S1	+1½	+ 1/8	1/16	10
	S2	+2	+ ½	1/16	9½
1937	All	+1½	+ 1/8	1/16	5 3/8
1938	All	+1½	+ 1/8	1/16	5 3/8
1939	All	+1½	+ ¼	1/16	5 3/8
1940-41	All	Zero	+ 3/8	1/16	5 3/8
1942-48	All	Zero	+ 3/8	1/32	5 3/8
1949-50	All	−2	+ 3/8	1/32	5 3/8
1951-52	All	−2	Zero	Zero	5¾

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935	SF	Molded	19 13/16	2	3/16	5/16
	SG	Molded	22 5/32	2	3/16	5/16
1936	S1 Deluxe	Molded	19 13/16	2	3/16	5/16
	S1 Custom	Molded	22 5/32	2	3/16	5/16
	S2	Molded	22 5/32	2	3/16	5/16
1937	All	Molded	(A) 19 13/16 (B) 17 19/64	2	3/16	5/16
1938-42	All	Molded	19 7/16	2	3/16	5/16
1946-49	All	Molded	(A) 23 (B) 20 3/8	2	13/64	3/16
1950-52	All	Molded	25 1/8	2	13/64	3/16

A—Front wheel.
B—Rear wheel.

DE SOTO

FIRST SERIAL NUMBER

LOCATION—1935-42: On right front door pillar.
1946-52: On left front door pillar.

Year	Model	
1935	SF	6023501
	SG	5082201
1936	S1 De Luxe	6043701
	S1 Custom	5500001
	S2	5089001
1937	S3	5517301
1938	S5	5598301
1939	S6	5634001
1940	S7S	6064301
	S7C	5688001
1941	S8S	6096001
	S8C	5720401
1942	S10S	6142001
	S10C	5771001
1946	S11S	6154001
	S11C	5784001
1947	S11S	6172863
	S11C	5825785
1948	S11S	6190370
	S11C	5885816
1949	S13S	6212001[1]
		30002001[2]
	S13C	50000101[1]
		62004001[2]
1950	S14S	6233501[1]
		60005001[2]
	S14C	50062001[1]
		62011501[2]
1951	S15-1	6269001[1]
		60011001[2]
	S15-2	50155001[1]
		62024001[2]
1952	S15-1	62836011[1]
		600130012[2]
	S15-2	502301011[1]
		620326012[2]
	S17	550000011[1]
		640010012[2]

[1] Detroit, Mich. [2] Los Angeles, Cal.

FIRST ENGINE NUMBER

LOCATION—1935-52 Sixes: Left front of cylinder block. 1952 V8: Top of cylinder block just back of water pump.

Year	Model	
1935	SF	SF-1001
	SG	SG-1001
1936	S1	S1-1001
	S2	S2-1001
1937	S3	S3-1001
1938	S5	S5-1001
1939	S6	S6-1001
1940	S7	S7-1001
1941	S8	S8-1001
1942	S10	S10-1001
1946	S11	S11-1001
1947	S11	Note A
1948	S11	Note A
1949	S13	S13-1001
1950	S14	S14-1001
1951	S15	S15-1001
1952	S15	Note A
1952	S17	S17-1001

A—Continued from previous year.

DODGE

INDEX OF SERVICE OPERATIONS

Specifications are tabulated on the pages immediately following this index. For service procedure, see the Chrysler chapter, using the index below to find the job in which you are interested

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Six	DU	116	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1936	Six	D2	116	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1937	Six	D5	115	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1938	Six	D8	115	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1939	De Luxe Six	D11	117	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
	Special Six	D11S	117	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1940	De Luxe Six	D14	119½	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
	Special Six	D17	119½	In Block	3¼ x 4⅜	217.0	6.5	87 @ 3600	166 @ 1200	45 @ 30
1941	De Luxe Six	D19S	119½	In Block	3¼ x 4⅜	217.0	6.5	91 @ 3800	170 @ 1200	45 @ 30
	Custom Six	D19C	119½	In Block	3¼ x 4⅜	217.0	6.5	91 @ 3800	170 @ 1200	45 @ 30
1942	De Luxe Six	D22S	119½	In Block	3¼ x 4⅝	230.2	6.7	105 @ 3600	185 @ 1600	45 @ 30
	Custom Six	D22C	119½	In Block	3¼ x 4⅝	230.2	6.7	105 @ 3600	185 @ 1600	45 @ 30
1946–48	De Luxe Six	D24S	119½	In Block	3¼ x 4⅝	230.2	6.7	102 @ 3600	184 @ 1200	45 @ 30
	Custom Six	D24C	119½	In Block	3¼ x 4⅝	230.2	6.7	102 @ 3600	184 @ 1200	45 @ 30
1949	Wayfarer Six	D29	115	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
	Coronet Six	D30	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
	Meadowbrook Six	D30	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
1950	Wayfarer Six	D33	115	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
	Coronet Six	D34	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
	Meadowbrook Six	D34	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	40 @ 25
1951–52	Wayfarer 6	D41	115	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	45 @ 45
	Coronet 6	D42	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	45 @ 45
	Meadowbrook 6	D42	123½	In Block	3¼ x 4⅝	230.2	7.0	103 @ 3600	190 @ 1200	45 @ 45

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note D	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935	All	AC-S9	.025	.020	35–38	153624	A	Positive	450–500		65–70
1936	All	AC-K9	.025	.020	35–38	153624	A	Positive	450–500		65–70
1937–38	All	CH-J8	.025	.020	35–38	153624	A	Positive	450–500		65–70
1939–40	A'l	AL-A7B	.025	.020	35–38	153624	B	Positive	450–500		65–70
1941–42	All	AL-A7B	.025	.020	35–38	153624	C	Positive	450–500		65–70
1946–48	All	AL-A5	.025	.020	35–38	153624	C	Positive	450–500		65–70
1949	All	AL-AR5	.025	.020	35–38	153624	C	Positive	450–500		65–70
1950–52	All	AL-AR8	.035	.020	35–38	153624	C	Positive	450–500	450–500	65–70

A—Fourth line after "O" mark on vibration damper.
B—"O" mark on vibration damper.
C—With fluid drive, second line before "O" mark on vibration damper. Cars without fluid drive, "O" mark.
D—Plus or minus .002".

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935–40	All	.006H	.008H	.012	45	B	8	40@1¾	.001–.003	.002–.004	.3410	.3400
1941	All	.008H	.010H	.014	45	B	9	40@1¾	.001–.003	.002–.004	.3410	.3400
1942	All	.008H	.010H	.014	45	9	6	40@1¾	.001–.003	.002–.004	.3410	.3400
1946–48	All	.008H	.010H	.014	45	12	6	40@1¾	.001–.003	.002–.004	.3410	.3400
1949–52	All	.008H	.010H	.014	45	8	7	40@1¾	.001–.003	.002–.004	.3410	.3400

A—BTDC means before top dead center; ATDC means after top dead center.
B—Six degrees after top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935–36	All	Above	.002	7 to 14	.007	.007	.002 –.003	.002 –.003	C	E
1937–38	All	Above	.002	7 to 14	.007	.007	.0015–.003	.0015–.003	C	E
1939	All	Above	.002	10 to 16	.007	.007	.0015–.004	.0015–.004	C	E
1940	All	Above	.002	10 to 16	.007	.007	B	.001 –.0025	C	E
1941–48	All	Above	.0015	10 to 17	.007	.007	.0025–.004	.001 –.0025	C	E
1949–52	All	Above	.002	5 to 7	.007	.007	D	.001 –.0025	C	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Top ring .002-004″, second ring .0015-.0035″.
C—Floating type. Pin retained by snap rings in piston bosses.
D—Top ring .0025-.004″, second ring .002-.0035″.
E—Thumb push fit in piston and rod but with piston heated.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935-40	All	.002–.006	.001–.003	2.0615–2.0625	.0005–.0015	.006–.011	45–50	2.499–2.500	.001–.003	.003–.007	B
1941-52	All	.002–.006	.001–.003	2.0615–2.0625	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.003–.007	75–80

A—Thrust taken by rear bearing.
B—75–80 Lbs. Ft. on 1941–48 and 80–85 Lbs. Ft. on 1949–52.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts (Without Heater)	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil, Above +32°F.	ENGINE: Grade of Oil, Above +10°F.	ENGINE: Grade of Oil, Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil, Summer	TRANSMISSION: Grade of Oil, Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil, Summer	DIFFERENTIAL: Grade of Oil, Winter
1935	All	17	15	5	20	20W	10W	2½	140	90	3¼	140	90
1936	All	15	15	5	20	20W	10W	2½	140	90	3¼	140	90
1937	All	16	16	5	20	20W	10W	2¼	140	90	3¼	90H	90H
1938	All	15	16	5	20	20W	10W	2¼	140	90	3¼	90H	90H
1939	All	15	18	5	20	20W	10W	2¼	140	90	3¼	90H	90H
1940-48	All	15	17	5	20	20W	10W	2¾	90	90	3¼	90H	90H
1949-50	All	15	17	5	30	20W	10W	2¾(A)	80(B)	80(B)	3¼	90H	90H
1951-52	All	14	17	5	30	20W	10W	2¾(A)	80(B)	80(B)	3¼	90H	90H

H—Hypoid gear lubricant.
A—For semi-automatic transmission, 3 pints.
B—For semi-automatic transmission, use S.A.E. 10W engine oil.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935-36	All	+2	+ ½	1/16	9½
1937-38	All	+2	+ ½	1/16	5
1939	All	+ ½	+ ⅛	1/16	6
1940-48	All	Zero	+ ⅜	1/16	5⅜
1949-50	All	Zero	+ ⅜	1/32	5⅜
1951-52	All	Zero	Zero	Zero	5¾

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-52	All	.006-.010	Shims	Shims	.003-.008

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935-36	All	Molded	19 13/16	2	3/16	5/16
1937	All	Molded	(A)19 13/16 (B)17 19/64	2	3/16	5/16
1938-42	All	Molded	19 7/16	2	3/16	5/16
1946-1948	All	Molded	(A)23 (B)20⅜	2	3/16	5/16
1949-1952	D29,33,41	Molded	(A)21 (B)18½	2	13/64	3/16
	D30,34,42	Molded	(A)23 (B)20⅜	2	13/64	3/16

A—Front wheel.
B—Rear wheel.

FIRST SERIAL NUMBER

LOCATION—1935-42: On right front door pillar.
1946-52: On left front door pillar.

Year	Model	
1935	DU	3756501
1936	D2	4015051
1937	D5	4530451
1938	D8	30001001
1939	D11	30100001
	D11S	4276701
1940	D14	30216001
	D17	4349001
1941	D19	30342401
1942	D22	30577001
1946	D24	30645001[1]
		45000001[2]
1947	D24	30788738[1]
		45002146[2]
1948	D24	31011766[1]
		45022453[2]
1949	D29	37000101[1]
		48000101[3]
	D30	31245001[1]
	D30	45050001[3]
1950	D33	37060001[1]
		48502001[2]
		48004001[3]
	D34	31420001[1]
		45505001[2]
		45064001[3]
1951	D41	37135001[1]
		48008001[3]
		48506001[4]
	D42	31663001[1]
		45079001[4]
		45418001[4]
1952	D41	37175001[1]
		48009901[3]
		48507601[2]
	D42	31867801[1]
		45090601[3]
		45527501[2]

[1] Detroit, Mich. [2] Los Angeles, Cal.
[3] San Leandro, Cal.

FIRST ENGINE NUMBER

LOCATION—On left front of cylinder block.

Year	Model	
1935	DU	DU-1001
1936	D2	D2-1001
1937	D5	D5-1001
1938	D8	D8-1001
1939	All	D11-1001
1940	All	D14-1001
1941	D19	D19-1001
1942	D22	D22-1001
1946	D24	D24-1001
1947	D24	Note A
1948	D24	Note A
1949	All	D30-1001
1950	All	D34-1001
1951	All	D42-1001
1952	All	Note A

A—Continued from previous year.

FORD

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheel-base Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	V8	48	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.30	85 @ 3800	144 @ 2200	30 @ 30
1936	V8	68	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.30	85 @ 3800	144 @ 2200	30 @ 30
1937	V8-60	74	112	In Block	2.6 x 3.2	136.0	6.60	60 @ 3600	94 @ 2500	30 @ 30
	V8-85	78	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.20	85 @ 3800	153 @ 2200	30 @ 30
1938	V8-60	82A	112	In Block	2.6 x 3.2	136.0	6.60	60 @ 3500	94 @ 2500	30 @ 30
	V8-85	81A	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.12	85 @ 3800	146 @ 2000	30 @ 30
1939	V8-60	922A	112	In Block	2.6 x 3.2	136.0	6.60	60 @ 3500	94 @ 2500	30 @ 30
	V8	91A	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.15	90 @ 3800	155 @ 2200	30 @ 30
1940	V8-60	022A	112	In Block	2.6 x 3.2	136.0	6.60	60 @ 3500	94 @ 2500	30 @ 30
	V8	01A	112	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.15	90 @ 3800	155 @ 2200	30 @ 30
1941	V8	11A	114	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.15	90 @ 3800	155 @ 2200	30 @ 30
	Six-cyl.	1GA	114	In Block	3.3 x 4.4	226.0	6.70	90 @ 3300	180 @ 1200	30 @ 30
1942	V8	21A	114	In Block	$3\frac{1}{16}$ x $3\frac{3}{4}$	221.0	6.20	90 @ 3800	156 @ 2200	30 @ 30
	Six-cyl.	2GA	114	In Block	3.3 x 4.4	226.0	6.70	90 @ 3300	180 @ 1200	30 @ 30
1946	V8	69A	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	30 @ 30
	Six-cyl.	6GA	114	In Block	3.3 x 4.4	226.0	6.70	90 @ 3300	180 @ 1200	30 @ 30
1947	V8	79A	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	30 @ 30
	Six-cyl.	7GA	114	In Block	3.3 x 4.4	226.0	6.70	90 @ 3300	180 @ 1200	30 @ 30
1948	V8	89A	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	57 @ 40
	Six-cyl.	87HA	114	In Block	3.3 x 4.4	226.0	6.80	95 @ 3300	180 @ 1200	57 @ 40
1949	V8	8BA	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.80	100 @ 3600	180 @ 2000	57 @ 40
	Six-cyl.	8HA	114	In Block	3.3 x 4.4	226.0	6.80	95 @ 3300	180 @ 1200	57 @ 40
1950	V8	OBA	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.80	100 @ 3600	181 @ 2000	57 @ 40
	Six-cyl.	OHA	114	In Block	3.3 4.4	226.0	6.80	95 @ 3300	180 @ 1200	57 @ 40
1951	V8	1BA	114	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.80	100 @ 3600	187 @ 1800	57 @ 40
	Six-cyl.	1HA	114	In Block	3.3 x 4.4	226.0	6.80	95 @ 3300	185 @ 1500	57 @ 40
1952	V8		115	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	7.20	110 @ 3800	194 @ 1900	57 @ 40
	Six		115	In Head	3.56 x 3.60	215.0	7.00	101 @ 3500	185 @ 1300	57 @ 40

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935–42	V8	CH-H10	.025	.015	36	B	A	Positive	450–475		C
1941–42	Six	CH-H10	.030	.015	36	153624	A	Positive	450–475		50-60
1946–47	V8	CH-H10	.030	.015	36	B	A	Positive	450–475		50-60
	Six	CH-H10	.030	.015	36	153624	A	Positive	450–475		50-60
1948	V8	CH-H10	.030	.015	36	B	A	Positive	450–475		50-60
	Six	CH-H10	.030	.025	35	153624	D	Positive	450–475		50-60
1949–51	V8	CH-H10	.030	.015	28	B	D	Positive	450–475	425	65-70
	Six	CH-H10	.030	.025	36	153624	D	Positive	450–475	425	65-70
1952	V8	CH-H10	.030	.015	28	B	D	Positive	450–475	425	65-70
	Six	CH-H10	.035	.025	36	153624	E	Positive	450–475	425	65-70

A—There are no timing marks. Spark can be advanced or retarded by adjusting vacuum brake set screw on distributor housing.

B—Firing order 1-5-4-8-6-3-7-2. Starting with the front cylinder of the right bank as viewed from rear of engine, firing order is 1R, 1L, 4R, 4L, 2L, 3R, 3L, 2R.

C—Cast iron heads, 50-60; aluminum, 35-40.

D—Grooved mark on crankshaft pulley.

E—On vibration damper.

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935–36	All	.012C	.014C	.012	45	9 1/2	6 1/2	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
1937–38	V8-60	.012C	.014C	.012	45	9 1/2	6 1/2	26@2	.0015–.0035	.0015–.0035	.2790	.2790
	V8-85	.012C	.014C	.012	45	9 1/2	6 1/2	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
1939–40	V8-90	.012C	.014C	.012	45	E	6	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
	V8-60	.012C	.014C	.012	45	9 1/2	6 1/2	26@2	.0015–.0035	.0025–.0045	.2790	.2790
1941–42	V8	.012C	.014C	.012	45	E	6	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
	Six	.014C	.014C	.014	45	3	6	37@2 1/8	.0015–.0035	.0015–.0035	.3095	.3095
1946	V8	.012C	.014C	.014	45	E	6	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
	Six	.014C	.014C	.014	45	5	4	37@2 1/8	.0015–.0035	.0015–.0035	.3105	.3105
1947	V8	.012C	.014C	.014	45	E	6	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
	Six	.014C	.014C	.014	45	11	10	37@2 1/8	.0015–.0035	.0015–.0035	.3105	.3105
1948	V8	.012C	.014C	.014	45	E	6	37@2 1/8	.0025–.0045	.0025–.0045	.3095	.3095
	Six	.014C	.014C	.014	45	11	10	37@2 1/8	.001 –.003	.001 –.003	.3410	.3410
1949	V8	B	B	B	45	C	D	40@2 1/8	.001 –.003	.0015–.0035	.3465	.3465
	Six	.010C	.014C	.010	45	11	10	47@2 7/64	.0015–.0035	.002 –.004	.3410	.3410
1950–51	V8	.014C	.018C	.014	45	5	3	40@2 1/8	.001 –.003	.0015–.0035	.3465	.3465
	Six	.010C	.014C	.010	45	11	10	47@2 7/64	.0015–.0035	.002 –.004	.3410	.3410
1952	V8	.014C	.018C	.013	45	24	14	39@1.89	.001 –.003	.0015–.0035	.3410	.3405
	Six	.015H	.015H	.015	45	23	33	54@1.82	.001 –.003	.0015–.0035	.3415	.3410

A—BTDC means before top dead center; ATDC means after top dead center.
B—Early 1949 .012" intake, .014" exhaust. Late 1949 .014" intake, .018" exhaust.
C—To Serial No. 8BA-622468, top dead center; after 8BA-622468, 5 degrees before top dead center.
D—To Serial No. 8BA-622468, 6 degrees; after 8BA-622468, 3 degrees.
E—Top dead center.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note B	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-36	All	.003	.002	1.9990	.0017–.0036	.006–.014	40	1.9990(A)	.000–.003	.002–.006	80
1937-38	74, 82A	.003	.002	1.5990	.0015–.0035	.006–.014	40	1.9990	.000–.003	.002–.006	80
	78, 81A	.003	.002	1.9990	.0017–.0036	.006–.014	40	2.3990	.000–.003	.002–.006	80
1939	922A	.003	.002	1.5990	.0015–.0035	.006–.014	40	1.9990	.000–.003	.002–.006	80
	91A	.003	.002	1.9990	.0017–.0036	.006–.014	40	2.4990	.000–.003	.002–.006	80
1940	022A	.003	.002	1.6990	.0015–.0035	.006–.014	40	2.0990	.000–.003	.002–.006	80
	01A	.003	.002	1.9990	.0017–.0036	.006–.014	40	2.4990	.000–.003	.002–.006	80
1941	V8	.003	.002	1.9990	.0017–.0036	.006–.014	40	2.4990	.000–.003	.002–.006	80
	Six	.003	.002	2.2350	.0017–.003	.003–.007	40	2.4990	.000–.003	.002–.006	80
1942	V8	.003	.002	1.9990	.0017–.0036	.004–.008	40	2.4990	.000–.003	.002–.006	80
	Six	.003	.002	2.2350	.0017–.003	.003–.007	40	2.4990	.000–.003	.002–.006	80
1946-47	V8	.003	.002	2.1390	.0017–.0036	.004–.008	40	2.4990	.000–.003	.002–.006	80
	Six	.003	.002	2.2350	.0017–.003	.003–.007	40	2.4990	.000–.003	.002–.006	80
1948	V8	.003	.002	2.1390	.0017–.0036	.004–.008	40	2.4990	.000–.003	.002–.006	80
	Six	.003	.002	2.2988	.000 –.0025	.006–.014	40	2.8740	.0009–.0032	.003–.006	80
1949-50	V8	.003	.002	2.1390	.0005–.003	.006–.014	40	2.4990	.000–.003	.002–.006	100
	Six	.003	.002	2.2988	.0004–.0027	.006–.014	40	2.8740	.0005–.0032	.004–.008	100
1951	V8	.003	.002	2.1390	.0005–.003	.006–.020	40	2.4990	.001–.002	.002–.006	100
	Six	.003	.002	2.2988	.0004–.0027	.003–.007	40	2.8740	.0005–.002	.004–.008	100
1952	V8	.007	.002	2.1390	.0005–.003	.006–.020	45–50	2.4990	.001–.002	.002–.006	100
	Six	.003	.002		.0005–.0021	.003–.009	45–50		.0005–.0021	.004–.008	100

A—For large bearing crankshaft, use Model 78 dimensions.

B—On all models except 1952 Six taken on rear bearing. On 1952 Six thrust is taken on No. 3 bearing.

Year	Model	Fitting Pistons With Scale: Removed From	Fitting Pistons With Scale: Shim Thickness To Use	Fitting Pistons With Scale: Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A): Compression	Rings: Ring Gap, Minimum (Note A): Oil	Rings: Clearance in Groove: Compression	Rings: Clearance in Groove: Oil	Pins: Type	Pins: Fit
1935–36	All	Above	B	6 to 10	.012	.012	.0015–.003	.0015–.003	E	F
1937–40	V8-60	Above	C	7 to 12	.012	.012	.0015–.003	.0015–.003	E	G
	V8-85, 90	Above	B	6 to 10	.012	.012	.0015–.003	.0015–.003	E	G
1941–42	V8	Above	B	6 to 10	.012	.012	.0015–.003	.0015–.003	E	G
	Six	Above	B	6 to 12	.012	.012	.0015–.003	.0015–.003	E	F
1946–47	V8	Above	B	6 to 12	.014	.014	.0015–.003	.0015–.003	E	F
	Six	Above	B	6 to 12	.010	.010	.0015–.003	.0015–.003	E	F
1948	V8	Above	B	6 to 12	.014	.014	.0015–.003	.0015–.003	E	F
	Six	Above	.002	6 to 12	.010	.010	.0015–.003	.0015–.003	E	F
1949–50	V8	Above	.003	6 to 10	.007	.007	D	.001 –.003	E	F
	Six	Above	.003	6 to 12	.007	.007	D	.001 –.0025	E	F
1951	V8	Above	.003	6 to 10	.007	.007	D	.001 –.003	E	F
	Six	Above	.003	6 to 12	.010	.010	D	.001 –.0025	E	F
1952	V8	Above	.0015	3 to 12	.007	.007	D	.0015–.003	E	F
	Six	Above	.0015	6 to 12	.007	.007	H	.001–.003	E	F

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—With sleeves and aluminum pistons .0025″; without sleeves .002″.
C—With sleeves .0025″, without sleeves .002″.
D—Top ring .0015-.003″, lower rings .001-.0025″.
E—Floating type. Pin retained by snap rings in piston bosses.
F—Thumb push fit in piston and rod but with piston heated.
G—Aluminum pistons: Thumb push fit in piston and rod but with piston heated. Steel pistons: Thumb push fit in piston and rod with parts at 70° (room temperature).
H—Top ring .002-.0035″, lower ring .0015-.003″.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	Engine: Crankcase Refill Capacity, Quarts	Engine: Grade of Oil: Above +32°F.	Engine: Grade of Oil: Above +10°F.	Engine: Grade of Oil: Above −10°F.	Transmission: Capacity, Pounds or Pints	Transmission: Grade of Oil: Summer	Transmission: Grade of Oil: Winter	Differential: Capacity, Pounds or Pints	Differential: Grade of Oil: Summer	Differential: Grade of Oil: Winter
1935	All	20	14	5	30	20W	10W	2½	90	80	2½	140	90
1936	All	22	14	5	30	20W	10W	2½	90	80	2½	140	90
1937–38	74, 82A	15	14	4	30	20W	10W	1¾	90	80	2½	140	90
	78, 81A	22	14	5	30	20W	10W	2½	90	80	2½	140	90
1939	922A	15	15	4	30	20W	10W	1¾	90	80	2½	140	90
	91A	22	15	5	30	20W	10W	2½	90	80	2½	140	90
1940	022A	13	15	4	30	20W	10W	2¾	90	80	2½	140	90
	01A	22	15	5	30	20W	10W	2¾	90	80	2½	140	90
1941	V8	25½	17	5	30	20W	10W	2¾	90	80	2½	140	90
	Six	17½	17	5	30	20W	10W	2¾	90	80	2½	140	90
1942	V8	22	17	5	30	20W	10W	2¾	90	80	2½	140	90
	Six	15	17	5	30	20W	10W	2¾	90	80	2½	140	90
1946–47	V8	22	17	5	30	20W	10W	2¾	90	80	2½	140	90
	Six	14½	17	5	30	20W	10W	2¾	90	80	2½	140	90
1948	V8	22	17	5	30	20W	10W	2¾	90	80	2½	140	90
	Six	17	17	5	20	10	10W	2¾	90	80	2½	140	90
1949–50	V8	21	16	4	20W	10W	10W	3¼ (A)	80EP	80EP	3½	90HY	90HY
	Six	16	16	4	20W	10W	10W	3¼ (A)	80EP	80EP	3½	90HY	90HY
1951	V8	22	16	4	20W	10W	10W	3¼(A)	80EP(B)	80EP(B)	3½	90EP	90EP
	Six	17	16	4	20W	10W	10W	3¼(A)	80EP(B)	80EP(B)	3½	90EP	90EP
1952	V8	21	16	4	20W	10W	10W	3(A)	80EP(B)	80EP(B)	3½	90EP	90EP
	Six	16	16	4	20W	10W	10W	3(A)	80EP(B)	80EP(B)	3½	90EP	90EP

A—With overdrive, 4 pints; with Ford-O-Matic transmission 9¾ quarts. B—For Ford-O-Matic transmission use automatic transmission oil.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-48	All	.006-.010	None	Nut	.000-.015
1949-52	All	.003-.008	Shims	Shims	.001-.006

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935-36	All	+6¾	+ ⅝	3/32	8
1937-48	All	+6¾	+ ⅝	1/16	8
1949	All	−¼	+ ½	A	5¼
1950-51	All	−¼	+ ½	3/16	5¼
1952	All	−½	+ ½	3/32	5¼

A—Early cars (idler arm bracket has capscrew thread at lower mounting holes), ⅛ to 3/16 toe out. Late cars (idler arm bracket has nut at lower mounting hole), 1/16 to ⅛ toe in.

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935-36	All	Woven	26½	1¾	3/16	⅜
1937-38	All	A	26½	1¾	.212	⅜
1939-40	All	B	23¼	1¾	⅕	⅜
1941-42	All	Molded	23¼	1¾	⅕	⅜
1946-48	All	Molded	24	1¾	3/16	⅜
1949-52	All	Molded	22	(C) 2¼ (D) 1¾	3/16	⅜

A—Primary shoe, molded. Secondary, woven.
B—Primary shoe, woven. Secondary, molded.
C—Front wheels.
D—Rear wheels.

FIRST SERIAL & ENGINE NUMBERS

LOCATION—1935-48. On top of clutch housing and on left frame near cowl 1949-50 Plate on dash.

Year	Model	
1935	48	18-1234357
1936	68	18-2207111
1937	74	54-6602
	78	18-3331857
1938	82A	54-358335
	81A	18-4186447
1939	922A	Note A
	91A	18-4661001
1940	022A	54-506501
	01A	18-5210701
1941	11A	18-5896295
	1GA	1GA-1
1942	21A	18-6769036
	2GA	1GA-34801
1946	69A	99A-650280
	6GA	1GA-227524
1947	79A	799A-1412708
	7GA	71GA-326418(B)
1948	89A	899A-1984859
	87HA	87HA-0536
1949	8BA	8BA-101
	8HA	8HA-101
1950	0BA	B0-100001(C)
	0HA	H0-100001(C)
1951	1BA	B1-100001(C)
	1HA	H1-100001(C)

A—Continued through from 1938.

B—In late 1947, six cylinder serial numbers began at 77HA-0512.

C—Additional letters between basic model letters and serial numbers denote assembly plant.

ENGINE

ENGINE REMOVAL

1935-48—Remove the hood, radiator and all necessary sheet metal, including hood side panels, engine side pans, etc Detach water hose, heat indicator wire and battery cables Remove horns and air cleaner Disconnect choke and throttle rods, and the fuel line from the fuel pump Unfasten the front engine mountings and disconnect the engine from the transmission Before lifting out the engine, make a visual inspection to be sure that nothing has been overlooked which would prevent the engine's removal.

FORD SIX, 1949-51

ENGINE REMOVAL—

1 Remove hood and battery.
2 Drain crankcase and cooling system.
3 Disconnect water hose from radiator and remove radiator.
4 Disconnect heater hose at engine.
5 Remove carburetor air cleaner
6 Disconnect generator wires, temperature sender wire, oil pressure sender wire, and ignition switch-to-coil wire.
7. Fold cable harness out of the way.
8 Disconnect flexible fuel line
9. Disconnect choke wire, throttle linkage, and windshield wiper hose at carburetor.
10. Disconnect starter cable at starter motor
11. Disconnect exhaust pipe at manifold.
12 Disconnect clutch retracting spring and release rod
13. Remove engine front support bolts.
14. Install an engine lift bracket and take up load with a hoist
15 Remove transmission-to-flywheel housing screws.
16. Rock engine and pull it away from transmission; then raise engine carefully
17. With engine clear of car and hanging on hoist, remove manifold assembly if engine is to be mounted on a work stand

INSTALLATION — With the engine hanging on the hoist, install manifold assembly Shift the transmission into gear; then raise it until it just touches floor pan Center the clutch release bearing on the clutch and lower the engine in place Start the transmission mainshaft into the clutch It may be necessary to adjust the position of the transmission with relation to the engine If the engine "hangs up" after the pilot enters, turn the crankshaft slowly until the splines seat Complete the installation in the reverse order of removal

FORD V8, 1949-52

ENGINE REMOVAL—After performing Steps 1 through 12 under Ford Six procedure, continue as follows

1 Push accelerator cross shaft back against dash panel
2. Remove two top transmission-to-flywheel housing bolts
3. Remove engine front support nuts
4. Install engine lift brackets and take up load with a hoist
5 Support transmission and remove the two lower transmission-to-flywheel housing bolts
6. Rock engine and pull it away from transmission until the pilot and shaft separate from clutch, then raise engine carefully.
7. With engine clear of car and hanging on the hoist, remove exhaust crossover pipe and right-hand manifold if engine is to be mounted on a work stand

INSTALLATION—This procedure is the reverse of the removal operations Fol-

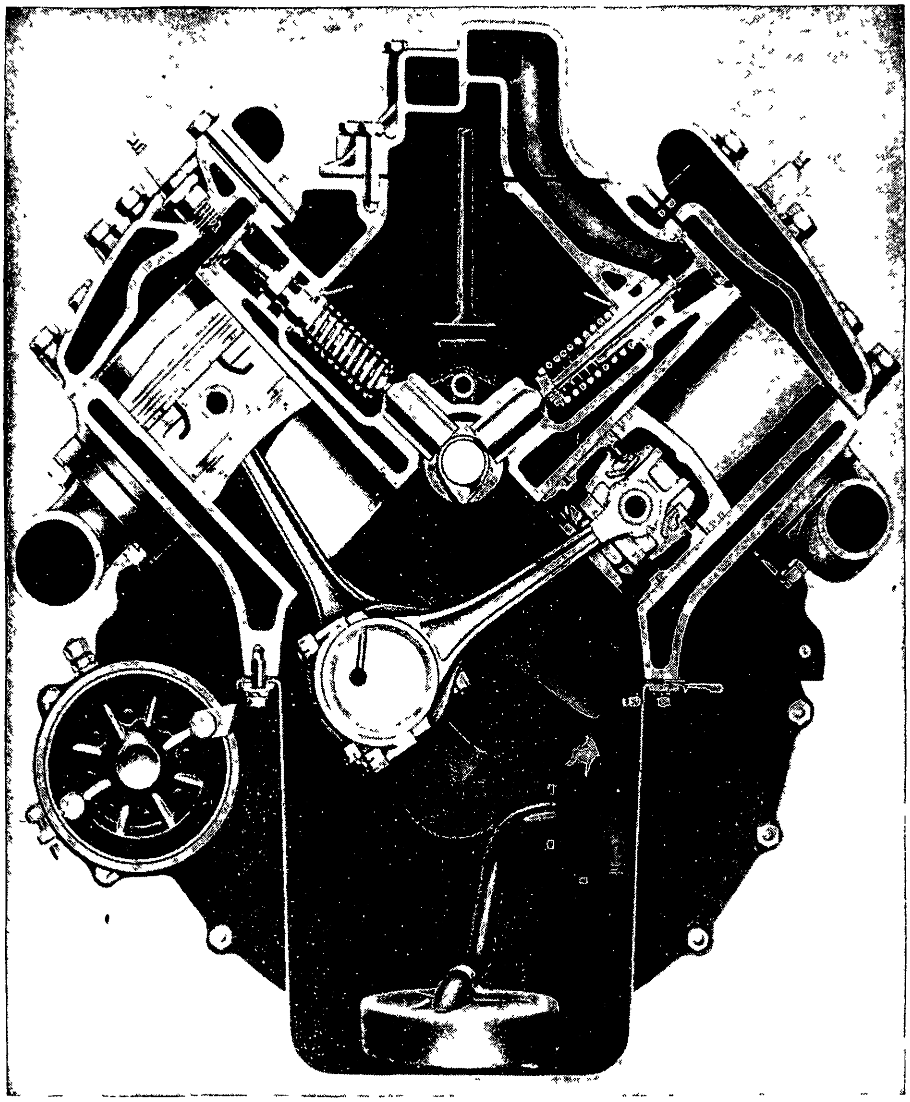


Fig. A 1949-52 Ford and Mercury V8 engine

low the precautions outlined under the Ford Six installation instructions.

MERCURY 1949-52

ENGINE REMOVAL—

1. Drain radiator and oil pan.
2. Mask edge of hood, fender and cowl to protect paint.
3. Remove hood, battery and air cleaner.
4. Remove heater hose from water pump and cylinder head.
5. Detach fuel pipe at flexible hose and windshield wiper tubing from vacuum booster pump.
6. Release throttle rod from throttle lever.
7. Remove engine-to-dash bonding strap (convertible only).
8. Remove battery wire from coil (also overdrive wire if used), wire from right cylinder head temperature sender unit, and wires from generator. Remove wiring cable from clip at left water outlet housing.
9. Remove wire from oil pressure gauge sender unit.
10. Remove overdrive cable from clip at rear of left cylinder head.
11. Remove both upper radiator hoses.
12. Remove generator and fan.
13. Loosen lower radiator hose clamps. Slide hose toward water pumps as far as possible.
14. Remove horizontal radiator support bar and radiator.
15. Remove battery cable at starter.
16. Remove bolts from engine and transmission mountings.
17. Remove propeller shaft by detaching rear universal joint from companion flange.
18. If equipped with overdrive, remove solenoid, governor, and control wire
19. Remove speedometer cable from overdrive or extension housing.
20. Detach shift rods from transmission and clutch equalizer shaft from release shaft.
21. Remove oil filter.
22. Install engine lifting hooks.

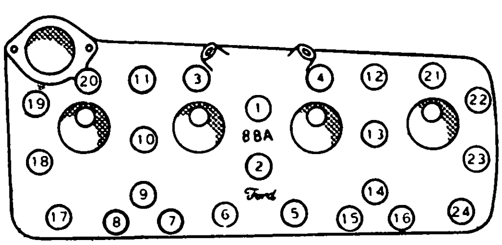


Fig. 1 Cylinder head tightening sequence, 1949-52 V8 Ford and Mercury

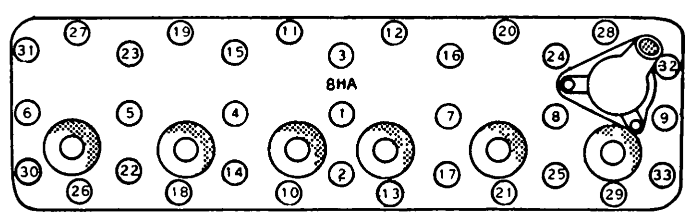


Fig. 2 Cylinder head tightening sequence, 1947-51 F rd Six

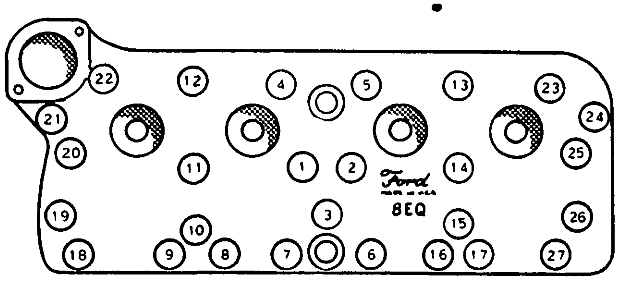


Fig. 3 Cylind r head tightening sequ nc ,1949-51 Linc ln

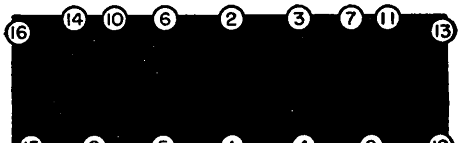


Fig. 4 Cylinder h ad tightening sequ nce. 1952 Ford Six

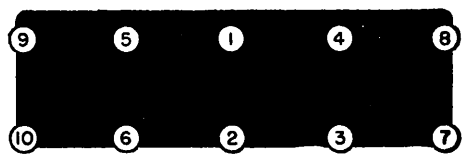


Fig. 4A Cylind r head tight ning s quenc . 1952 Linc ln

23. Remove exhaust crossover pipe.
24. Remove exhaust pipe.
25. Lift engine from vehicle.
26. To install the engine, reverse the above operations.

LINCOLN 1949-51

CARS WITH CLUTCH & STANDARD TRANSMISSION—Follow the same procedure outlined for Mercury cars but in addition (1) remove distributor cap from distributor body (do not remove wires) and move cap forward of distributor. (2) Remove capscrew that retains dip stick tube bracket to the engine and remove tube. (3) Remove nuts that retain exhaust pipe to exhaust manifold. Lifting the engine will facilitate removing the exhaust pipe.

CARS EQUIPPED WITH HYDRA-MATIC—Follow the procedure outlined for removing Mercury engines but disregard steps that refer to overdrive attachments. In addition to this procedure, it is necessary to remove the following parts:

1. Remove the two levers from transmission.
2. Remove three rods from bell crank.
3. Remove bolt that attaches bell crank stud and bracket assembly to the shim plate which is attached to the master cylinder. Pull plate and stud downward to remove. Remove bell crank, noting the bushing and spring located in its outer end.
4. Remove rod from accelerator cross shaft.
5. Support rear of transmission with a hydraulic jack.
6. Remove cross member and rear mount that support transmission.
7. While the engine is being lifted from the vehicle, the transmission should be guided by a mechanic from beneath the vehicle.
8. The installation of the engine is the reverse of the removal procedure.

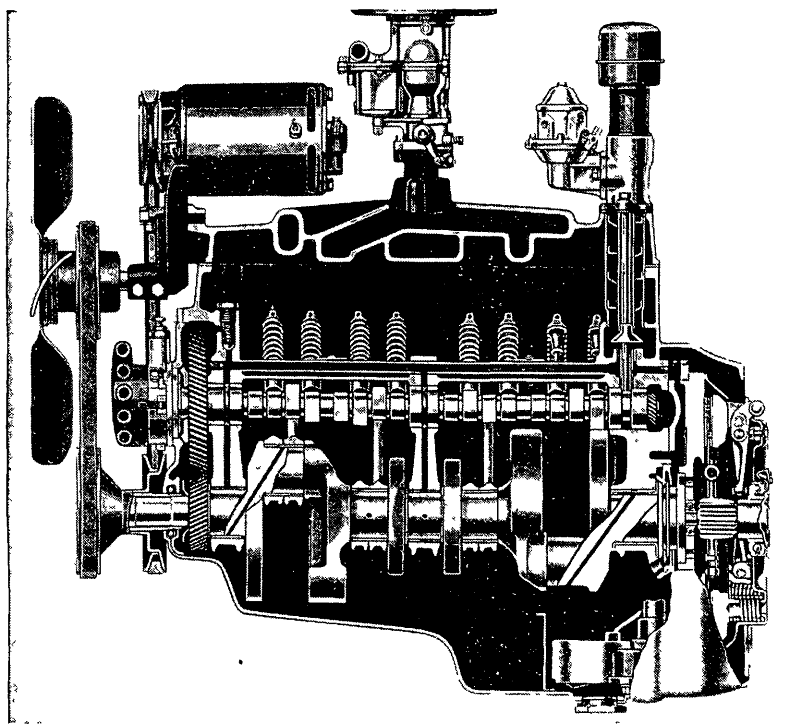


Fig. B 1942-48 Ford and Mercury V8 engine

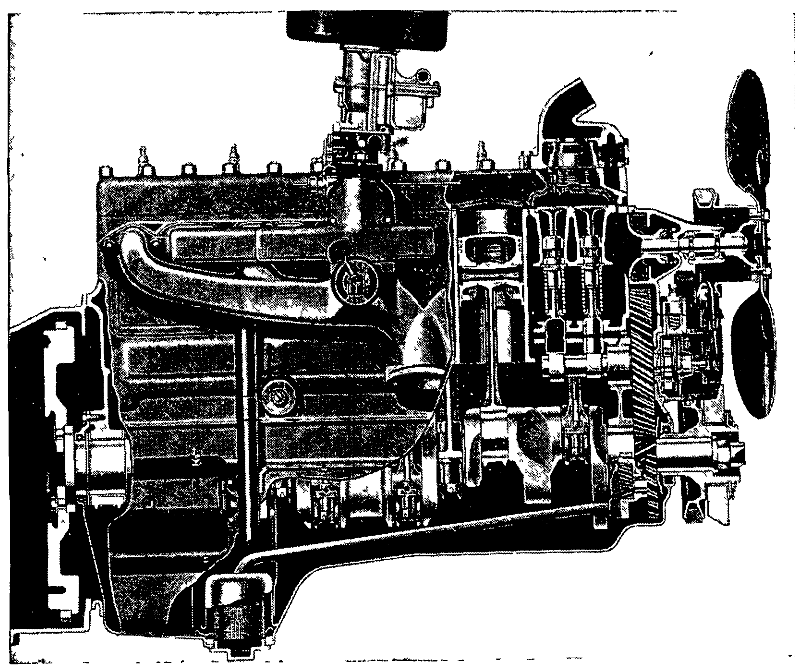


Fig. C 1941-47 Ford six-cylinder engine

CYLINDER HEAD

1935-52 L-Head Engines—If available, always tighten cylinder heads with a torque wrench to the values given in the *Tune Up* chart. If equipped with cast iron heads, make a final tightening after the engine has been warmed up. With aluminum heads, the final tightening should be made after the engine has been warmed up and allowed to cool.

On 1935-38 Ford engines, when installing new cylinder heads, be sure the heads have the correct shape combustion chamber for the pistons being used. With flat top pistons, heads should be used which have small combustion chambers that do not cover the entire area of the cylinder bore. With domed top pistons, heads having combustion chambers covering the entire cylinder bore area should be used.

Cylinder head gaskets are stamped with the word "front" and should be so installed. Improper installation of head gaskets will block some of the water passages, causing improper water circulation with the consequent overheating of the engine. (See Figs. 1, 2, 3.)

1952 Ford Six & Lincoln—After disconnecting or removing any parts that would interfere with the removal of a cylinder head on these engines, proceed as follows:

1. Take off rocker arm cover.
2. Relieve the tension on the valve springs by loosening the lock nuts and backing off the adjusting screws.
3. Remove the tower bolts and lift off the rocker arm assembly.
4. Take out the push rods, using care to keep them in the proper sequence for later replacement.
5. On Ford Six, remove the oil supply line by pulling it upward.
6. After removing the head bolts, remove the head.

When installing a cylinder head, inspect and clean the gasket surface and replace the gasket, which requires no cement. Install all head bolts finger tight before the final tightening. The final tightening should be done in the order shown in Figs. 4 and 4A and to the torque specifications given in the *Tune Up Chart*.

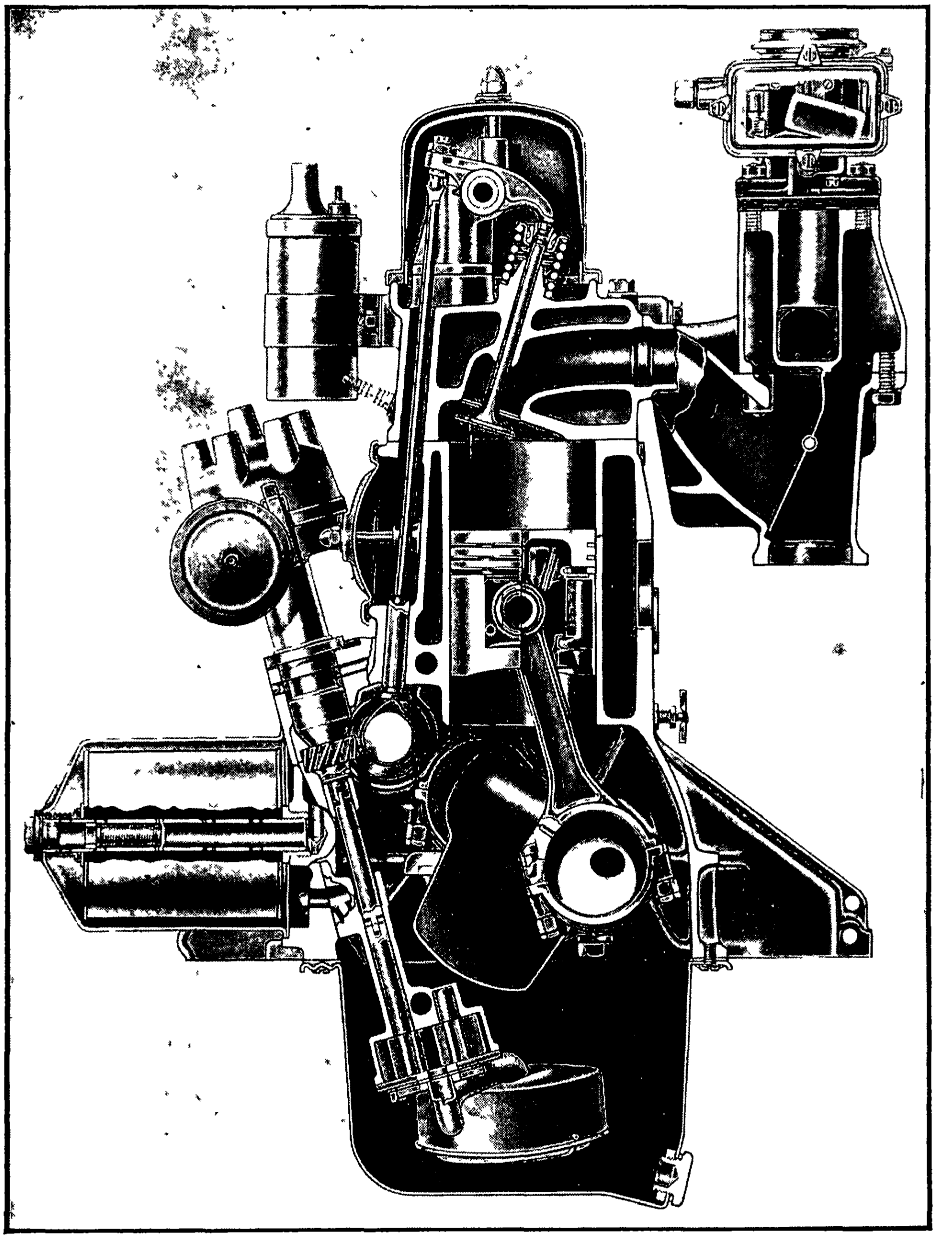


Fig. D Overhead valve engine. 1952 Ford Six

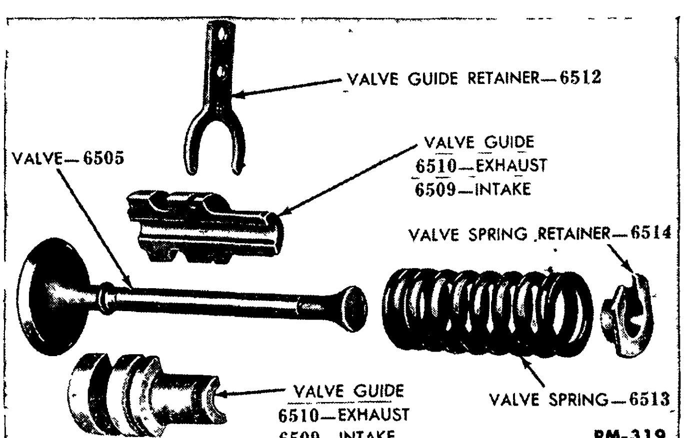


Fig. 6 Valv parts, 1935-48 F rd and Mercury V8, 1936-48 Linc ln H

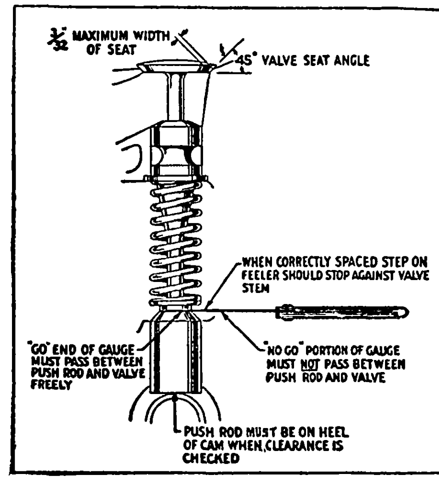


Fig. 5 Valve adjustment data n 1935-52 Ford and Mercury V8, 1941-47 F rd six and 1936-37 Lincoln Zephyr

VALVE SERVICE, 1935-52 L-HEAD ENGINES

VALVE ADJUSTMENT (1935-52 V8 Ford & Mercury, 1941-47 Ford Six, 1936-37 Zephyr)—Since there is no means of adjusting valves when these engines are assembled, this operation must be performed after the valves have been refaced, and before assembling the guides and springs.

To check the clearance, turn over the engine until the valve being checked is fully closed. Slip a feeler gauge between the valve stem and the tappet, Fig. 5. If the clearance is not according to the specifications given in the *Valve Data* chart, remove the valve and grind the end of the valve stem, being sure that the stem is ground perfectly square.

VALVE ADJUSTMENT (1948-51 Ford Six) — Adjustable tappets are used in these engines and the tappet screw is self-locking, no lock nut being required. Valve clearance is set with the engine cold and is performed as follows:

Crank the engine until both valves in No. 1 cylinder are closed. Start the feeler gauge between the tappet screw and valve stem. If the gauge does not enter, turn the adjusting screw clockwise until the gauge slides through with a slight drag. If there is excessive clearance, turn the adjusting screw counterclockwise.

After both valves of No. 1 cylinder are properly adjusted to the clearance given in the *Valve Data* chart, turn the engine over according to the firing order and adjust the remainder of the valves in the same manner.

If the car is driven at high speeds continuously, an additional .002" clearance for the exhaust valves is desirable.

VALVE ADJUSTMENT (1938-51 Lincoln)—These engines are equipped with hydraulic valve lifters of the Eaton type, the service of which is fully covered in the *Hydraulic Valve Lifters* chapter.

VALVES & GUIDES, REMOVE (1935-52 V8 Ford & Mercury, 1936-48 Lincoln)—The valve, guide, spring and retainer are assembled and installed in the engine as one unit. Prior to 1949 a two-piece valve

guide is used, Fig. 6, whereas a one-piece guide is used in later engines, Fig. 7.

To remove the assembly, insert a bar type valve lifter through the valve spring and to the flange on the lower end of the valve guide, Fig. 8. Using the top of the valve chamber as a fulcrum, pull down on the valve guide and withdraw the guide retainer. Then with the valve lifter tool, push the assembly up and remove it from above.

If the guides are stuck to the extent that they cannot be removed by this method, a puller is available to break them loose, Fig. 9.

On engines prior to 1949, disassemble each valve unit separately, being sure to keep the valve guide halves paired properly. Since the relationship between the inside and outside diameters of the valve guides are held to very close limits, it is important that they be kept in pairs as originally installed. If the guide parts become mixed, excessive clearance will result, causing noisy valves, lack of power and excessive oil consumption (see Fig. 10).

When replacing valve and guide assemblies in the block, be sure to have the joint in the valve guide at *right angles* to the camshaft.

VALVES & GUIDES (1941-47 Ford Six)—In these engines the design is the same as the Ford and Mercury V8s in that a two-piece guide is used with non-adjustable valve tappets. Follow the same procedure in servicing these valves as described above for the V8s.

VALVES & GUIDES (1948-51 Ford Six)—In these engines the valve guides are the solid one-piece type pressed into the cylinder block. A special removing and replacing tool is available, and when installing new guides, press them in to the depth shown in Fig. 11.

To remove the valves, remove the cylinder head and valve cover plate. Compress the valve spring by lifting the retainer and remove the two valve keys. Lift out the valve and take out the spring and its retainer. To prevent the valve keys from dropping down into the crankcase, cover the oil drain holes in the crankcase with cloth.

To install valves, start the valve through the valve guide. Hold the valve spring and its retainer in place in the valve chamber. Holding the valve down, compress the valve spring. Install the two valve keys in the groove provided at the bottom of the valve stem. Be sure the keys are installed with the taper facing upward. When the job is completed, check and adjust the tappets as described previously.

VALVES & GUIDES (1949-51 Lincoln)—The construction of these valves, springs and guides is quite similar to that of the 1949-51 Ford Six and service is performed in the same manner except that there is no mechanical tappet adjustment.

VALVE SPRINGS—After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring tension on a

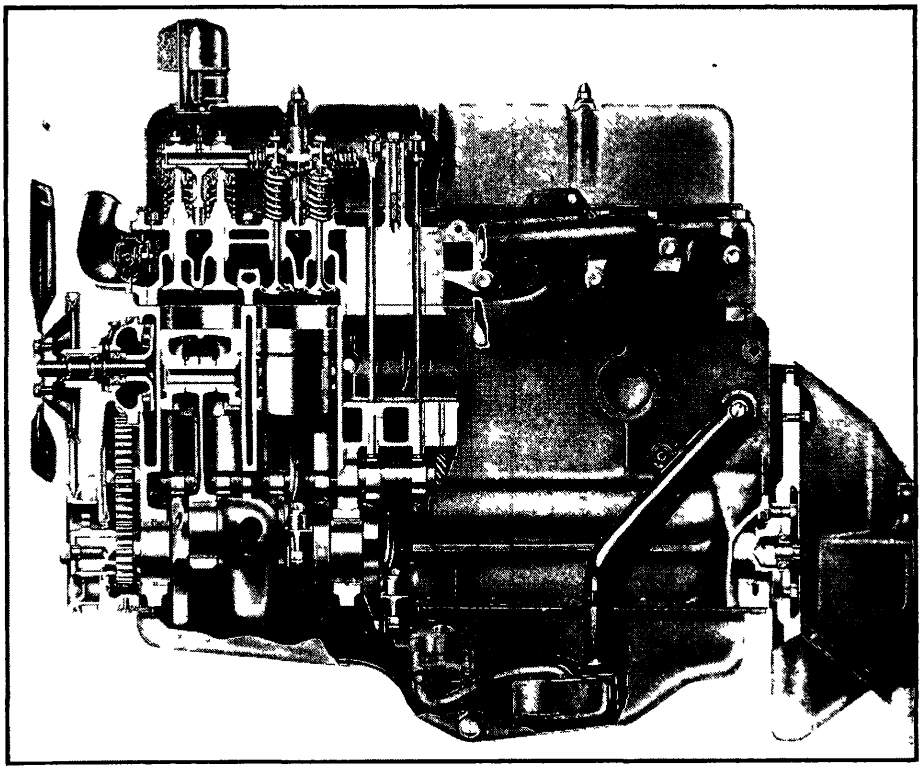


Fig. E Overhead valve engine. 1952 Ford Six

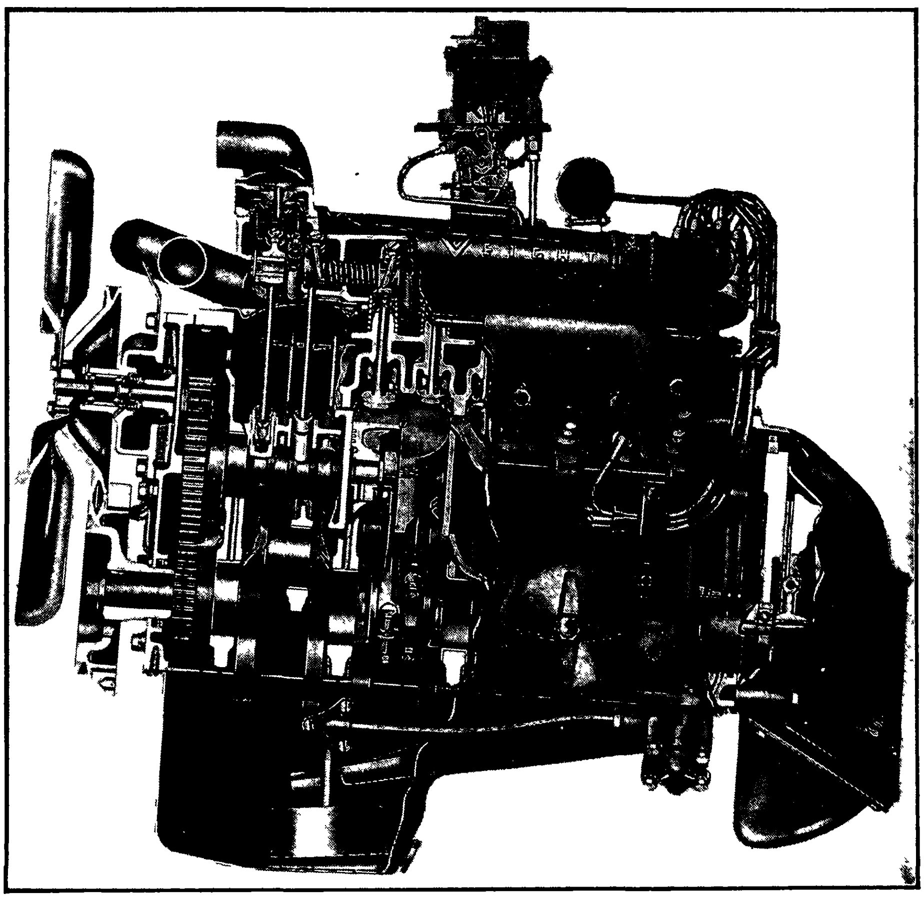


Fig. F Overh ad valv ngin . 1952 Linc ln V8

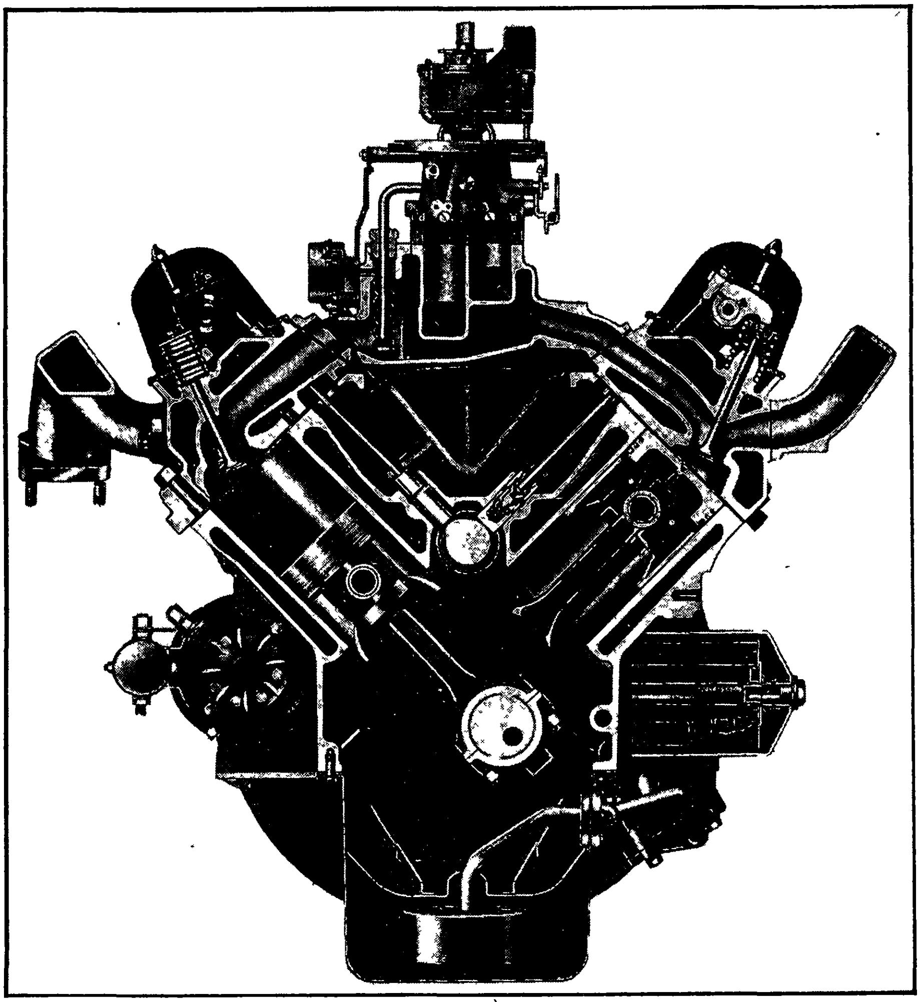


Fig. G Overhead valve engine. 1952 Lincoln V8

spring testing fixture if one is available. If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring. Any spring that does not conform to the pressure specifications given in the *Valve Specifications* table within 10 per cent should be replaced. Likewise any spring that stands shorter than the new spring used for comparison should be discarded.

VALVES, REFACE—Clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads as well as the gum which might have accumulated on the stems.

In refacing valves, take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced. In other words, the valve head margin must be at least $\frac{3}{64}$", otherwise the valve must be replaced. This margin is the area above the contact surface of the valve face.

Inspect the valve seats in the block for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats, regardless of their condition.

If new valve guides are required on engines with one piece guides (1948-51 Ford Six and 1949-51 Lincoln) they must be installed and reamed before refacing the seats if the equipment used for refacing the seats has a valve guide pilot.

The valve seat width after refacing should be not exceed $\frac{1}{16}$".

It is recommended that the fit of the valve in the valve seat be checked with a dial indicator for run-out, which should not exceed .0005".

If a dial indicator is not available, a simple check of the fit of the valve in the valve seat may be made by spreading a thin film of Prussian Blue on the valve face and then inserting the valve. With hand pressure, rotate the valve ¼ turn, remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indicate an inaccurate valve and seat refacing operation.

VALVE SEAT INSERTS — The tool shown in Fig. 12 is used to remove these inserts. If such a puller is not available, an insert may be removed by drilling two holes at opposite sides of the insert but not all the way through. Then cut through the undrilled portion with a sharp chisel and remove the two pieces.

To install the new insert, first remove all burrs and sharp edges from the seat recess. Then chill the insert with dry ice to obtain maximum contraction and place it in the recess, being sure it goes in straight.

VALVE GRIND DATA (1935-52 V8 L-Head Engines)—Fig. 13. When the cylinder heads are removed, one of the combinations of valves shown in the second column of the table below will be found wide open. As an example, if No. 8 exhaust valve and No. 5 intake valves are found to be fully open, the key would be the letter B and the six valves listed on the same line under the heading "Valves to Grind" can be ground.

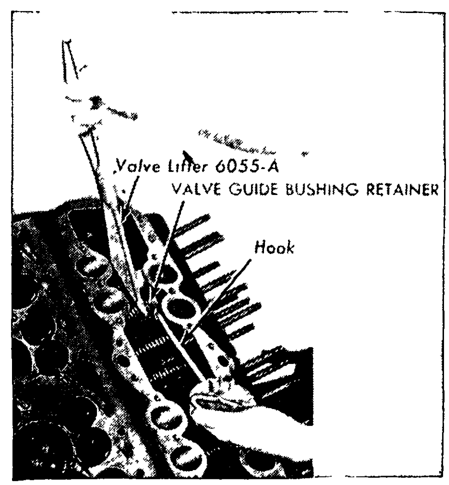


Fig. 8 Removing valve guid retainer, 1935-52 Ford and Mercury V8 and Linc ln 1936-48

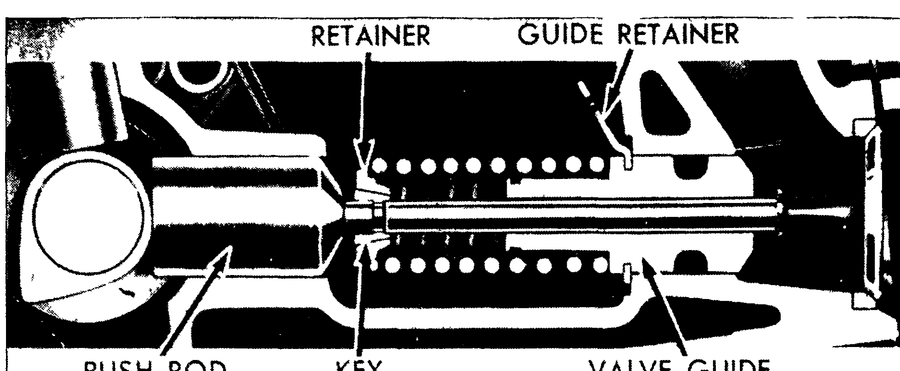


Fig. 7 1949-52 F rd and M rcury V8 valve details

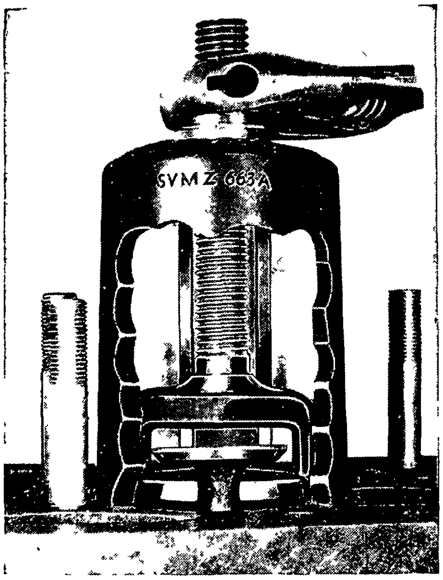


Fig. 9 Valve guide puller, 1935-48 Ford and Mercury V8 and 1936-48 Lincoln H

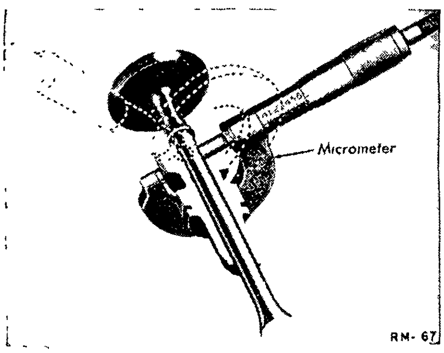


Fig. 10 Checking valve guide for wear, 1935-48 F rd and Mercury V8 and 1936-48 Lincoln H

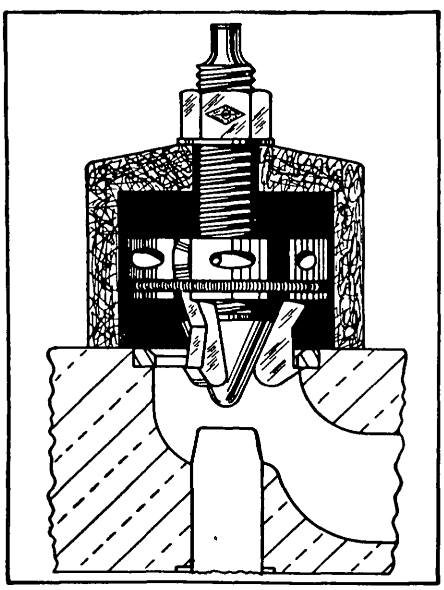


Fig. 12 Valv seat insert puller, 1935-52

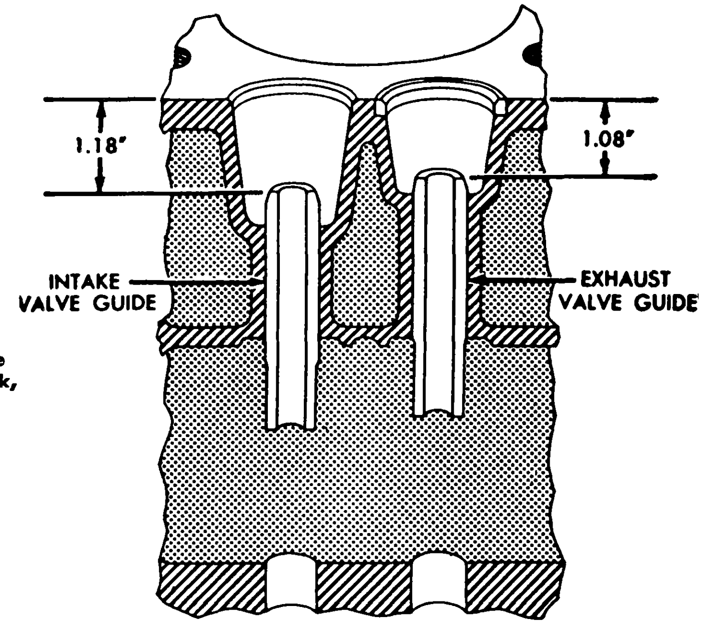


Fig. 11 Valve guide depth in cylinder block, 1948-51 Ford Six

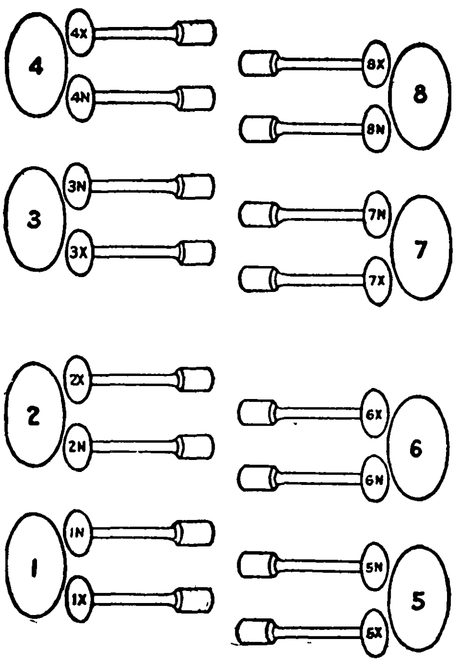


Fig. 13 Arrangement of valves, 1935-52 Ford and Mercury V8

The key letter for each combination of valves is in the first column. This letter is the key for the next crankshaft setting. After grinding the six valves designated, crank the engine until the next B combination of valves is fully open. In this case it will be No. 6 intake and No. 7 exhaust. In this position you will find that six valves may be ground, after which the next B combination is used, namely, No. 5 exhaust and No. 2 intake. In this position the remaining four valves are ground with but two part turns of the crank.

If the original combination of valves that were found to be wide open had been No. 4 exhaust and No. 1 intake, the letter A would be the key for each new setting of the crankshaft.

Data for Grinding Valves

Key: N-Intake X-Exhaust

Valves Open		*Valves to Grind*
A	4X + 1N	3X-8N-6N-7X-3N-2X
B	8X + 5N	1X-7N-6N-7X-3N-2X
C	6X + 4N	5X-2N-1X-7N-3N-2X
A	3X + 8N	1X-7N-5X-2N-4X-1N
B	6N + 7X	5X-2N-4X-1N-8X-5N
C	3N + 2X	4X-1N-8X-5N-6X-4N
A	1X + 7N	8X-5N-6X-4N
B	5X + 2N	6X-4N-3X-8N
C	4X + 1N	3X-8N-6N-7X

VALVE LIFTERS—Whenever valves are removed for service, the lifters should be taken out, cleaned and examined. If the top of the lifter is pitted, or if the side clearance is excessive, replace the lifter or adjusting screw.

Valve lifters on 1948-51 Ford Six are of the mushroom type which makes it necessary to remove the camshaft in order to take out the lifters. After dropping the oil pan, fasten the lifters with wire or spring type clothes pins so they will not drop to the floor as the camshaft is being withdrawn. After removing the camshaft, the lifters may be unfastened and taken out through the bottom of the block.

Hydraulic lifters are used on Lincoln engines. For service, see the *Hydraulic Valve Lifters* chapter.

VALVE SERVICE, OVERHEAD VALVE ENGINES

1952 FORD SIX & LINCOLN

VALVE ADJUSTMENT (Ford Six)—(See Figs. D and E). After all valve mechanism parts have been assembled and cylinder head tightened down, the valves should be given a cold adjustment to .015" clearance. By beginning with No. 1 piston at top center and valves

closed, the firing order may be followed to set up the valve adjustment. Valve clearance is measured between the valve stem and rocker arm with a feeler gauge. The adjusting screw controls the clearance.

Although a cold adjustment is made while assembling the engine, it is necessary to make the final adjustment when the engine is operating at normal temperature to a clearance of .015".

VALVE ADJUSTMENT (1952 Lincoln)—(See Figs. F and G). When valves and seats are reground, the position of the valves in the head is changed so as to shorten the operating length of the hydraulic lifter. This means that the plunger is operating closer to its bottomed position, and less clearance is available for thermal expansion of the valve train during high speed driving. Therefore, whenever the valves are ground, whenever the setting of the adjusting ball stud has been disturbed for any reason or whenever valve lifters have been removed and installed, an initial adjustment is required.

The initial adjustment must be made only when the lifter is on the camshaft base circle. An easy method of adjustment is to remove the distributor cap and turn the engine over to bring No. 1 cylinder to the top of its compression stroke, which is indicated when the breaker points open for this cylinder. In this position, both lifters for No. 1 cylinder will be on the base circle of the cam and both valves can be adjusted. After adjusting No. 1 valves, repeat by turning the engine over according to its firing order and adjust the valves of each cylinder in turn.

To make the adjustment, turn the adjusting screw down until all lash is removed between valve stem and rocker arm. This can be determined by checking the push rod side play at the adjusting screw and while turning the adjusting screw. At the point where no side play of the push rod can be felt, continue turning the adjusting screw down 1½ turns and tighten the lock nut securely. This places the lifter plunger in the center of its travel and no further adjustment is necessary.

CYLINDER HEAD, DISASSEMBLE—With the head removed as outlined previously, compress the valve springs with a suitable compressor, remove valve locks, seals and valve springs (exhaust valves do not use seals). Remove all valves and place them in a board with numbered holes so they can be identified as to the valve port from which they were removed.

VALVE SPRINGS—After washing the springs in gasoline or other solvent, examine them for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring pressure on a spring testing fixture if one is available. If not, at least check the free length of each spring by standing it alongside a new one. Any spring that does not conform to the pressure specifications given in the *Valve Specifications* chart within 10% should be replaced. Likewise, any spring that stands up shorter than the new spring used for comparison should be discarded.

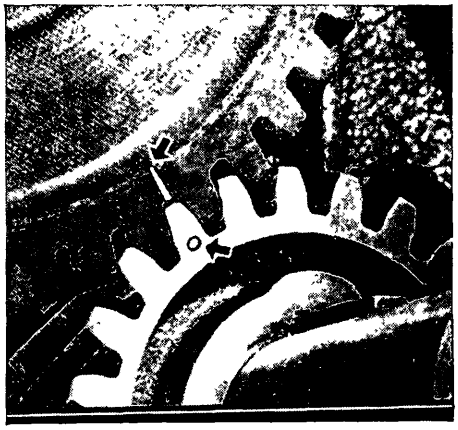


Fig. 14 Valve timing. All 1935-51 and 1952 V8 Ford and Mercury

VALVE GUIDES—Valve guides in these engines are an integral part of the head and, therefore, cannot be removed. For service, guides can be reamed oversize to accommodate one of three service valves with oversize stems.

REFACING VALVES & SEATS—This operation is performed in the same manner outlined previously for L-head engines.

ROCKER ARMS & SHAFTS—Sludge and gum formation in the rocker arms and shafts will restrict the normal flow of oil to the rocker arms and valves. Each time the rocker arm and shaft assemblies are removed they should be disassembled and thoroughly cleaned.

Remove the tower bolts, cotter pins, washers, springs, towers and shafts. Clean all sludge and gum formation from the inside and outside of the shafts and the oil lines. Clean oil holes and passages in the shafts and rocker arms. Inspect the shafts for wear. Check the fit of the rocker arms on the shafts and the valve end of the rocker arms for excessive wear.

VALVE LIFTERS (Ford Six)—Valve lifters should be a free fit in their guides and the end that contacts the camshaft should be smooth. If wear is apparent, replace with new parts.

VALVE LIFTERS (Lincoln) — If the operation of a valve lifter becomes faulty due to excessive varnish deposits or presence of dirt, it may be disassembled and cleaned as outlined in the *Hydraulic Valve Lifters* chapter.

As long as these lifters operate properly they should be left alone. They should not be disassembled and cleaned when removed for other work but should be wrapped in clean paper to avoid the entrance of dirt.

VALVE TIMING

All 1935-51 & 1952 V8 Ford & Mercury—There are no valve timing marks on the flywheel. When the marks on the timing gears are in mesh, Fig. 14, the valve timing is correct.

1952 Ford Six—When replacing the timing chain and sprocket assembly, it is necessary to line up the timing marks on the sprockets with the timing marks on the chain, Fig. 15. There should be 12 chain pins between the sprocket marks on the chain.

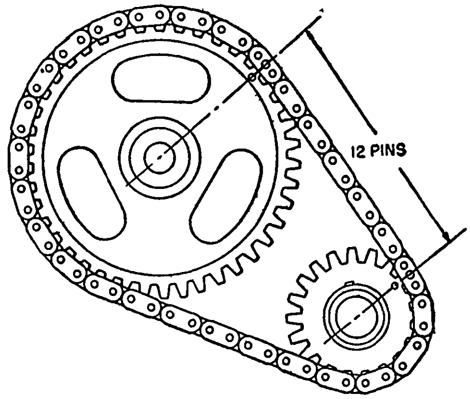


Fig. 15 Valve timing. 1952 F rd Six

1952 Lincoln—The camshaft is timed to the crankshaft by means of sprockets and a chain. Timing is set by aligning the two sprocket timing marks together on a center-to-center line between the camshaft and crankshaft, Fig. 16.

TIMING CASE COVER

All 1935-51 & 1952 V8 Ford & Mercury—The timing case cover carries an oil seal which should be renewed every time the cover is removed. Take out the old packing and clean out the groove thoroughly. Soak the new packing in oil for about 30 minutes to swell the fabric so that a good seal will be obtained immediately.

To remove the timing gear cover, drain the cooling system, disconnect the water hose, unfasten the radiator from its mountings and lift it out. Disconnect the generator lead wires, and take off the fan and generator belts.

On engines prior to 1949, unfasten the vacuum line and coil wire from the distributor, take off the distributor caps and shift the conduits out of the way. Remove the distributor, pull off the fan pulley and, on all models, remove the gear cover from the engine.

On all V8 and V12 engines prior to 1949, the top bolt hole in the gear cover carries a bolt having a shoulder which is designed to provide a closer fit and to aid in the proper alignment of the cover and correct distributor location. When assembling the cover to the engine, install this bolt first as its shoulder acts as a dowel. After installing the remainder of the bolts, make sure the cover is flush with the block on both sides, then tighten all bolts evenly.

1952 Ford Six & Lincoln — A special puller has been designed to remove the vibration damper. After pulling off the damper and removing the timing case cover, the sprockets can be slipped off their respective shafts as they are a slip fit over woodruff keys.

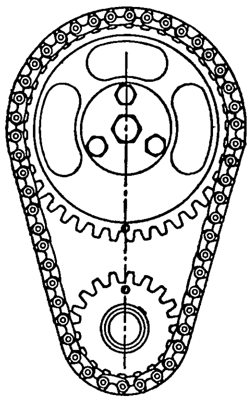


Fig. 16 Valve timing. 1952 Lincoln V8

CAMSHAFT REMOVAL

1935-52 V8 Ford & Mercury—After the valves and lifters have been removed from the engine, insert a screwdriver behind the camshaft gear to start the shaft forward. Then pull out the shaft, using great care not to allow the cam lobes to damage the camshaft bearings as the shaft is being withdrawn.

If it is desired to remove the camshaft without taking off the cylinder heads, remove the valve chamber covers and oil baffles. Then use a bar type valve lifter to pull down the valve spring in order to remove the valve guide retainer. Raise the valve assembly enough so that the opening in the side of the valve lifter is across the boss in the valve chamber. Raise all the lifters in this manner and insert the valve guide retainers in these openings. With the lifters held up in this manner, the camshaft may be withdrawn.

1941-51 Ford Six—On 1941-47 engines, camshaft removal procedure is the same as described above for the V8s.

On 1948-51, however, since mushroom type valve lifters are used, it will first be necessary to raise the lifters and hold them in the raised position with wire or spring type clothes pins. The camshaft may then be removed from the block by rotating it as required so the cam lobes will clear the bottom of the lifters.

1949-51 Lincoln—Since mushroom type lifters are used, follow the same procedure outlined above for 1948-51 Six.

1952 Ford Six—The general procedure for removing the camshaft is as follows:

1. Remove radiator, rocker arm cover, rocker arm and shaft assembly, push rods, fuel pump and oil pump.
2. Remove vibration damper, chain case cover, chain and camshaft sprocket.
3. Remove camshaft thrust plate.
4. Carefully withdraw camshaft from engine, being careful not to damage the five camshaft bearings.

1952 Lincoln—The general procedure for removing the camshaft from these engines is similar to that outlined for 1952 Ford Six.

CAMSHAFT BEARINGS

1935-52—With the equipment shown in

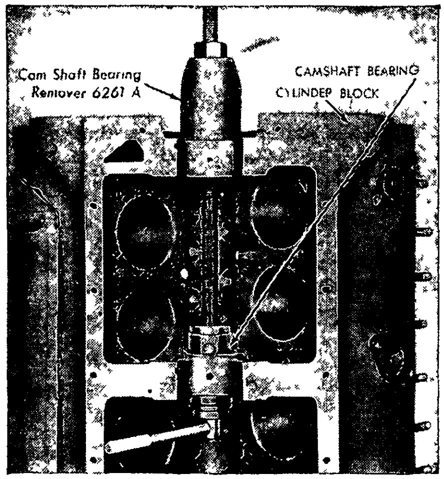


Fig. 17 Removing camshaft bearings, 1935-52 V8 Ford and Mercury

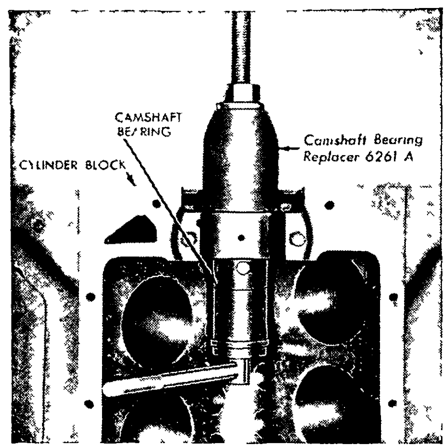


Fig. 18 Installing camshaft bearings, 1935-52 V8 Ford and Mercury

Figs. 17 and 18, camshaft bearings may be removed and replaced on 1935-52 V8 Ford and Mercury engines. Similar equipment is available to perform this operation on Ford Sixes and 1952 Lincoln.

PISTONS & RODS, INSTALL

1935-52 V8 Ford & Mercury—Connecting rods and caps are marked R1-2-3-4 for the right bank and L1-2-3-4 for the left bank. When installed in the engine the numbers on the rods and caps should be in line. Markings on rods used in the left bank should be to the left, whereas those on the rods used in the right bank should be to the right.

1941-51 Sixes—When installed in the cylinder the oil squirt hole in the connecting rod should face the camshaft side of the engine.

1952 Ford Six & Lincoln—Piston heads are marked for location on the forward side. Rods and caps are numbered on the same side as the piston they serve.

PISTONS

1935-52—On 1949-52 models, pistons are furnished in standard sizes and oversizes of .0025, .020, .030 and .040". On engines

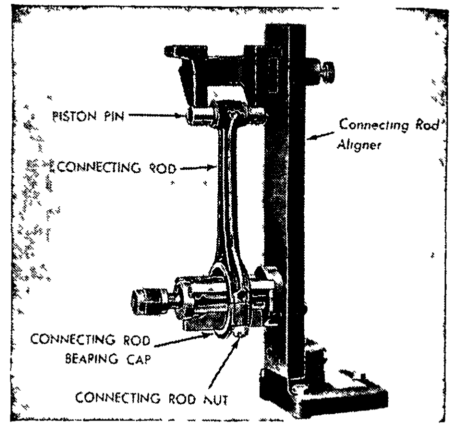


Fig. 19 Checking for bent c nnecting r d, 1935-52

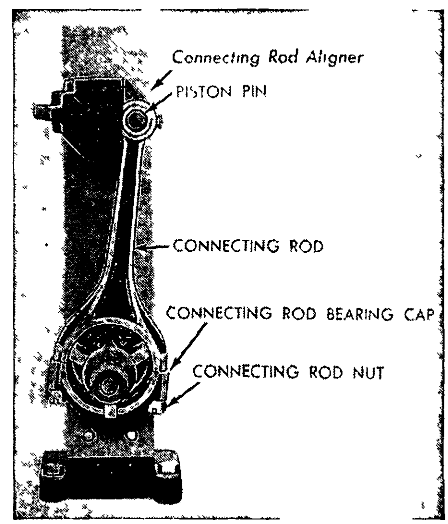


Fig. 20 Checking for twist d c nnecting rod, 1935-52

prior to 1949, oversizes of .005, .015 and .030" are available.

When fitting pistons, the dimension at the top of the skirt must be used to determine the piston size and clearance between piston and cylinder wall. Measurement must be made across the piston pin boss, at right angles to the pin.

The cylinder bore should be measured crosswise to the engine at a point two inches from the bottom of the bore. It is measured at this point because piston clearance must be established at the smallest diameter of the bore to prevent scoring. The difference between this dimension and the diameter of the piston skirt represents the amount of clearance for the piston.

Be sure to check the alignment of the connecting rods before installation, Figs. 19 and 20.

PISTON RINGS

1935-52—On 1949-51 models, rings are furnished in standard sizes and oversizes of .020, .030 and .040". Prior to 1949, oversizes of .015 and .030" are available.

Always use standard size rings in cylinder bores that are *standard at the bottom, regardless of the amount of cylinder*

bore taper. Rings may have ample clearance in the upper part of the cylinder but at the bottom of the piston stroke the ends may jam, causing the rings to buckle and distort. Always see that the end gap is within specifications at the *bottom of the cylinder.* When fitting rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side of their own weight.

Before removing pistons, the ridge at the tops of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder walls, never try to remove all traces of the ridge; this can be done afterward by honing.

CYLINDER SLEEVES

1939-52—These sleeves, when used, are pressed in the cylinder bores with the parts at normal room temperature. They are held in place by a flange at the top of the sleeve which seats into a counterbore at the top of the cylinder.

Replacement can easily be made by using suitable equipment, Fig. 22. The hook end of the puller is inserted into the bore after positioning the crankshaft so that the crankpin for that particular cylinder does not interfere with the operation. A split collar is then slipped into position on the nut at the bottom of the puller screw. Turn the crankshaft so that the anvil of the hook rests on the crankpin. When the screw is turned in a clockwise direction, the sleeve can be pulled out.

When installing a new sleeve, run the nut down to the bottom of the bar (the split collar is not used in this operation). Insert the puller up through the cylinder, keeping the crankpin in the same position as when removing the sleeve. Slip the sleeve over the screw and position it in the top of the cylinder. Install the top collar and turn it down until the upper flange of the sleeve rests squarely on the collar. Then turn the puller screw counter-clockwise to draw the sleeve into the cylinder. When installed, be sure the flange is flush with the top of. the cylinder.

CONNECTING ROD BEARINGS

1935-48 V8s — Replace all rod bearings that are worn, pitted, scored or discolored (due to overheating). Bearings otherwise satisfactory but with small pits need not be replaced unless the pits extend to the side of the bearing, which would allow oil to be bypassed.

To check the fit of these bearings, place a round piece of accurately ground stock on the inside surface of the bearing, Fig. 23, and measure the thickness of the bearing and round stock with a micrometer. Deduct the thickness of the round stock from the reading obtained to determine the thickness of the bearing. Replace each bearing that measures less than .1085″ thick.

1936-52 Lincoln; 1949-52 Ford & Mercury V8—Rod bearings used in these engines are of the insert type, held in a fixed position by lock notches. When worn they can be replaced without removing the rod by simply taking off the bearing cap and replacing the upper and lower halves. Bearings should be replaced in sets and under no circumstances should rods or caps be filed or altered in any way in an attempt to make them fit.

NOTE—All 1949-52 V8 engine crankshafts are drilled to form a sludge trap at the connecting rod journals. A pressed-in hollow plug seals the outlet. These plugs may be removed for clean-out purposes, but *new* plugs must be driven in and the crankshaft properly peened or staked to prevent oil pressure from forcing out the plugs.

1941-52 Six — All 6-cyl. engines built prior to Jan. 25, 1950, were equipped with connecting rods having shims. Engines built after this date were equipped with connecting rods without shims.

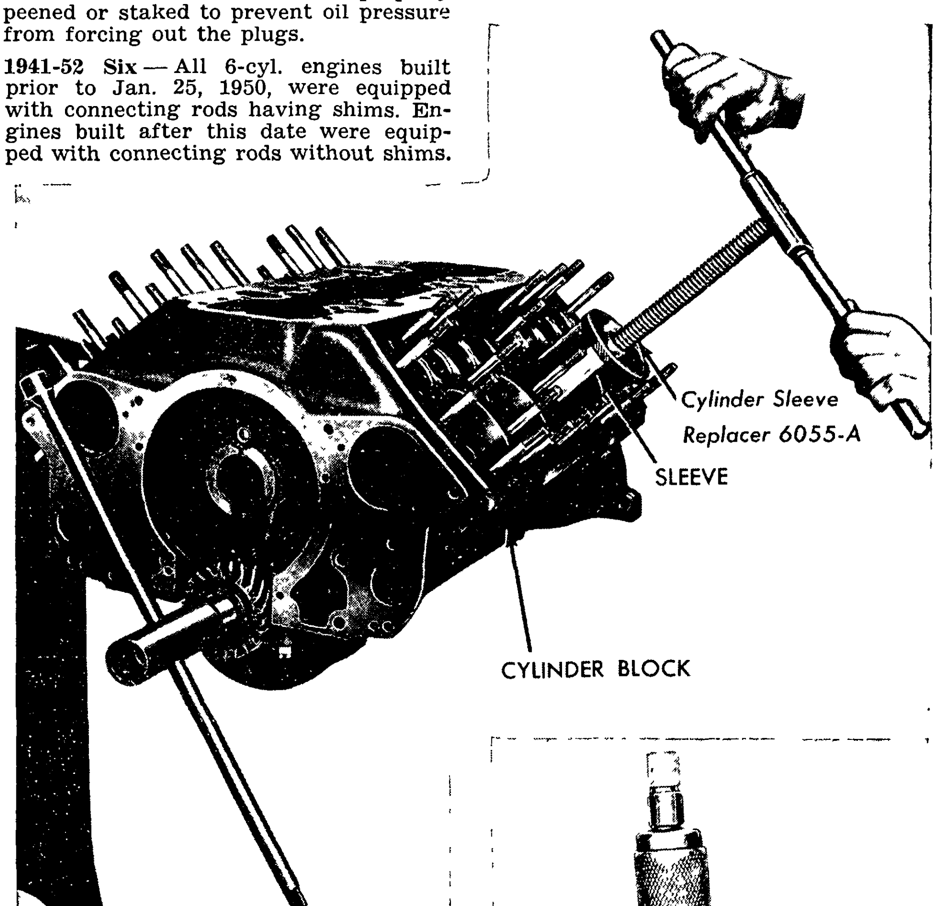


Fig. 22 Installing cylinder sleeve

Rods on the earlier engines must be serviced with shims while later ones must be serviced without shims. This is necessary because both rods were bored to the same diameter, rods with shims being bored with shims in place at the time of the boring operation.

The shimmed rods were built with one .0015-in. shim on each side, between the parting face of the cap and the rod. These shims permit selecting desired bearing clearance of .0007 in. to .0013 in. When assembling new rods and new crankshafts and bearing clearance is in excess of .0007 to .0013 in., the removal of one shim will reduce clearance .00075. If both shims are removed, bearing clearance will be reduced .0015.

After determining what the bearing clearance is with both shims installed, it can be readily determined whether one or both shims should be removed, or left in place to get desired clearance of .0007″ to .0013″.

These shims were used only to eliminate necessity of select fitting bearing in order to get a closer fit and were not intended to take care of worn bearings. Removal of shims in some cases may give desired clearance. However, in most cases when bearing is worn to the point where removal of shims would give desired clearance, the overlay on the bearing is worn off and it should not be used again.

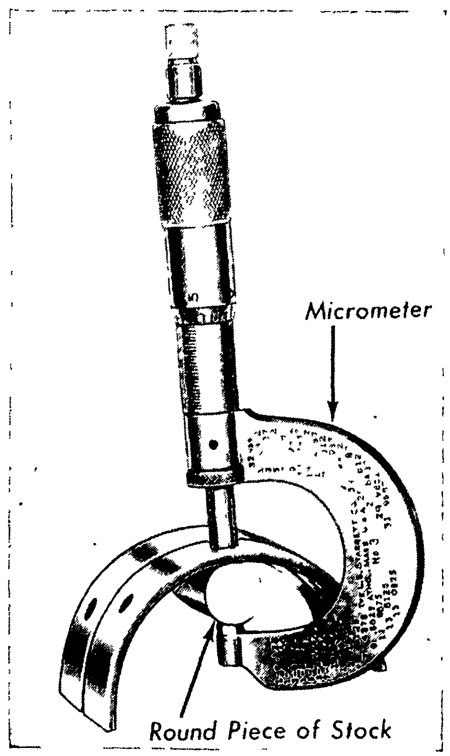


Fig. 23 Measuring c nnecting rod bearing f r wear, 1935-48 V8

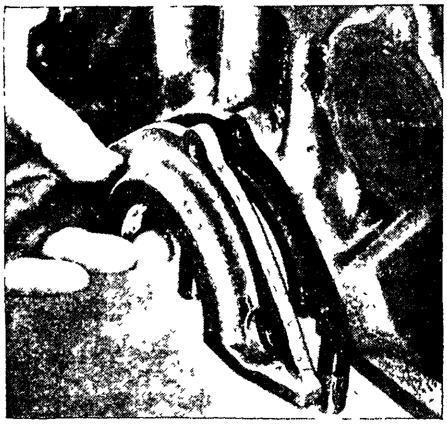


Fig. 24 Crankshaft rear oil seal, 1941-51 Ford Six

In the future it is contemplated to select fit connecting rod bearings from two or three sizes in order to obtain desired bearing clearances.

MAIN BEARINGS

1935-52 — Some 1935-36 Ford engines were equipped with poured babbitt bearings. When bearings of this type require replacement, the engine will have to be removed and new bearings installed and line-reamed to size. All other engines are equipped with replaceable insert type bearings.

To install new bearings of the insert type, remove the bearing cap and take out the worn lower shell. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.

To install the new bearing, place the upper shell on the crankshaft journal with the lock notch in the correct position, and rotate the shaft to turn the shell in place. Place the lower shell in the cap and replace the cap.

CRANKSHAFT REAR OIL SEAL

1935-52 V8 Ford & Mercury & Lincoln V12—Oil sealing in these engines is controlled by a two-piece metal retainer having a groove which returns excess oil to the crankcase. These retainers can be replaced without removing the crankshaft by simply taking off the rear main bearing cap. The upper half of the retainer can be pushed around and taken out through the bottom.

1941-51 FORD SIX—The seal, Fig. 24, is carried in a retainer which is bolted to the crankcase.

1952 Ford Six & Lincoln—The rear main bearing oil seals may be replaced while the engine is in the car. However, extreme care should be exercised in those steps which pertain to lowering and raising of the crankshaft as described in the following:

1. The car should be raised and stands placed under it at all four corners, keeping the engine in its normal position and on a level plane.
2. Remove transmission.
3. Remove oil pan.
4. Remove rear main bearing and cap. Do not remove other main bearing caps.
5. Loosen each main bearing cap attaching screw approximately ¼ turn or just enough to break loose each screw from its fully tightened position.
6. Back out each screw approximately ½ turn at a time. This will permit the crankshaft to lower itself slowly and evenly.
7. Continue backing out each screw ½ turn at a time, making sure that the crankshaft is being supported by all main bearing caps while being lowered. The rear end of the crankshaft may be lowered approximately ½" in this manner.
8. Remove the rear bearing upper seal from its groove in the cylinder block, using a pointed tool such as awl or ice pick.
9. Remove the lower seal from the rear bearing cap.
10. Before starting to install the upper seal, it should first be pressed into the form or shape it assumes when it is in its groove in the cylinder block. This may be done by pressing the seal into the groove in the bearing cap.
11. Use a smooth, rounded tool of wood or metal to work the packing from end to end toward the center of the cap to force and shape the packing in the groove.
12. After the seal has been formed and shaped, it may be fed up around the crankshaft and into its groove in the cylinder block.
13. When the seal is properly positioned, tighten each bearing cap attaching screw a ½ turn at a time to raise the crankshaft slowly and evenly.
14. Tighten the cap screws alternately in stages of ½ turn until all are snugly tightened.
15. Turn the crankshaft over two or three revolutions This will tend to burnish the seal into position.
16. Continue tightening the cap screws by stages until the final torque specified in the *Engine Bearing Data* chart is obtained. After each tightening operation, rotate the crankshaft to further "burnish-in" the seal.
17. After tightening the bearing caps to their final torque, the ends of the upper seal should be cut off flush with the split line in the cylinder block.
18. The lower seal may be installed in the bearing cap in the same manner but the over-lapping ends should be cut off so that 1/16" of the seal extends at each end.
19. Install the rear bearing cap and tighten it to the proper torque.

ENGINE OILING

OIL PAN REMOVAL

1935-48 Ford & Mercury—Remove the engine mounting bolts and loosen the lower radiator hose at the engine end. Disconnect the oil level gauge tube at the oil pan and remove the oil filter discharge line. Disconnect the exhaust pipe flange (both sides on V8s). Use a wooden block between the oil pan and a jack and raise the engine as far as possible. Insert a wooden block 1½" thick between the front engine mounting and rubber support, after which remove the jack. Raise the front of the car with a hoist until the front wheels are clear of the floor.

On V8s, remove the exhaust crossover pipe and starter motor.

On Sixes and V8s, disconnect the oil pan from the transmission case and unhook the brake pedal return spring. Remove all cap screws and lower the oil pan.

On some models, it may be necessary to move the fan pulley forward to provide sufficient clearance to drop the pan. It may also be necessary to disconnect the ball cap and block the radius rod down to hold it out of the way.

1949-52 V8 Ford & Mercury—It is not necessary to raise the engine to take off the pan on these cars, but the proper combination of standard tools will have to be used to reach the two forward 5/16" cap screws holding the pan to the block. To remove the pan, proceed as follows:

1. Remove the exhaust crossover pipe. Do not remove the heat valve but run a nut on the manifold stud to prevent the heat valve from falling off.
2. Unfasten the steering idler arm support from the frame and pull down on the steering linkage.
3. Remove the starter motor.
4. Remove flywheel housing cover.
5. Take out the oil level dipstick and unfasten the pan from the block.
6. Lower the pan, rear end first.

1949-51 Six — In order to remove the oil pan from these engines it will be necessary to remove the engine from the chassis due to the fact that there is not sufficient clearance to drop the pan due to steering linkage, etc.

1936-48 Lincoln H—Disconnect the radius rod at the rear end and block down out of the way. Hoist the front of the car (not front axle). Take off the starter, disconnect the exhaust pipe and steering rods. Remove the oil pan screws and work the pan down and out.

1949-51 Lincoln—After draining the oil, proceed as follows:

1. Remove No. 2 spark plug and bring piston up on top center.
2. Turn steering wheel to right as far as possible.
3. Remove exhaust crossover pipe. Do not remove heat valve but run a nut on the manifold stud to prevent the valve from falling off.
4. Unfasten steering idler arm from frame and pull down steering linkage.
5. Remove starter motor.
6. Remove oil level dipstick tube.
7. Remove oil pan sump.
8. Remove oil pan attaching screws.
9. After removing cap screw holding road draft tube bracket, push tube to left to gain access to the forward cap screws.
10. Tip rear of pan down and slide it out to the rear.

1949-51 Cosmo—On these Cosmopolitan

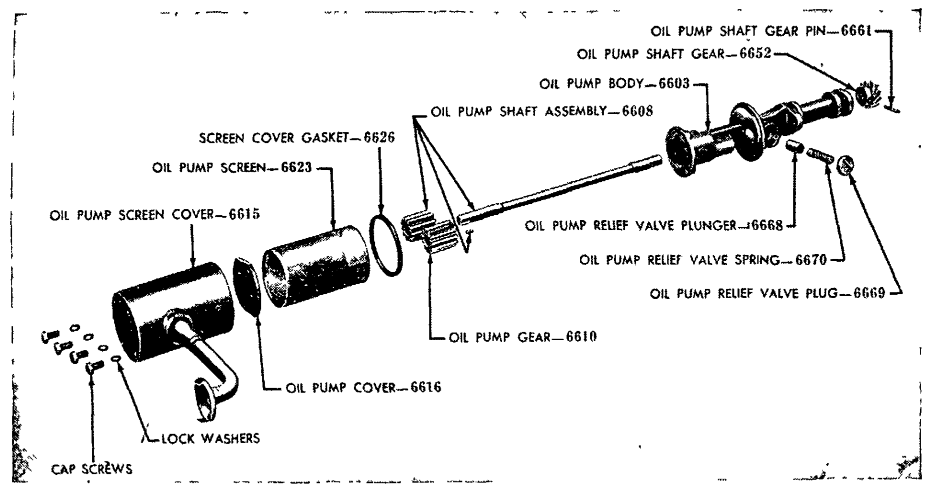


Fig. 25 Oil pump. Typical of all 1935-48 models

models, in addition to the above procedure, perform the following:

1. Drain radiator and remove two lower hoses.
2. Turn fan so that wide angle between blades is up.
3. Remove fuel pump.
4. Remove front engine mounting nuts, jack up engine and place blocks between engine mounts and mounting brackets.
5. When lowering oil pan, tip rear end down and rotate it so that front oil seal will straddle left cap screw of front main bearing cap.

On Ford V8 60 hp engines, take off No. 1 main bearing cap and remove the pump.

1952 Ford Six—To remove the pan, unfasten the steering idler arm support from the frame and pull down on the steering linkage. Then unfasten the pan and take it down.

1952 Lincoln—To remove the pan, disconnect any steering linkage that seems necessary. Remove the external oil supply tube. Remove the oil pan screws and lower the pan.

OIL PUMP REMOVAL

1935-52 V8 Ford & Mercury, 1952 Six, 1936-48 V12—After removing the oil pan, remove the locking wire and cap screws holding the pump to the engine and take off the pump.

1941-47 Ford Six—After dropping the oil pan, remove No. 1 and 3 main bearing caps and take off the pump.

1949-51 Ford Six—In order to remove the oil pump with the engine in the chassis, it is necessary to raise the front of the engine so that the pump will clear the frame side rail when it is pulled out.

Before removing the pump, check the backlash between the oil pump gear and camshaft gear, which should be .003 to .005". This can be done by moving the distributor rotor and checking the distributor shaft free play. Free play in the rotor should be less than ¼".

To remove the pump, disconnect the right front engine support. Disconnect radiator hoses. Raise engine so that pump will clear frame when removed.

1952 Lincoln—The oil pump is located on the outside of the engine where it can be conveniently serviced.

OIL PUMP, OVERHAUL

1935-52 V8, 1952 Six, 1938-48 V12—Before disassembling the pump, Figs. 25 and 26, move the drive gear at the top of the unit from side to side. If the total movement is not in excess of .005", the pump need not be dismantled. If it is, however, it indicates worn bushings.

To disassemble the pump, drive the pin from the drive gear and press the gear from the shaft. The bushings may then be pressed out of the housing and new ones installed.

When assembling the pump, press the gear onto the drive shaft so that there is .017" clearance between the bottom of the gear and the upper end of the pump body. Press the gear on at right angles to the old pin hole and drill a new hole in the shaft at that point. Use a 3/32" drill and be guided by the hole in the gear hub when drilling the shaft. Install a new locking pin and peen the ends over so it won't work loose.

1941-47 Ford Six & V8-60 — The pump body is an integral part of the front main bearing cap and the oil delivery passage is directly through the body of the cap to the crankcase. The oil pump drive gear is on the front of the cap and meshes with the crankshaft timing gear. The suction line is part of the oil pump cover plate and is attached to the rear side of the front main bearing cap.

1948-51 Ford Six—A rotor type oil pump is used on these engines, Fig. 27. To disassemble, turn the pump upside down and turn the drive shaft until the outer rotor slips out of the housing. Drive out the pin securing the gear to the shaft, and press the gear off the shaft. The shaft and inner rotor may now be removed from the pump body.

To assemble, insert the inner rotor and shaft into the body. Line up the pin hole

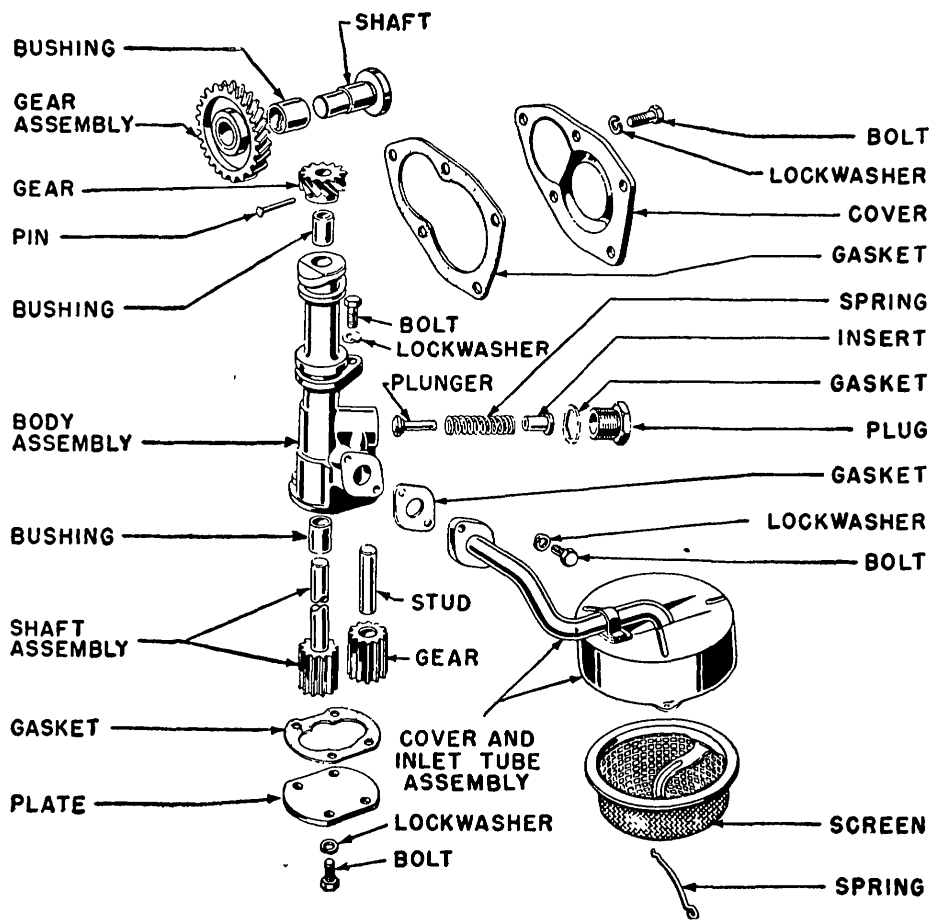


Fig. 26 1949-52 F rd and M rcury V8 il pump

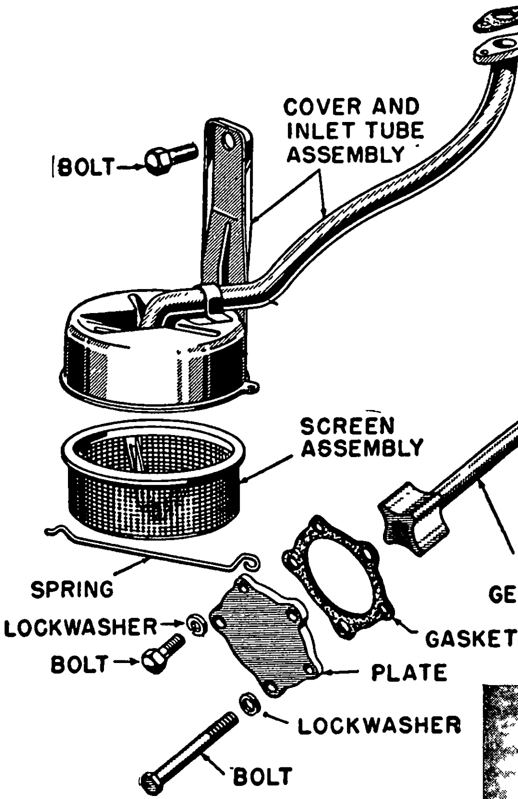


Fig. 27 1948-51 Ford Six oil pump

in the gear with the hole in the shaft and press the gear onto the shaft. New shafts are not drilled, and when installed as above, allow .004" drill clearance between the gear and body and drill the shaft. Then install the pin, peening over both ends so it won't work loose. Slide the outer rotor in position and install the cover, using a new gasket.

OIL PRESSURE REGULATOR

1935-48 V8 Ford & Mercury—The oil pressure regulator consists of a spring-loaded ball-ended valve, Fig. 28, which is accessible by removing the valve chamber cover. Oil pressure is automatically regulated when the screw cap is turned down on its seat.

When examining the ball end of the valve, do not mistake the small flat spot on the face of the valve as an indication of wear. The purpose of the flat spot is to allow a small quantity of oil to flow through the line even at low pressures.

On Ford V8-60 hp engines, the regulator is of the same general design as the larger engines except that it is located at the front part of the engine under the valve chamber cover.

1936-51 Lincoln—Oil pressure is regulated by a relief valve located in the oil pump, and pressure to the hydraulic valve lifters (when equipped) is controlled by a relief valve located in the valve chamber. Fig. 29 shows the 1938-48 Series H arrangement.

1941-51 Ford Six—On 1941-47 models, the regulator is located at the timing gear side cover plate. On 1948-51 models, a non-adjustable relief valve is located

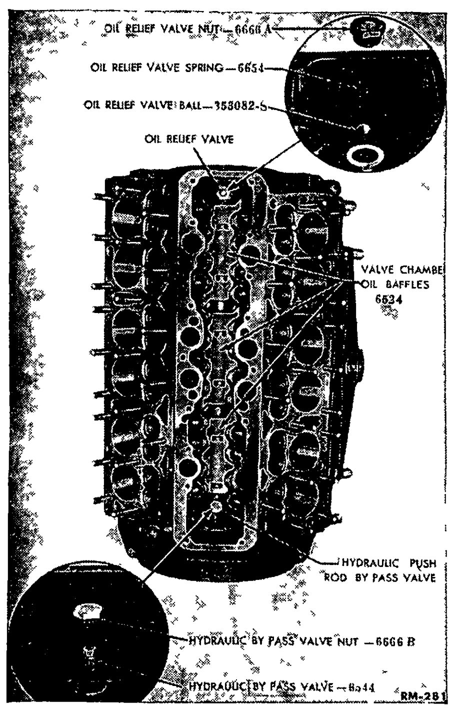


Fig. 29 Oil pressure relief valve, 1939-48 Lincoln H

on the left side of the engine behind the oil filter, and is accessible for inspection.

1949-52 V8 Ford & Mercury, 1952 Ford Six & Lincoln—As shown in Fig. 26, the oil pressure relief valve is installed in the pump body and is not adjustable.

COOLING SYSTEM

RADIATOR CORE REMOVAL

1935-38 Ford—Remove or raise the hood, as required, and take off the radiator brace rods and generator. Disconnect all

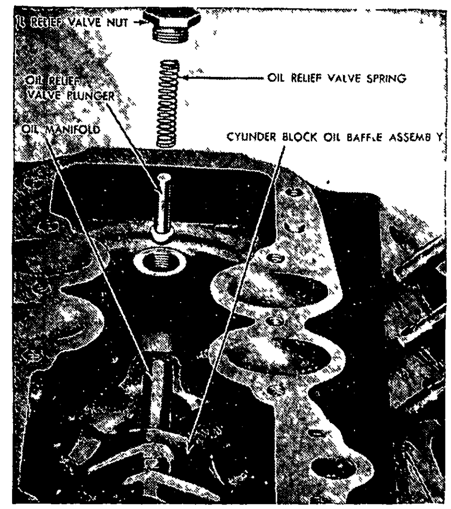


Fig. 28 Oil pressure relief valve disassembled, 1935-48 V8

connecting hose. It is advisable, and in some cases necessary, to remove the distributor. Unbolt the core from the shell and core support and lift it out.

1939-52 Ford & Mercury—Raise the hood, drain the cooling system and remove all water hose. Unbolt the core side braces and lower mountings. Lift the core up and out over the engine.

1936-37 Lincoln Zephyr—Raise the hood, drain the cooling system, and remove all water hose, generator, distributor and fan. Unbolt the core from the shell and lift the core up and out over the engine.

1938-52 Lincoln—Raise the hood, drain the cooling system and remove all water hose. Loosen the generator bracket and remove the generator and belt. Take off the fan. Unfasten the core from its support and lift it out over the engine.

WATER PUMP REMOVAL

1935-52 V8 & V12—Drain the cooling system and remove the pump hose connection. If necessary, raise the engine so the forward mounting bolts just clear the pump attaching bolts. Take off the fan belt. Unfasten the pump from the engine and lift it off.

1941-52 Ford Six—Drain the cooling system, remove the lower radiator hose and fan. Loosen the generator and take off the fan belt. Unfasten the pump from the engine and lift it off.

WATER PUMP, OVERHAUL

1935-36 Ford—Drive out the pin and press the shaft out of the pulley. Remove shaft and impeller from housing. Drive bushing from housing.

When assembling, install packing spring on shaft with small end of spring next to impeller. Then install packing washer, packing and thrust washer and push the shaft through the bushing. Install the front thrust washer. Place the felt and felt retainer in the pulley. Press the pulley on the shaft and secure it with the lock pin.

1937-40 Ford V8-60—A special spanner

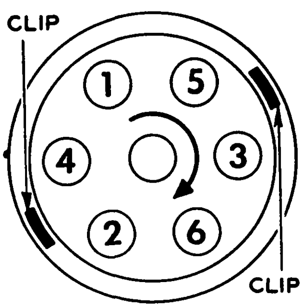


Fig. 32 Diagram of distribut r cap, 1947-51 F rd Six

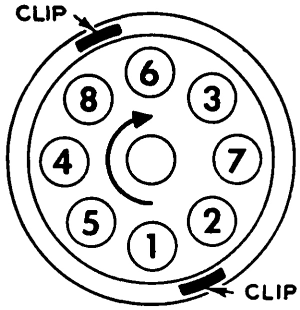


Fig. 33 Diagram of distributor cap, 1949-52 V8 Ford and Mercury

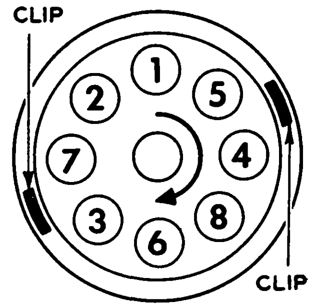


Fig. 34 Diagram of distributor cap, 1949-51 Lincoln

wrench should be used to remove and replace this type pump since it is retained by a large nut, notched around its edge to facilitate removal and replacement

To disassemble, pull the spring retainer out to expose a few coils of the spring and wedge the spring in this position while removing the retainer which is held by the hook at the other end of the spring Allow the spring to retract and remove the impeller with the spring, pulling the spring through the hollow pump shaft The pump may then be disassembled

1937-48 V8 Ford & Mercury—Press the shaft out of the pulley and remove the shaft and impeller from the rear of the housing Note the relative position of the seal parts as they are removed so they can be reassembled in the same order If required, the old bushing may be pressed out and new one installed.

1941-47 Ford Six—Pumps used on these engines are very similar to that used on 1937-48 V8 Be sure to take careful note of the seal parts as they are removed in order to assure correct installation

1949 V8 Ford & Mercury—Fig 30 To disassemble, pull off the pulley Release the snap ring, pull off the impeller and press the shaft out through the front end of the housing Press the bushing and seal out through the impeller end The roller bearing may be pressed off the shaft and the snap ring removed if necessary

Assemble in the reverse order, but when installing the impeller on the shaft, allow 030 to 040" clearance between the impeller blades and the housing When the job is done, saturate the bushing with engine oil through the oil cup provided

1948-51 Ford Six—Fig 31 This pump is equipped with two snap rings to prevent end play in the pump shaft

To disassemble, remove the screws holding the pulley to the hub Remove the snap ring from the pulley end of the housing Support the pulley hub and press out the shaft It should not be necessary to remove the inner snap ring

To assemble, install a new seal assembly, and the inner snap ring if it has been removed Insert the shaft into the forward end of the housing and press it in until it bottoms on the inner snap ring Install the forward snap ring Press the pulley hub on the shaft until the shaft end is flush with the pulley hub Press the impeller on the shaft so there is 020 to 040" clearance between the impeller and housing.

1936-48 Lincoln H—This pump is quite similar in design to that used on 1937-48 V8, and servicing may be done in the same manner Be sure, however, to note the arrangement of the seal parts as they are removed to assure correct installation.

1949-52 Lincoln—The water pump used on these models is of the same general design as that which is used on 1948-52 Ford Six, and service procedure is performed in the same manner.

ELECTRICAL

IGNITION

1935-51—For details of the ignition system, see the *Ignition System* chapter Figs 32, 33 and 34 illustrate diagrams of distributor caps, showing firing order, direction of rotation and location of clips.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-52 — Free play in the clutch pedal should be maintained at from 1 to 1½ . See cuts for adjustment points

CLUTCH REMOVAL

1935-52—After removing the transmission as outlined further on, proceed as follows

1 Remove flywheel housing (1949-51)
2 On 1949-52 Lincoln, take out clutch release bearing and hub
3 Prick punch flywheel and clutch cover so that at asembly these parts may be placed in their original positions
4 Loosen clutch-to-flywheel attaching screws a turn or two at a time until clutch spring pressure is relieved Then remove the screws and take the clutch from the flywheel As a further precaution to prevent clutch distortion, clutch spring pressure may be relieved by inserting wooden wedges between the clutch cover and release levers, as shown in Fig 38

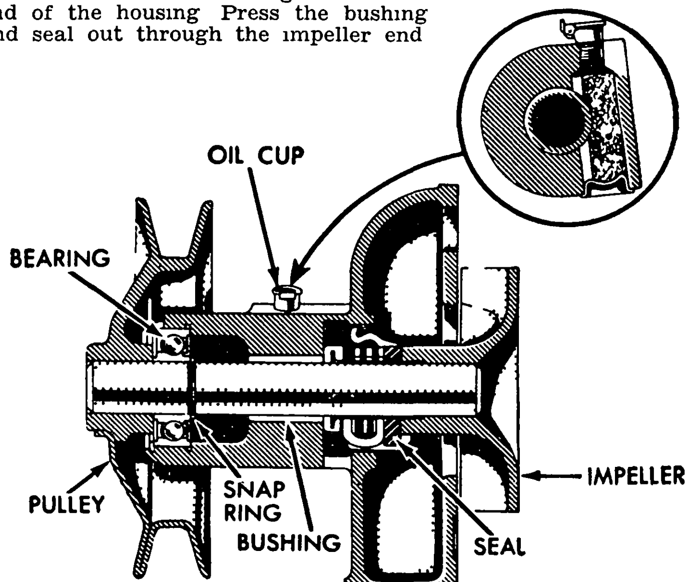


Fig 30 1949 F rd and M rcury V8 wat r pump

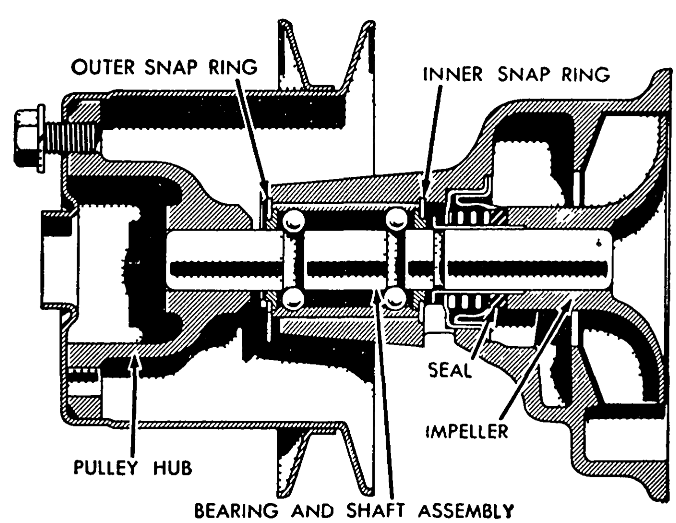


Fig. 31 1948-51 F rd Six water pump 1950-52 V8 is similar

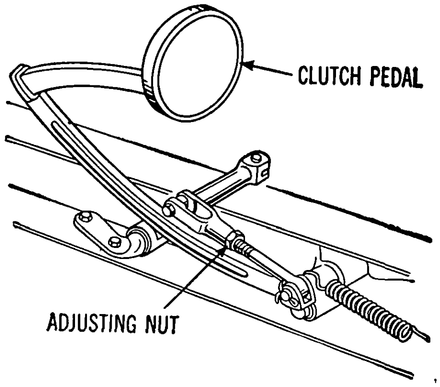


Fig. 35 Clutch pedal adjustment, 1939-48 F rd and Mercury

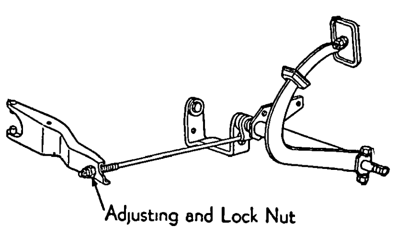


Fig. 35A Clutch pedal linkage, 1949-52 Ford

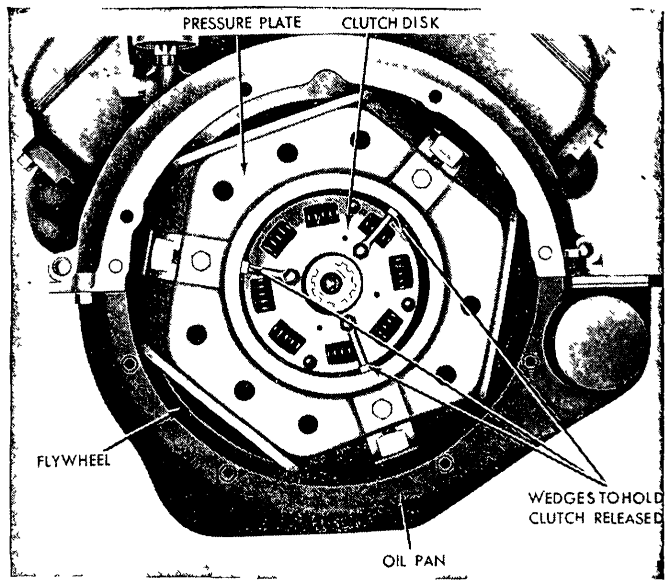


Fig. 38 Rear view of clutch showing wedges being used to keep clutch released while being removed and replaced, 1935-52

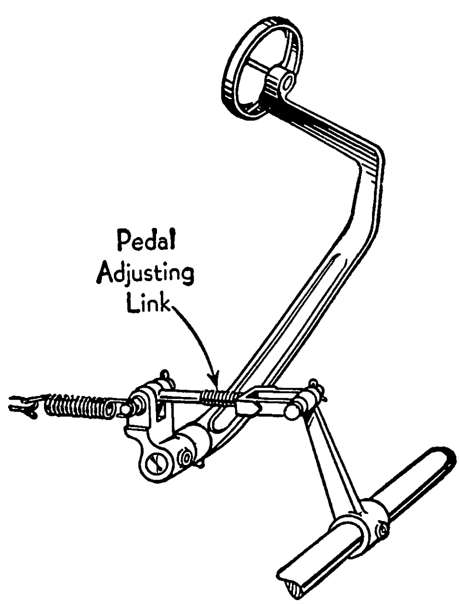


Fig. 36 Clutch pedal adjustment, 1935-38 Ford

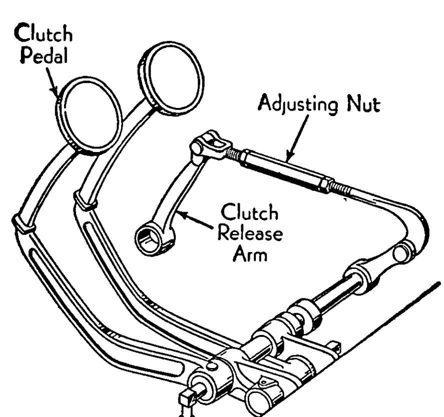


Fig. 37 Clutch pedal adjustment, 1938-48 Lincoln H

TRANSMISSION

TRANSMISSION REMOVAL

1935-48—After removing the real axle assembly from the car, remove the transmission as follows:

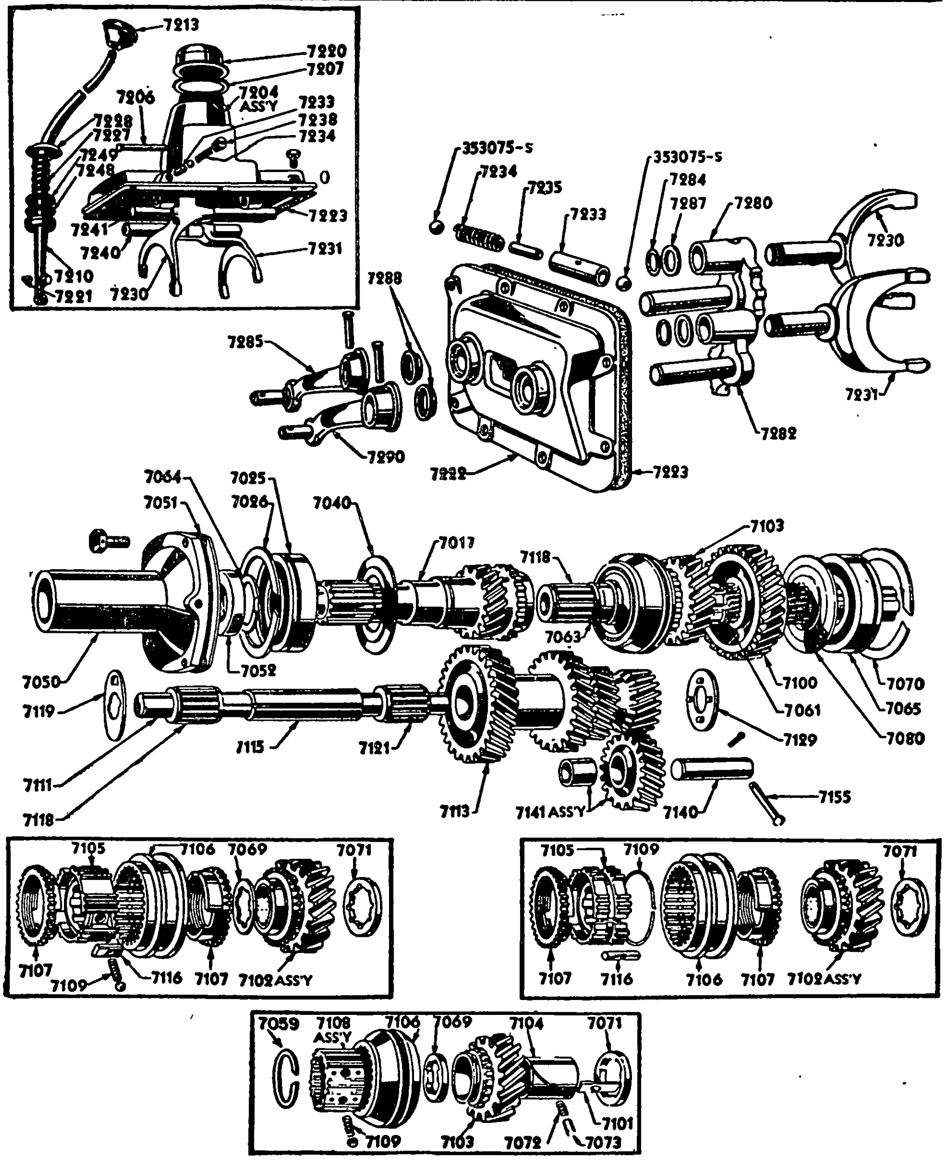
1. Remove floor pan or boards as required.
2. Remove clutch equalizer shaft.
3. Detach shift rods from transmission.
4. Place jack under engine to support its weight.
5. If car is equiped with overdrive, disconnect wiring and controls.
6. Unfasten transmission from engine and lift it out.

1949-51 Ford—

1. Remove muffler inlet pipe.
2. Remove clevis pin which attaches parking brake equalizer rod to the equalizer lever, then disconnect the lever from the equalizer bracket.
3. Disconnect clutch pedal and gearshift linkage at transmission.
4. Remove speedometer cable and gear.
5. Remove drive shaft.
6. Remove capscrews which attach transmission extension to No. 2 frame crossmember.
7. Place a support under engine, then remove No. 2 crossmember. The bolts which attach the crossmember to the top of the frame side rails are accessible through holes in the body floor pan.
8. Disconnect transmission from flywheel housing, install two guide pins and remove transmission from vehicle.
9. When removing transmission equipped with overdrive, be sure first to disconnect the overdrive control cable and lockout switch wire.
10. Install transmission by reversing the order of the foregoing operations.

1949-51 Mercury—Two different procedures are possible in removing the transmission from these models. One method is to remove the transmission from the underside of the car without disturbing the floor covering. The other method is to remove the floor covering, the transmission cover plate, and pull the transmission into the vehicle and out through the right door opening. The procedure for the second of the two methods is as follows:

1. Remove front seat cushion.
2. Remove pins that retain forward side of seat frame to floor and tip seat back as far as possible
3. If equipped with overdrive, remove retaining nut and push kickdown switch through transmission floor cover plate.
4. Remove lock clip attaching accelerator pedal rod to accelerator shaft.
5. Remove transmission floor cover plate.
6. Drain transmission.
7. Disconnect shift rods at transmission.
8. Remove cap screw that retains speedometer cable to overdrive or extension housing. Pull cable from housing and remove speedometer gear.
9. If car has an overdrive, disconnect overdrive control cable from control arm. Release cable from transmission cover retaining clip.
10. Remove solenoid.
11. Remove governor, using Tool 1246 if possible in order to avoid damage to unit when removing assembly from vehicle.
12. Remove shift rail switch.
13. Disconnect necessary overdrive wiring.
14. On cars with or without overdrive, remove large bolt that retains extension or overdrive housing to frame.
15. Remove cotter pin and pin that retains equalizer shaft to clutch bearing release shaft.
16. Remove bolts attaching rear uni-



TRANSMISSION

7017 Main Drive Gear
7025 Main Drive Gear Bearing
7026 Main Driv Gear Bearing Snap Ring
7040 Main Driv Gear Bearing Oil Baffle
7050 Main Drive Gear Bearing Retainer
7051 Retainer Gasket
7052 Oil Seal
7059 Mainshaft Snap Ring
7061 Mainshaft
7063 Mainshaft Pilot Bearing Spacer or Ring
7064 Mainshaft Snap Ring
7065 Mainshaft Bearing
7069 Spacer
7070 Snap Ring
7071 Second Gear Thrust Washer
7072 Thrust Washer Plunger Spring
7073 Thrust Washer Plunger
7080 Bearing Oil Baffle
7100 Low and Reverse Sliding Gear
7101 Second Gear Thrust Washer Key
7102 Second Speed Gear
7103 Second Speed Gear
7104 Second Speed Gear Sleeve
7105 Second and High Clutch Hub
7106 Clutch Hub Sleeve
7107 Synchronizer Ring
7108 Clutch Hub
7109 Clutch Hub Spring
7111 Countershaft
7113 Countershaft Gear
7115 Countershaft Bearing Spacer
7116 Clutch Hub Insert
7118 Countershaft Bearing—Short
7119 Countershaft Gear Thrust Washer
7121 Countershaft Bearing—Long
7129 Countershaft Thrust Washer
7140 Reverse Idler Shaft
7141 Reverse Idler Gear
7155 Countershaft and Reverse Idler Shaft Retainer
7204 Gear Shift Housing
7206 Housing Guide Pin
7207 Housing Cap Gasket
7210 Gear Shift Lever
7213 Shift Lever Ball
7220 Housing Cap
7221 Trunnion Lever
7222 Gear Shift Housing
7223 Housing Gasket
7227 Shift Lever Spring
7228 Shift Lever Spring Seat
7230 Second and High Shifting Fork
7231 Low and Reverse Shifting Fork
7233 Shaft Lock Plunger
7234 Lock Plunger Spring
7235 Gear Shift Interlock Pin
7238 Lock Plunger Seat
7240 Low and Reverse Shift Shaft
7241 Second and High Shift Shaft
7248 Lever Oil Seal
7249 Lever Oil Seal Washer
7280 High and Second Cam and Shaft
7282 Low and Reverse Cam and Shaft
7284 Gear Shift Fork Retainer
7285 Second and High Shift Lever
7287 Shift Cam Thrust Washer
7-88 Gear Shift Bearing Seal
7290 Low and Reverse Shift Lever
353075-S Ball

Fig. 39 Exploded view of transmission, 1935-48. Insets show variations in synchronizers used through the years

versal joint to companion flange and take out drive shaft.

17. Support rear of engine.
18. Shift transmission back and lift into vehicle. Remove through right door opening.
19. Install the transmission by reversing the foregoing operations.

1949-51 Lincoln—The transmission may be removed by two methods: One method is to remove it through the floor with the engine remaining in the car; the other method is to remove the engine and transmission as a unit. The following gives the procedure for the first method.

1. Remove seat cushion.
2. Remove nut that retains hydraulic seat adjuster to the seat frame.
3. Remove seat adjuster electrical connections from the seat switch.
4. Remove clevis pins (4) that retain front seat frame to the floor. Move seat back as far as possible.
5. Remove floor covering.
6. If equipped with overdrive, remove kickdown switch retaining nut and push switch through floor plate.
7. Detach accelerator rod from accelerator shaft.
8. Remove transmission floor cover plate.
9. Drain transmission.
10. If equipped with overdrive, remove governor, solenoid, rail switch and control cable.
11. Remove capscrew which retains speedometer cable to overdrive or extension housing. Pull cable from housing and remove speedometer gear.
12. Remove transmission shift rods at transmission.
13. Remove inspection cover and detach release bearing retracting spring.
14. Unfasten rear universal joint and remove propeller shaft.
15. Remove large capscrew which retains the overdrive or extension housing to the frame cross member.
16. Support rear of engine.
17. Unfasten transmission from flywheel housing.

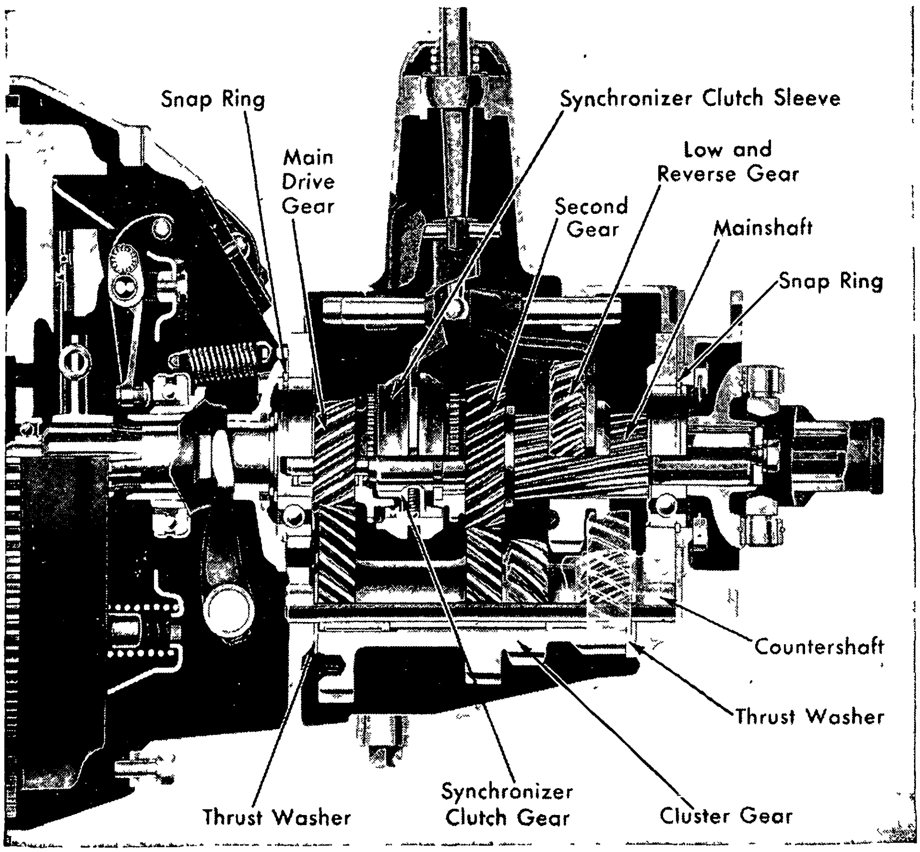


Fig. 40 Sectional view of 1935-39 transmission

18. Slide transmission back as far as possible, raise the forward end and lift the unit into and out of the car.

TRANSMISSION, OVERHAUL

1935-48—Figs. 39, 40, 41.

1. Remove front and rear bearing retainers, transmission cover and clutch release bearing.
2. Push countershaft out through rear, allowing cluster gear to lie in bottom of case.
3. Remove main drive gear through front.
4. Push mainshaft to rear, pull off rear bearing and lift mainshaft out through cover opening.
5. Lift out cluster gear.
6. Drive out reverse idler gear shaft and lift out gear.

Mainshaft, Disassemble — Before disassembling the mainshaft, mark the relationship of the synchronizer clutch sleeve with the teeth of the blocker rings (if used) so that assembly may be made in the same relative position.

On models having the six-ball retainer type synchronizer, slide the low and reverse gear from the mainshaft. Remove the synchronizer, using care not to allow the unit to come apart during the process, otherwise the balls and springs may be lost. Take off the thrust washer from the front of the second speed gear. Insert a pointed tool through a hole in the second speed gear and depress the spring plunger. With the plunger depressed, push the locking key forward until it is clear of the rear thrust washer, then slide the gear and washers from the shaft.

Assembly of Synchronizers—Before disassembling the six-ball type, mark the relationship of the clutch gear with the sleeve so that assembly may be made in the same relative position. Then wrap a cloth around the assembly and push the gear out of the sleeve allowing the cloth to catch the balls and springs.

To assemble, apply a liberal quantity of grease to the holes in the clutch gear. Assemble the balls and springs in position and use a clamp (similar to a piston ring compressor) to compress the springs enough to enable the sleeve to be installed.

NOTE—When replacing this type synchronizer on the mainshaft, be sure that the hub portion of the clutch gear and the side of the sleeve having the straight portion at the end of its taper are toward the front.

To assemble the spring retainer type synchronizer, position the shifting plates in the cut-outs of the clutch gear and install the spring over the gear and into the grooves of the shifting plates. The assembly may then be installed into the clutch sleeve, being sure that the spring is positioned properly in the groove of the sleeve.

Transmission, Assemble — Reverse the order of the foregoing procedure to assemble the transmission, taking note of the following precautions.

When assembling the countershaft, the long bearing should be placed at the rear of the assembly.

When assembling the mainshaft on units having the six-ball type synchronizer, make sure that the second speed gear thrust washers are locked to prevent their rotating on the mainshaft. Be sure that the spring plunger engages the locking key. And if the second speed gear bushing was removed, see that the omitted spline on the mainshaft is directly over the locking key and plunger when replacing the bushing.

To install the mainshaft, slip the assembly into the case from above, then tilt the forward end of the mainshaft upward, allowing the rear of the shaft to protrude through the rear of the case. Press the rear bearing on the end of the mainshaft and install the snap ring. Now push the assembly into position in the case and install the rear bearing retainer.

NOTE — On early 1938 Ford models, when removing the rear engine mounting, be careful to prevent the mainshaft from moving rearward, as the synchronizer unit shifter balls are likely to drop out of place and fall into the transmission. The possibility of such occurrence is eliminated on later production cars in 1938 by the use of a retainer fastened

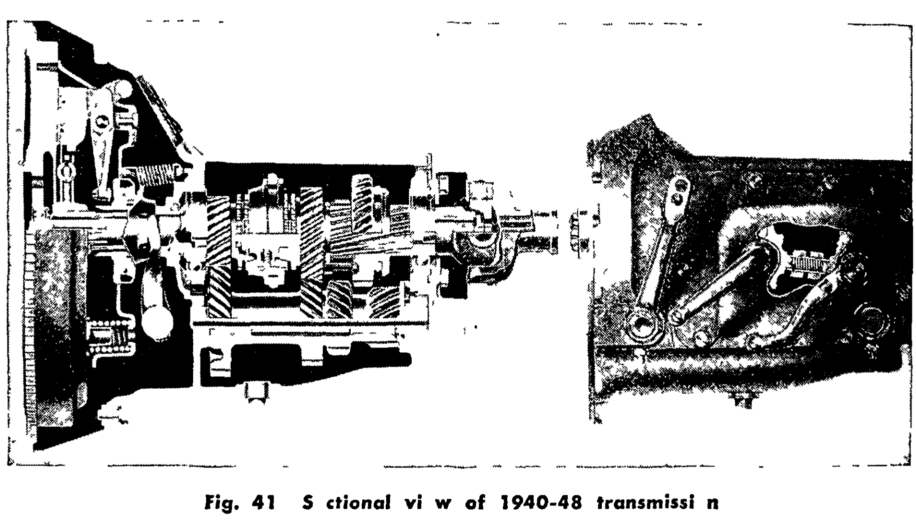


Fig. 41 S ctional vi w of 1940-48 transmissi n

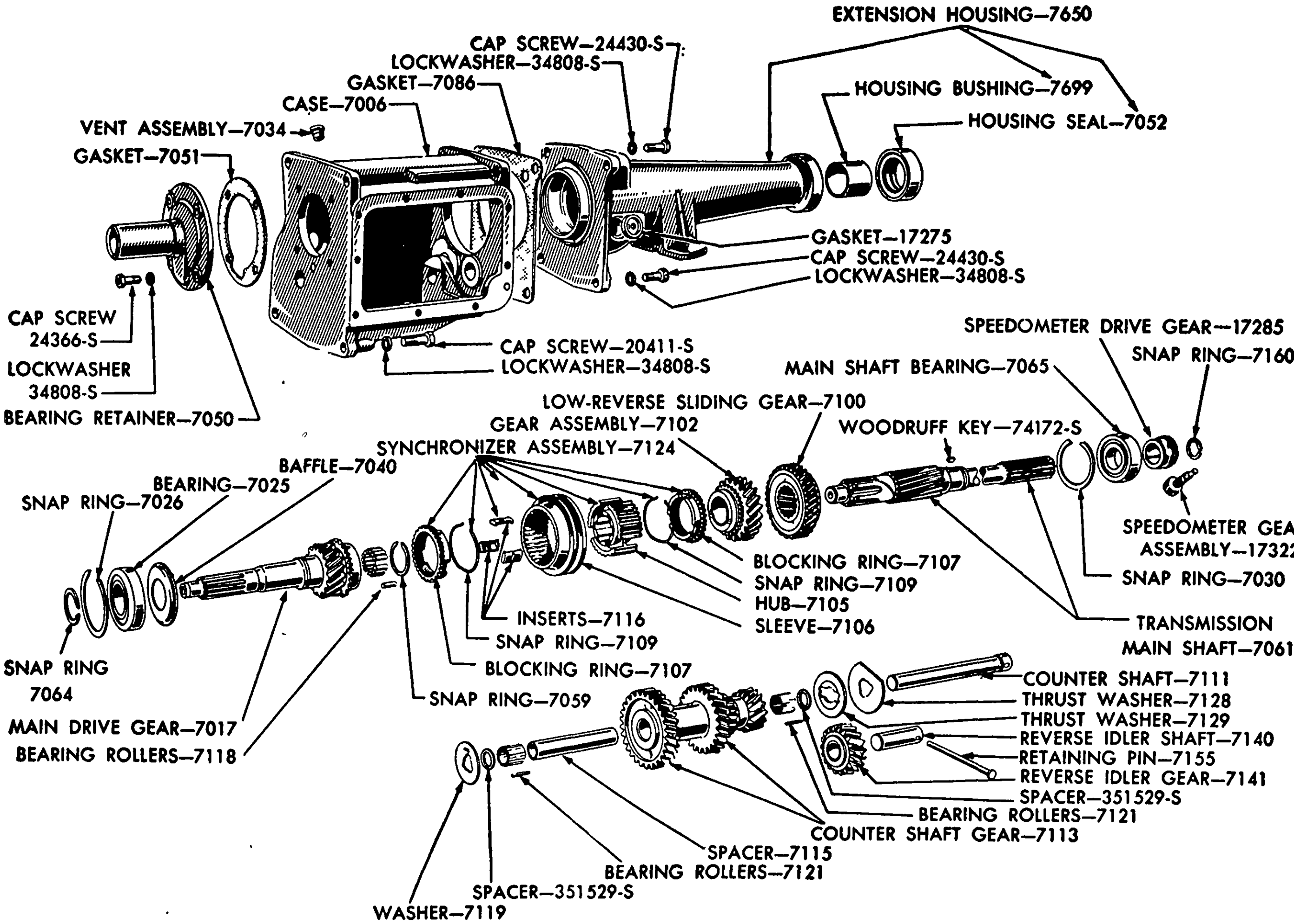


Fig. 42 Synchromesh transmission with basic part numbers. 1949-52 Ford and 1951-52 Mercury

on the rear of the case. This retainer can be installed on early 1938 models.

TRANSMISSION, OVERHAUL

1949-52 Ford & Mercury—The following describes the procedure for units without overdrive. For detailed service on the overdrive, consult the *Overdrive* chapter. To disassemble the transmission, see Figs. 42 and 42A and proceed as follows:

1. Remove gearshift housing.
2. Drive out the pin that retains the countershaft and idler gear shaft to the transmission case.
3. On 1949-50 Mercury, remove clutch release bearing retracting spring and remove bearing and hub. Using a brass drift, drive on the front end of the countershaft until the shaft projects from the rear of the case. Pull the shaft from the housing, permitting the cluster gear to drop to the bottom of the case where it is to remain until after the main drive gear and mainshaft assembly is removed from the case. Unfasten and remove the extension housing and mainshaft from the case.
4. On 1949-52 Ford and 1951-52 Mercury, unfasten the extension housing and twist it ¼ turn counterclockwise to permit removal of countershaft. Drive countershaft out the rear of case, using a cluster gear roller retainer shaft tool or a spare countershaft cut to the length of the cluster gear. Leave cluster gear and dummy shaft in case until after main drive gear and mainshaft have been removed. Remove extension and mainshaft assembly from case.
5. Drive reverse idler shaft out of case and lift out reverse idler gear.
6. Unfasten and remove main drive gear bearing retainer.
7. Tap main drive gear out through front of case.
8. To disassemble mainshaft, remove snap ring that holds it to the extension housing. Tap mainshaft out of extension. Remove snap ring from in front of synchronizer and strip mainshaft of all parts.
9. After cleaning and inspecting parts, reassemble transmission by reversing the order of the foregoing procedure.

1949-50 Lincoln — This procedure deals with transmissions without overdrive inasmuch as detailed instructions for this unit is given in the *Overdrive* chapter. See Fig. 42B and proceed as follows:

1. Remove gearshift housing.
2. Remove main drive gear bearing retainer.
3. Remove small snap ring in front of main drive gear bearing and the large snap ring from the bearing.
4. Pull off main drive gear bearing.
5. Pull main drive gear forward and tilt it so it clears countershaft gear.
6. Unfasten and pull extension housing back and tilt it in a manner that will allow mainshaft and gears to clear countershaft gears.
7. Remove main drive gear from case, being careful not to lose the bearing rollers located inside the gear.
8. Drive countershaft from case from front to rear, using a suitable pilot tool to hold roller bearings in place while cluster gear is lifted from case.
9. Drive out idler gear shaft and lift gear from case, being sure not to lose any of the roller bearings.
10. Remove snap ring from front of synchronizer and strip mainshaft of all parts.
11. After cleaning and inspecting all parts, reassemble transmission by reversing the order of the foregoing procedure.

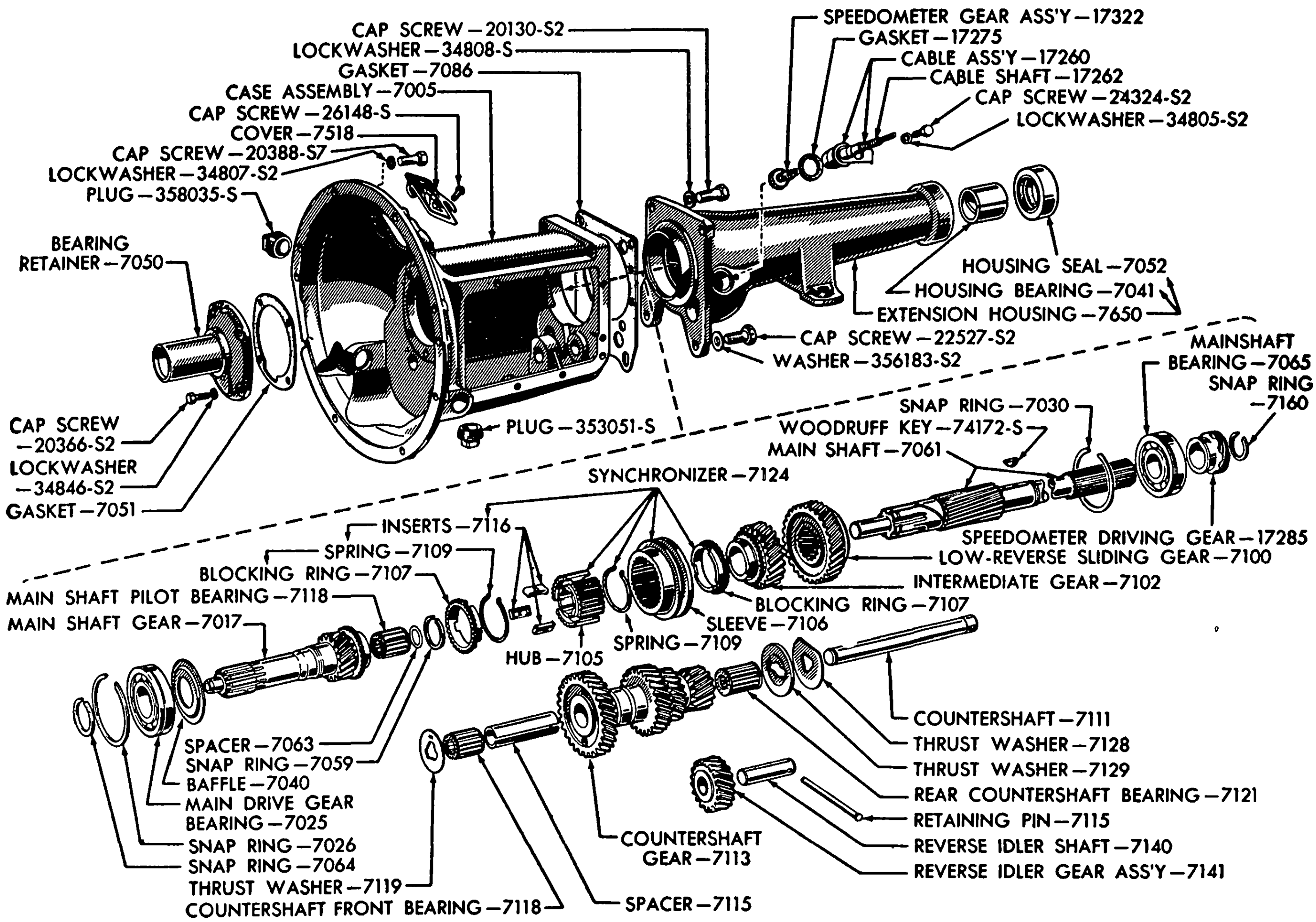


Fig. 42A Synchromesh transmission with basic part numbers. 1949-50 Mercury

FORD-MERCURY AUTOMATIC TRANSMISSION

1951-52—Called Ford-O-Matic when used on Ford and Merc-O-Matic when installed on Mercury, the transmission combines an air-cooled three-element torque converter and a hydraulically controlled three speed and reverse planetary gearbox, Fig 43.

The drive is always through the torque converter and one of the planetary gear ranges The range selector lever, located on a dial above the hub of the steering wheel, has a choice of five positions lettered "P" (park), "R" (reverse), "N (neutral), "D" (drive) and "L" (low)

Virtually all normal driving is done in the "drive" range in which the 1 48 to 1 intermediate ratio and the 1 to 1 high ratio function automatically in accordance with the driver's demand for performance The intermediate ratio of 1 48 to 1 times the torque converter ratio of 2.1 to 1 at stall provides an overall transmission starting ratio of 3 11 to 1, which meets all requirements under normal conditions of acceleration, hill climbing and downhill braking

The path of power under all conditions is shown diagramatically in Fig. 44.

How Ranges Are Selected—The engine is started with the selector in "N" and then moved to "D" The car then starts in intermediate (second) gear and automatically shifts to high somewhere between 17 and 63 mph, depending upon how far the throttle is opened

At speeds between 57 and 20 mph it is possible to shift down into intermediate by pressing the accelerator beyond the wide open position At speeds below approximately 20 mph, at part throttle, the unit will automatically shift down Under closed throttle or coasting conditions, the downshift occurs between 5 and 8 mph

Low range is used only for maximum acceleration, hill climbing or downhill braking In this range the car remains in low until the selector is moved to ' drive" Downhill braking can be achieved by shifting to low If the shift is made below 40 mph, regardless of throttle opening, low gear is engaged, and will stay there regardless of throttle opening Shifts between "low" and "drive" are accomplished under torque at any throttle opening The car can be "rocked" by moving the selector between "L" and "R" when mud, snow or sand is encountered

Torque Converter Details—Fig. 45. The torque converter is a simple three-element type, consisting of a pump or drive member, a turbine or output member, and a stator or reaction member

The stator has a sprag type of overrunning clutch nested in the center of its hub assembly The stator redirects fluid flow or increases torque up to an engine speed of approximately 1,900 rpm (48 mph in high) It then freewheels (turns in direction of pump and turbine) to form a fluid coupling

The pump, forming part of the housing, has 31 steel blades or vanes and is driven by the engine through a flexible plate This plate, forward of the starter ring gear, cuts down the amount of vibration transferred from the engine to the transmission

The 33-blade turbine is the forward member that transmits the power to the planetary gearbox

Cooling of the converter and transmission oil is accomplished by fins cast in the aluminum pump cover or housing These fins serve as a cooling surface and pump cool air through the inlet on the left side to the outlet at the bottom right

Planetary Gearbox—The hydraulically controlled planetary gearbox employs a gearset of the double (long and short) pinion type with two sun gears and one

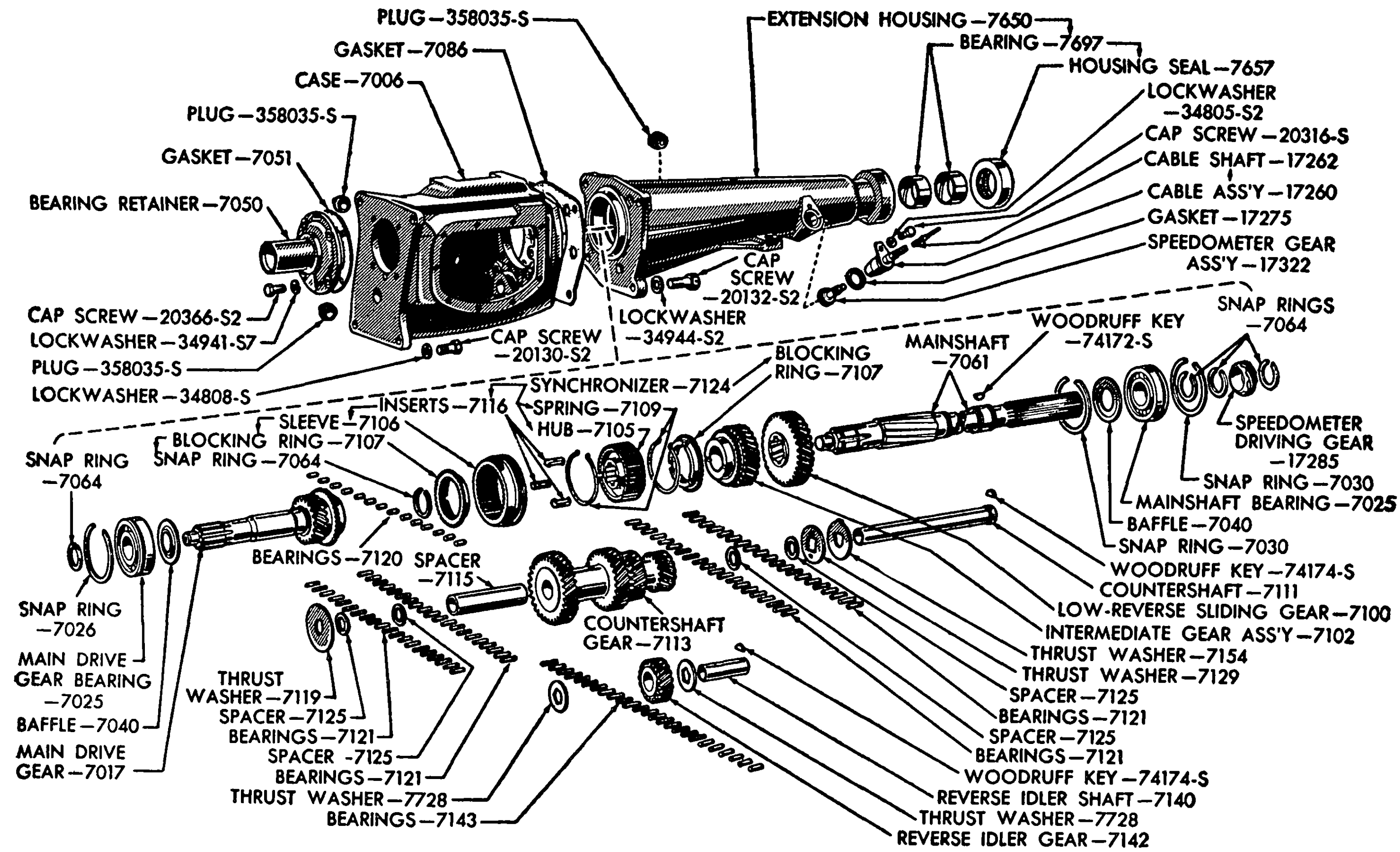


Fig. 42B Synchromesh transmission with basic part numbers. 1949-52 Lincoln

internal gear. This total of nine gears provides three forward ratios — two geared, one direct and one reverse Actual ratios are Low 2.44 intermediate 1.48, high 1.00, and reverse 2.00 These, of course, are supplemented by the variable converter range of from 2.1 to 1 to 1 to 1

Two multiple disc clutches and two brake bands, all hydraulically actuated, determine the path through which power flows in various gears

Two oil pumps, one driven at all times by the engine and one by the output shaft, deliver oil under pressure to charge the converter, actuate and control bands and clutches and pressure lubricate the entire mechanism

The control system consists of a pressure regulator assembly, a hydraulic governor mounted on the output shaft, and the main hydraulic control unit or valve body assembly All manual and automatic controls are centered in the valve body assembly.

Operating pressures of the pumps vary with operating conditions Idle and cruising pressure requirements are approximately 75 lbs sq in At full throttle stall conditions, pressure in drive range is increased to 125 lbs sq in and in low and reverse 150 lbs sq in

In drive range at full throttle, pressure requirements graduate downward from 125 at stall to a nominal line pressure of 75 lbs at approximately 35 mph

Service Features—There are only four adjustments in the entire transmission, two external and two internal The internal adjustments are the front and rear bands, while the manual and throttle rods are the external adjustments

The transmission is so designed that the gearbox can readily be removed from the converter housing by removing the four case-to-housing screws, thereby leaving the converter untouched and intact

All control elements, such as the pressure regulator assembly, valve body, front and rear servos, can readily be removed from below after taking off the oil pan The governor can be removed in a few minutes by removing an inspection cover on the extension housing

LUBRICATION

Checking Fluid Level—

1 Apply the emergency brake, place the selector lever in N position and run the engine at idle speed for approximately four minutes

2 Clean all lint and dirt from the right-hand section of the floor mat Then roll the mat back to gain access to the fluid level indicator inspection plate

3 Clean the area around the plate thoroughly to prevent dirt from getting into the transmission Remove the four screws and take off the cover plate

4 With the emergency brake applied and engine running at slow idle, move the selector lever to the P position When the engine and transmission have reached normal operating temperature, move the selector lever through all ranges to assure fluid distribution throughout the transmission

5 Clean all dirt from the fluid level indicator cap Turn the cap ½ turn counterclockwise with pliers and remove the indicator

6 Wipe the indicator clean and insert it in the transmission, being sure the indicator is seated and locked Remove the indicator and read the fluid level.

7 If necessary to add fluid, use only Automatic Transmission Fluid, Type A, in the amount sufficient to raise the fluid level to the FULL mark on the indicator

8 Replace the indicator, making sure it is firmly seated and tightened (½ turn clockwise)

9 Install the inspection plate and tighten its four capscrews

Changing Fluid—The transmission fluid should be changed at least every 15,000 miles Use the following procedure

1 Remove the converter housing lower plate

2 To drain the converter, remove one drain plug Then rotate the converter 180 degrees and remove the second drain plug so the unit will be vented

3 Remove transmission oil pan drain plug and drain fluid Then install transmission and converter drain plugs.

4 Add 6 quarts of Automatic Transmission Fluid, Type A Start engine and run at idle speed for approximately two minutes Then add 3 quarts of fluid and bring transmission to normal operating temperature.

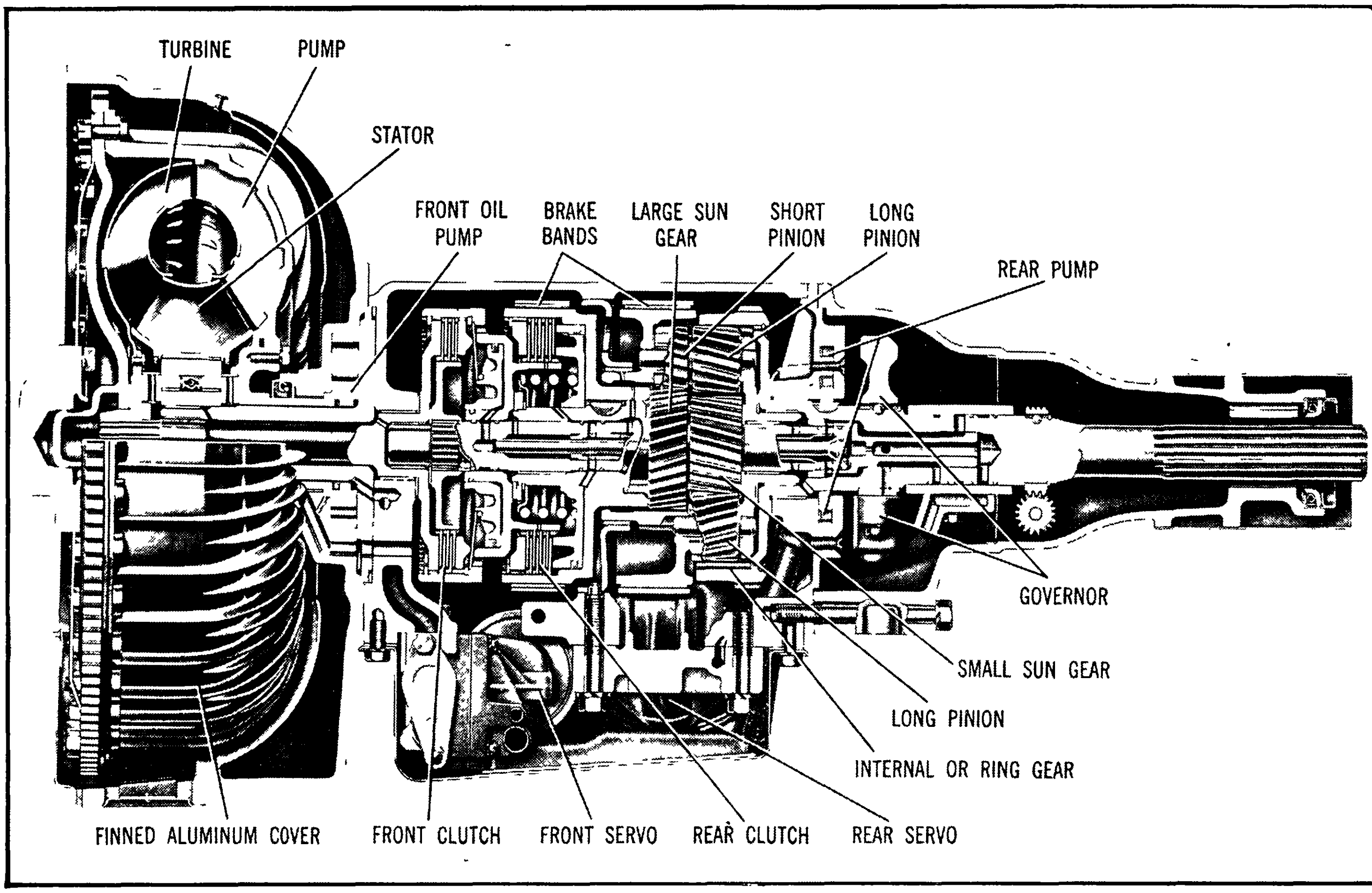


Fig. 43 1951 Ford and Mercury automatic transmission

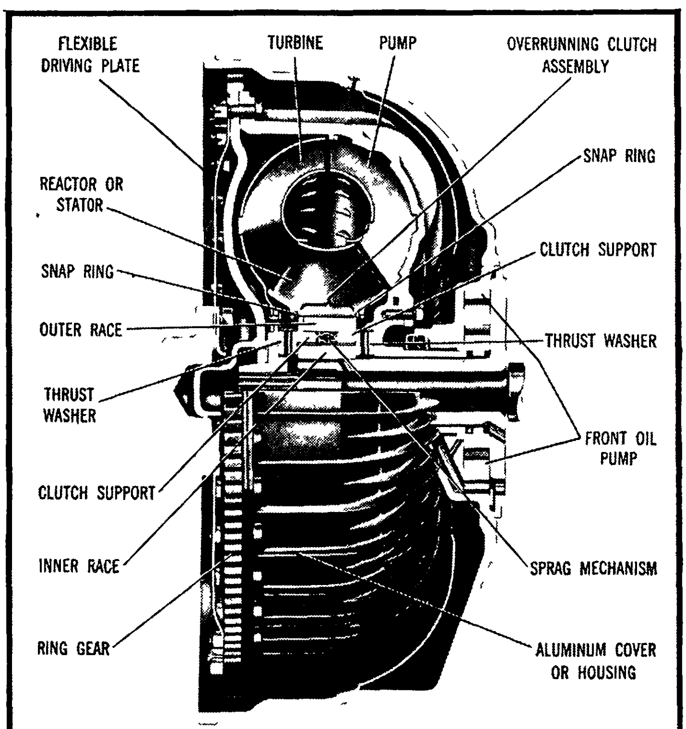


Fig. 45 S cti nal view f t rque c nverter

5. Move selector lever through all ranges. Then place selector lever in the P position and check fluid level. Add fluid if the level is not up to the FULL mark on the indicator.

CHECKING FOR LEAKS

1. Inspect the bottom of the floor pan at the rear of the transmission for evidences of fluid. If fluid is found here, the rear extension housing seal is leaking between the two sections of the telescopic shield. Replace the seal.
2. Check the speedometer cable connection at the transmission and replace the rubber seal if necessary.
3. Check the governor inspection plate for evidence of leakage. Install a new gasket if needed.
4. Leakage around the oil pan gasket usually can be stopped by tightening the attaching bolts to 10-13 lbs. ft. torque. Install a new gasket if necessary. Inspect the transmission drain plug. Tighten the plug to 20-25 lbs. ft. torque. If tightening the plug does not stop the leakage, replace the plug and gasket.
5. If leakage is evident at either the throttle lever shaft or manual lever shaft, replace either or both seals.
6. Inspect the two hex head pipe plugs on each side of the transmission case at the front. If either plug shows leakage, tighten the plug to 7-15 lbs. ft. torque. If tightening does not stop the leakage, replace the plug.
7. Inspect the discharge air duct for evidence of fluid. If fluid is found, check the converter cover nuts for proper tor-

que (25-28 lbs. ft.). Do not tighten these nuts when they are hot as leakage may result.

Caution—Fluid found in the discharge air duct may be engine oil that has leaked past the rear main bearing. Be sure to determine which type of leak exists.

ADJUSTMENTS

Engine Idle Speed — Place the selector lever in N position and start the engine. Run the engine until normal operating temperature is reached. Check the idle speed with a tachometer and adjust to 425 rpm.

Anti-Stall Setting—Loosen the dashpot adjusting screw lock nut, Fig. 46. Hold throttle lever in closed position and turn the adjusting screw out (counterclockwise) until the end of the screw bottoms the dashpot rod.

To obtain the proper clearance of .038-.040 in. between the end of the dashpot rod and the adjusting screw head, turn the adjusting screw in 1¼ turns.

Manual Linkage — Disconnect the upper end of the manual control rod from the selector arm, Fig. 47.

Position the selector lever so that the indicator at the steering wheel is down

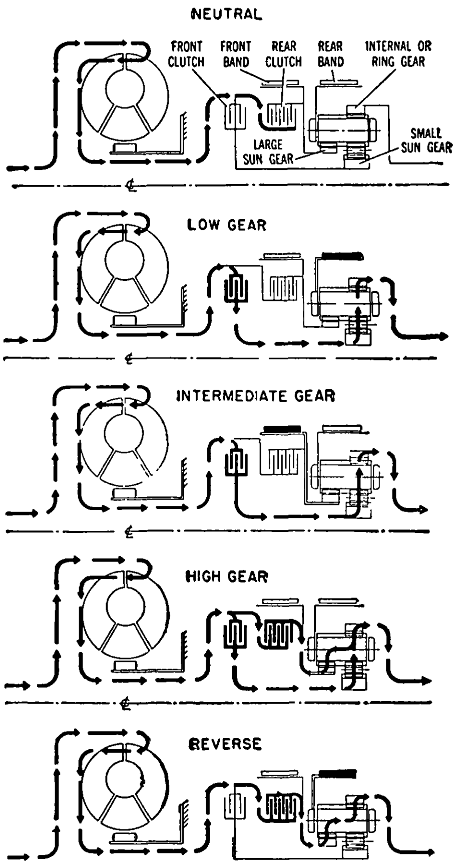


Fig. 44 Path f p w r is c ntr lled by tw clutches and tw brak bands. Fr nt clutch is engaged in all f rward speeds and disengaged in neutral and revers . Fr nt band is applied in int rm diate nly. R ar band is applied in l w and revers . In neutral, n bands r clutch s are applied

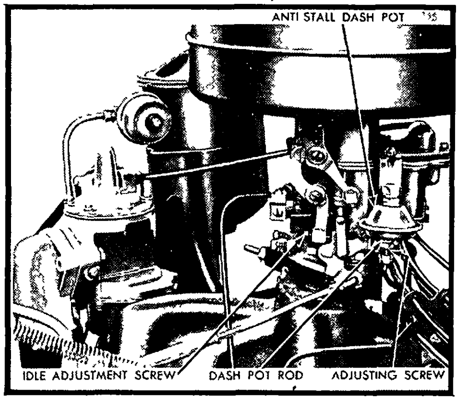


Fig. 46 Engine idle adjustment

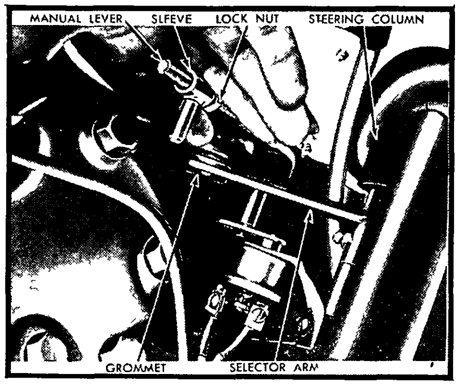


Fig. 47 Disconnecting manual rod from arm

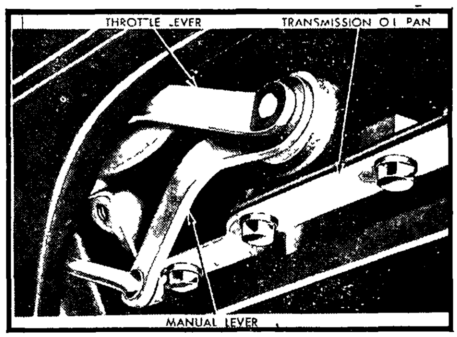


Fig. 48 Manual lever in DR position

against the stop in the DR position. Position the transmission manual lever in the DR position (second position from bottom, Fig. 48).

Adjust the rod length so that the pin on the sleeve trunnion freely enters the grommet on the selector arm. Lengthen the rod by turning the sléeve one full turn counterclockwise.

Reassemble the rod to the selector arm and lock the sleeve in place with the lock nut. Check the alignment of the pointer for all positions of the selector lever.

Starter Neutral Switch — Check the starter circuit in all selector lever positions. The circuit must be open in all positions except neutral. Loosen the neutral switch from the steering column and position the switch so the starter circuit is closed when the selector lever is in neutral position.

Throttle Linkage—Remove the clip from the carburetor to Z-bar rod at the Z-bar end. Reinsert the rod in the Z-bar lever and place the tool at the end of the rod as shown in Fig. 49.

With the tool resting on the clean, finished surface of the cylinder block, adjust the rod length to hold the carburetor throttle lever against the idle stop.

Remove the tool and reassemble the rod to the Z-bar with the clip.

Remove the clevis pin from the upper end of the Z-bar to transmission rod and pull upward gently but firmly on the rod from the transmission throttle lever to hold the lever against the stop. Adjust the clevis so the clevis pin will freely enter the clevis and Z-bar hole. Lengthen the rod by turning the clevis counterclockwise. 2½ turns. Then assemble the rod to the Z-bar with the clevis pin, Fig. 50. Tighten the lock nut while holding clevis in alignment to prevent binding

Front Band Adjustment—Drain the fluid from the transmission into a drain can with a fine mesh screen. Remove oil pan and screen.

Loosen the front servo adjusting screw lock nut two full turns and pull back on the actuating rod. Insert the gauge block of the front band adjusting tool between the servo piston stem and adjusting screw and tighten the adjusting screw until the wrench overruns, Fig. 51.

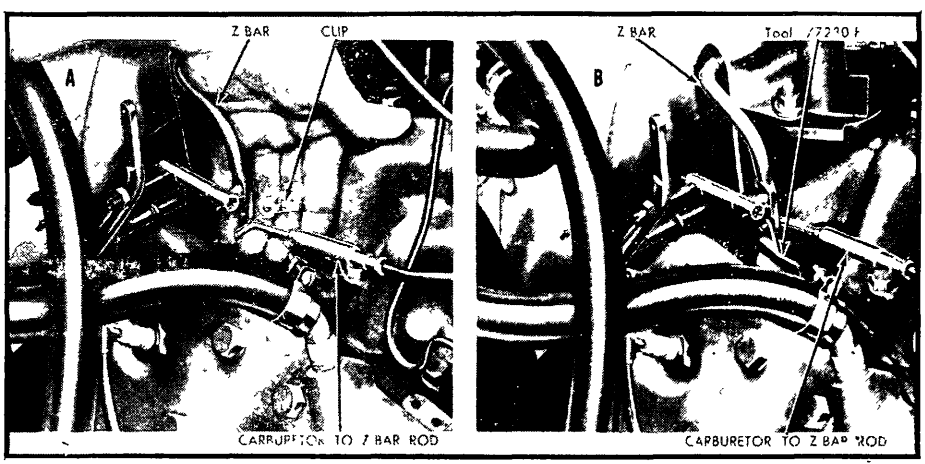


Fig. 49 Thr ttle linkage adjustment

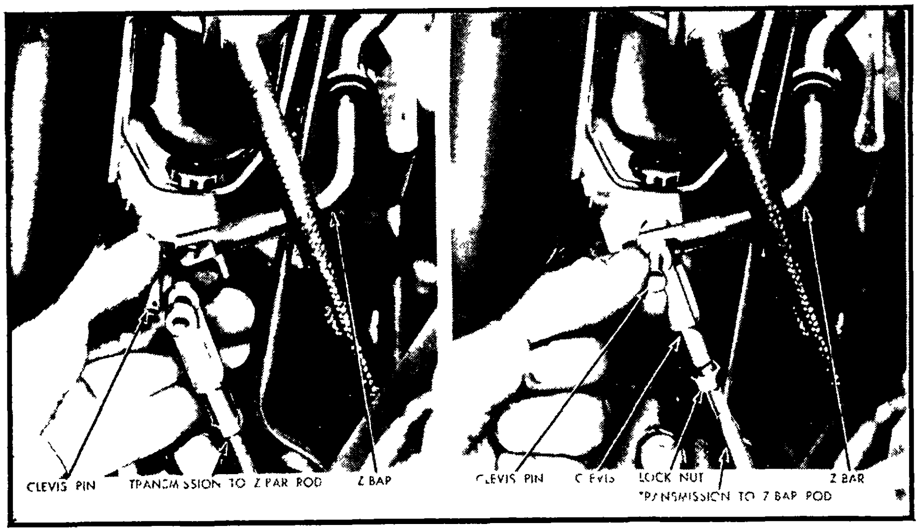


Fig. 50 Thr ttle rod adjustment

Back off the adjusting screw exactly one complete turn. Then, while holding the adjusting screw stationary, tighten the lock nut 20-25 lbs. ft. torque. Remove the gauge block.

Install the fluid screen and oil pan, using a new gasket. Install the drain plug and tighten to 25-25 lbs. ft. torque. Refill the transmission to the FULL mark on the level indicator.

Rear Band Adjustmnet—Remove the access hole cover on the right side of the transmission floor pan. Loosen the rear band adjusting screw lock nut with the tool shown in Fig. 52. Then, using the T-handle of the tool, tighten the adjusting screw until the wrench overruns. If the screw is tighter than the wrench capacity (10 lbs. ft.), loosen the screw several turns and retighten until the wrench overruns.

Back off the adjusting screw 1½ turns. Hold the adjusting screw stationary and tighten the lock nut to 35-40 lbs. ft. torque. Install the inspection plate and floor mat.

Road test the car for performance and check the shift points as described below.

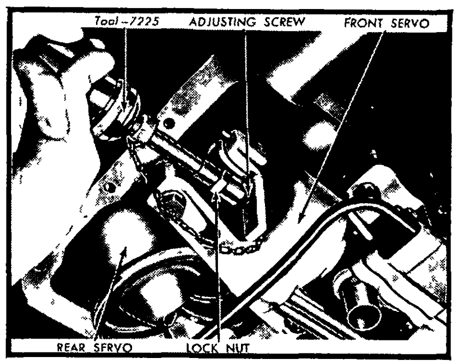


Fig. 51 Adjusting front band

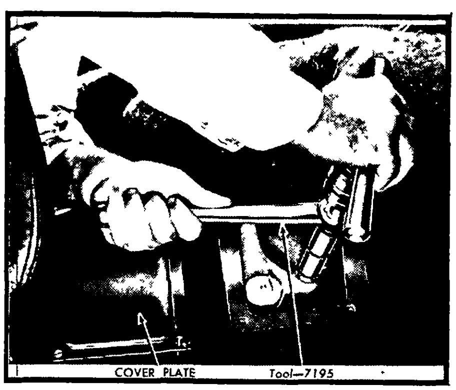


Fig. 52 Tightening rear band

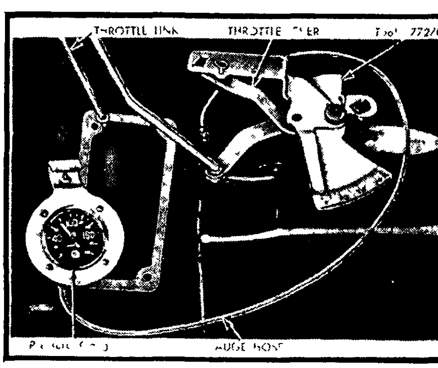


Fig. 53 Pressur gauge installati n adjusting screw

CHECKING SHIFT POINTS

Select a smooth, level road for the test. First, check the shift from intermediate to high with part throttle. Place the selector lever in the DR position and, starting from a standstill, apply the accelerator lightly but steadily. The shift from intermediate to high should occur between 14-19 mph.

Allow the car to decelerate until the downshift occurs from high to intermediate. The downshift range is from 7 to 3 mph.

With the car speed below 50 mph, press the accelerator pedal fully to the floor. This action shifts the transmission from high to intermediate. The downshift occurs only with the car in high gear and at a speed of less than 55 mph.

With the car speed between 45-50 mph, manually shift the selector lever from the DR position to LO. Instead of shifting to low range, the transmission will shift from high to intermediate. When the car speed is reduced to 23-27 mph, the transmission will then shift into the low range. The manual shift from DR range into LO can be at any vehicle speed.

With the car speed at 30 mph and in DR range, again shift from DR to LO range. The transmission shifts into low at approximately 23 to 27 mph.

Bring the car to a full stop and place the selector lever in R position. Press the accelerator lightly to move the car in reverse.

With the car at a full stop, move the selector lever to P position. This locks the transmission and the car cannot move either forward or backward.

STALL TEST

The stall test is made in the DR range and R range and determines whether the bands and clutches are holding properly.

When making this test, never hold the throttle open more than *five seconds* at a time.

Connect a tachometer to the engine and adjust the engine idling speed to 425 mph with engine at normal operating temperature. Firmly apply the parking and service brakes. Place the selector lever in the DR range and press the accelerator all the way to the floor. The engine speed should be between 1400 and 1600 rpm.

If below 1400 rpm, tune up the engine and repeat the test.

If engine speed exceeds 1600 rpm, release the accelerator immediately because it indicates that the front band or clutch is slipping.

Repeat the test with the selector lever in the R pisition. If slippage occurs, it is the rear band or rear clutch. Release the accelerator immediately.

If the stall test shows proper band and clutch operation, but the transmission operation is faulty, proceed with the shift points test as outlined previously. If slippage is evident, make a pressure test as follows:

OPERATING PRESSURE CHECK

Set the parking brake firmly and hoist the car until the rear wheels clear the floor. Remove the converter air intake duct and screen. Disconnect the throttle linkage at the outer throttle lever. Remove the ¼ in. pipe plug, located near the throttle lever. Then connect the pressure gauge so that it can be read under the car, Fig. 53.

Position the throttle lever protractor gauge over the throttle lever shaft, locating the large elongated hole over the large shaft to the rear of the control lever, Fig. 54.

Set the indicator on the gauge to 0 degrees and lock in place with the knurled thumb screw.

Hold the throttle lever against the stop (up) and insert the gauge pin through the small elongated hole in the gauge and the hole in the throttle lever. If the gauge pin enters these two holes freely the throttle mechanism has not been distorted and need not be replaced. Replace the throttle mechanism if it is distorted.

With the throttle lever still held up against the stop, lock the throttle lever to the gauge by tightening the thumb

screw on the gauge. Remove the gauge pin. Then loosen the knurled screw and advance the lever fully (down). The lever should travel 28-33 degrees.

Use an engine tachometer and set the idle speed to 600 rpm by means of the idle adjusting screw. With the engine idling, move the selector lever to the R position. Observe the pressure at 0 degrees throttle lever position. The pressure should be 60-80 lbs.

From underneath the car, advance the throttle lever slowly and observe the angular reading at the point the pressure begins to rise. The pressure rise should begin between 4 and 6 degrees throttle advance.

Continue to advance the throttle lever slowly until maximum pressure is indicated. Pressure should be 140-160 lbs. with an angular reading of 14 to 16 degrees.

Move the selector lever to the DR position and repeat the procedures given previously under R position. The maximum pressure in the DR range should be 120-135 lbs.

If pressures are correct and slippage is indicated, adjust the front and rear bands.

If pressures are not correct, adjust front and rear bands and clean or replace the control valve body.

If pressures are still not correct after the bands have been adjusted and the control valve body has been cleaned or replaced, overhaul or replace the transmission and converter assembly.

After the necessary repairs have been made, remove the protractor gauge and pressure gauge. Install the pipe plug. Connect the link to the throttle lever. Install the converter air intake screen and duct.

Reset the engine idle speed to 425 rpm with engine at normal operating temperature with selector lever in N position. Finally, adjust the throttle linkage at the upper end of the throttle lever link and Z bar (2½ turns off stop).

REPLACING SUB-ASSEMBLIES (TRANSMISSION IN CAR)

Governor—To remove the governor, raise the car and remove the governor inspection cover from the transmission extension housing. Rotate the drive shaft to bring the governor body in line with the inspection hole. Remove the two screws that secure the governor body to the counterweight, and remove the body.

Remove the valve from the new governor body. Lubricate the valve with automatic transmission fluid. Install the valve in the governor body, making sure the valve moves freely in the bore. Install the body on the counterweight with the side plate forward. Be sure the fluid passages in the body and counterweight are aligned.

Install the body attaching screws, and the inspection cover with a new gasket. Tighten the screws 4 to 6 lbs. ft. torque.

Front Servo—Take off the transmission oil pan and screen. Remove the lubrication tube. Loosen the control valve body attaching bolts. Remove the front servo attaching bolt and, while holding the strut with the fingers, take off the servo assembly.

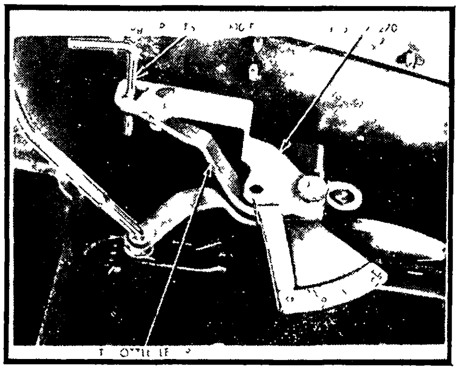


Fig. 54 Throttle lever protractor gauge installation

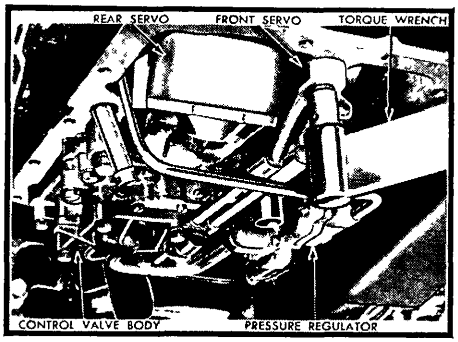


Fig. 55 Front servo installation

To install the servo, first position the servo band forward in the case with the band ends down. Align the large end of the servo strut with the servo actuating lever and align the small end with the band end. Rotate the band, strut and servo into position, aligning the tubes from the valve body to the servo and the anchor end of the band with the anchor in the case.

Install the attaching bolt and tighten to 30-35 lbs. ft. torque, Fig. 55. Tighten the control valve body attaching bolts to 8-10 lbs. ft. torque. Install the lubrication tube, then adjust the front band.

Install the oil pan with a new gasket and tighten the capscrews to 10-13 lbs. ft. torque. Install and tighten the drain plug to 20-25 lbs. ft. torque.

Fill the transmission with new fluid. Then after running to bring it to normal temperature, recheck the fluid level.

Rear Servo—Remove the oil pan, screen, lubrication tube and rear pump intake tube. After taking off the front servo, remove the rear servo attaching bolts. then hold the actuating and anchor struts with the fingers and remove the rear servo.

To install the rear servo, position the servo anchor strut and rotate the servo band to engage the strut. Hold the servo anchor strut in position with the fingers, position the actuating lever strut and install the servo, tightening the attaching bolts to 40-45 lbs. ft. torque. Be sure the longer servo attaching bolt is installed in the forward bolt hole.

Complete the assembly of the other parts removed and, after bringing the transmission to normal operating temperature, recheck the fluid level.

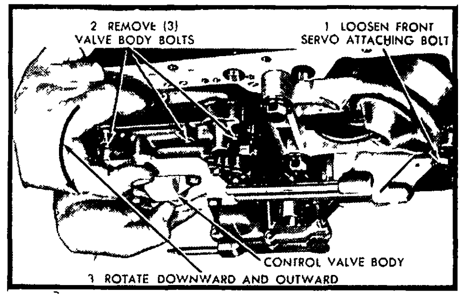


Fig. 56 Removing control valve b dy

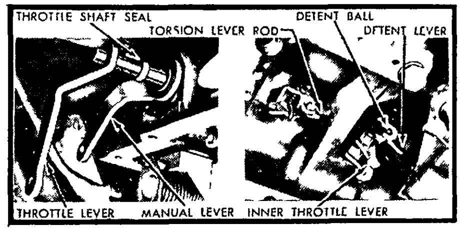


Fig. 57 Transmissi n linkage

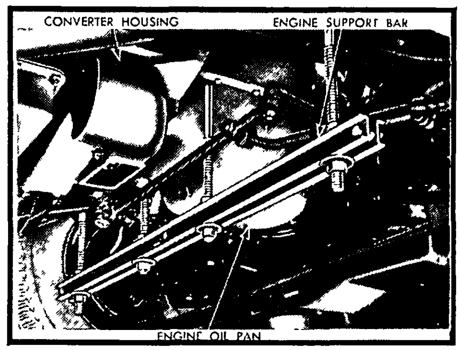


Fig. 58 Support bar installation

Control Valve Body—After removing the oil pan and screen, remove the two "U" tubes from the pressure regulator and the control valve body. Loosen the front servo attaching bolt three full turns. Unscrew the three valve body attaching bolts and lower the valve body and pull it off the servo tubes, Fig. 56.

To install the valve body, align the servo tubes with the holes in the control valve body. Position the manual lever in neutral, then position the inner throttle lever between the throttle lever stop and downshift valve, and at the same time push the throttle valve in to clear the transmission case. Make sure the manual valve engages the actuating pin in the manual detent lever. Install but do not tighten the control valve body attaching bolts.

Install the two "U" tubes in the pressure regulator and control valve body. Tighten the valve body attaching bolts to 8-10 lbs. ft. torque. Tighten the front servo attaching bolt to 35-40 lbs. ft. torque. Then adjust both bands.

Complete the assembly of the parts removed and fill the transmission with the recommended fluid.

Pressure Regulator—Take off the oil pan and screen and lubrication tube. Re-

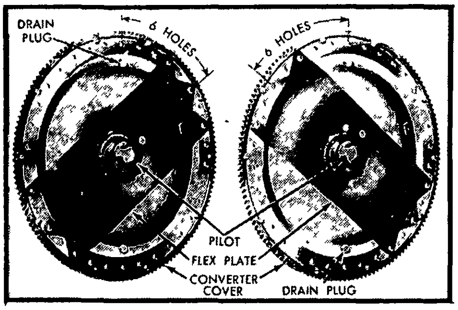


Fig. 59 Fl x plate installation

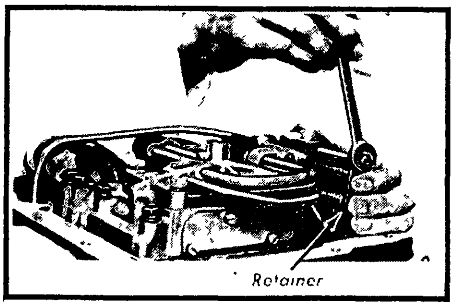


Fig. 60 Rem ving spring retainer

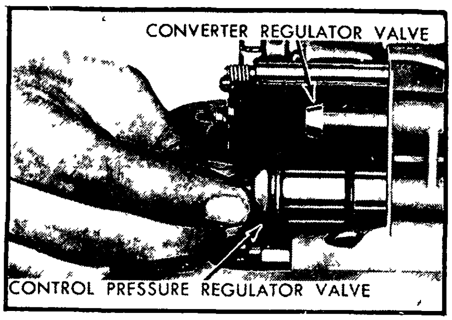


Fig. 61 Removing pressure r gulator valves

move the small compensator pressure tube and the large control pressure tube from the control valve body and pressure regulator. Remove the regulator spring retainer. Maintain pressure on the retainer to prevent the springs from flying out. Remove the control pressure and converter pressure valves. Then unfasten the bolts and remove the pressure regulator.

To replace the pressure regulator, position the regulator body on the transmission case and install the attaching bolts, tightening them to 17-22 lbs. ft. torque. Install the converter pressure and control pressure valves, making sure the valves operate freely in the bores. Install the valve springs and retainer.

Complete the assembly of the parts and fill the transmission with the recommended fluid.

REPLACING OIL SEALS

Extension Housing Rear Seal—After removing the drive shaft and telescopic shield, the seal may be pulled out of the extension housing. Tool No. 1175-AE is designed for this operation.

Before installing the new seal, inspect

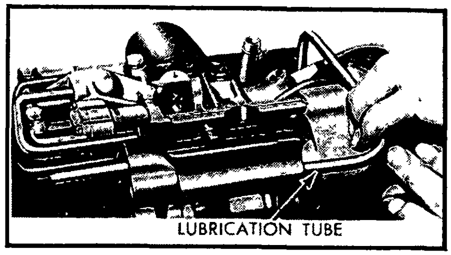


Fig. 62 Removing lubrication tube

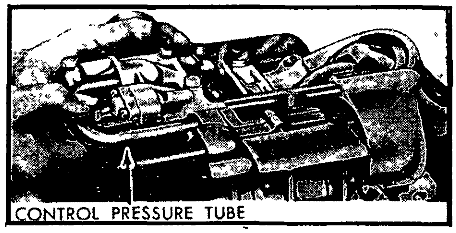


Fig. 63 Removing control pressure tube

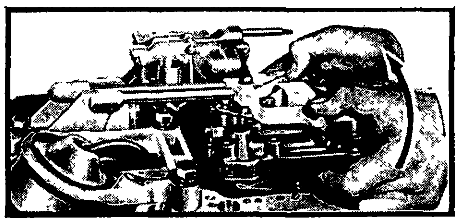


Fig. 64 Removing valve body

the sealing surface of the universal joint yoke for scores. If scores are evident, replace the yoke. Inspect the counterbore of the housing for burrs. Polish off all burrs with crocus cloth.

To install the seal, position it in the bore of the extension housing with the felt side of the seal to the rear. The seal may be driven into the housing with Tool No. 7657 which is designed for the purpose.

Manual & Throttle Lever Seals—To replace these seals, remove the control valve body and disconnect the manual and throttle linkage at the transmission. Remove the inner throttle lever shaft nut and inner throttle lever, Fig. 57. Take off the outer throttle lever and shaft. Remove the throttle shaft seal from the counterbore in the manual lever shaft, Fig. 57, and take off the parking pawl torsion lever rod. Rotate the manual lever shaft until the detent lever clears the detent ball, then remove the detent ball and spring, taking care not to allow the ball to fly out of the case. Unscrew the manual lever shaft nut and remove the detent lever. The outer manual lever and shaft assembly may now be removed from the transmission case. Remove the shaft seal.

To install the outer control levers, install a new seal with special replacing tool No. 77288. Insert the manual lever and shaft in the case. Rotate the shaft until the manual lever is pointing downward, then place the detent lever on the inner end of the shaft.

Install the detent lever attaching nut and tighten it to 35-40 lbs. ft. torque. Place the detent spring in the hole in the transmission case and place the ball on the spring. Use a piece of thin wall tubing to depress the ball and spring, then rotate the detent lever until the ball is held in place by the detent lever.

Place the parking pawl torsion lever rod, Fig. 57, in position and secure the rod in place with new cotter pins. Install a new seal on the throttle lever shaft and install the outer throttle lever and shaft in the case.

Place the inner throttle lever on the inner end of the throttle lever shaft, securing it in place with the nut by tightening it to 25-28 lbs. ft. torque. Connect the manual and throttle linkages at the transmission, and install the control valve body.

TRANSMISSION & CONVERTER, REPLACE

Removal—Place the car on a hoist. Fold the front floor mat from each side to the center of the car, then remove the rubber plugs over the top cross member-to-frame bolt on each side and remove the bolts. Remove the four rubber plugs and four top converter housing-to-engine bolts.

Raise the car on the hoist. Take off the starter motor and remove the converter housing front plates. Remove one of the converter housing drain plugs. Rotate the converter 180 degrees, remove the second drain plug and allow the fluid to drain. If desired, the converter may be drained after the unit has been removed from the car.

Drain the fluid from the transmission. Then remove the snap-on plate at the bottom of the converter and remove the six converter-to-flex plate bolts. Position the flex plates horizontally and replace the lower converter housing front plate to prevent the converter from sliding out of the housing when the transmission is removed.

Position the special engine support bar, Fig. 58, so that the engine can be lowered 3/4 in. below normal position. Disconnect the manual linkage at the transmission manual lever, the throttle linkage at the transmission throttle lever, and the accelerator pedal shaft at the accelerator cross shaft.

Remove the drive shaft and speedometer cable. Disconnect the parking brake assembly at the cross member and move the cable and equalizer to one side.

Remove the two rear engine support-to-transmission bolts. Position a transmission jack under the transmission and raise the transmission slightly to take the weight off the rear cross member. Remove the remaining cross member bolts and take out the cross member.

Lower the transmission until the engine is carried by the engine support bar. With the weight of the transmission firmly on the stand, remove the remaining two converter housing bolts. Move the transmission and jack to the rear far enough to clear the converter pilot, then lower the assembly.

Installation—If the converter has been removed from the converter housing, position the converter in the housing and install the converter housing lower

front cover plate to prevent the converter from slipping out of the housing. Rotate the converter until the flex plate bolt holes are in the horizontal position.

If a new transmission is being installed, drive the rear extension housing dust shield onto the housing, using the special holding tool No. 7657 and adapter No. 7657-B to ensure a correct installation.

Raise the assembly with a jack until the converter pilot, housing dowel holes and flex plate holes are in proper alignment. Coat the converter pilot with lubriplate, then move the assembly forward into position. Install the two lower converter housing bolts and tighten them to 40-45- lbs. ft. torque.

Raise the engine and replace the cross member. Then install all but the top cross member bolts. Lower the unit onto the cross member, install the rear engine support bolts and remove the engine support bar.

Coat the universal joint knuckle with transmission fluid and install the drive shaft, parking brake and speedometer cable.

Connect the manual linkage at the transmission manual lever, and the throttle linkage at the transmission throttle lever.

Remove the converter housing lower front plate. Install both front plates on the converter housing, and the snap-on plate at the bottom of the converter. Then install the starter motor, lower the hoist and remove the car from the hoist.

Install the two top frame cross member bolts and replace the rubber plugs. Install the four converter housing-to-engine bolts, tightening the bolts to 40-45 lbs. ft. torque. Replace the rubber plugs.

Fill the transmission with the recommended fluid, following the procedure outlined previously. Then check the transmission and converter for leaks, and adjust the manual and throttle linkages.

TRANSMISSION ONLY, REPLACE

Removal — Place the car on support stands with all four wheels approximately 12 in. off the floor. Drain the fluid from the transmission. Disconnect the manual and throttle linkage from the transmission levers, the speedometer cable from the extension housing and the parking brake at the cross member.

Disconnect the drive shaft at the rear and remove the shaft and universal joint from the transmission output shaft. Remove the bolts which attach the rear engine support to the transmission. Position a transmission jack under the transmission and raise the engine and transmission sufficiently to install the special engine support tool, Fig. 58.

Raise the transmission until its weight is off the cross member and remove the cross member. Then lower the transmission jack until the weight of the engine rests on the engine support.

Reposition the transmission jack under the assembly and raise the jack until the transmission's weight is on the jack. Remove the four transmission-to-converter housing bolts. Slide the transmission toward the rear to disengage the turbine shaft. Then lower the assembly and remove it from under the car.

Installation — Install two special guide

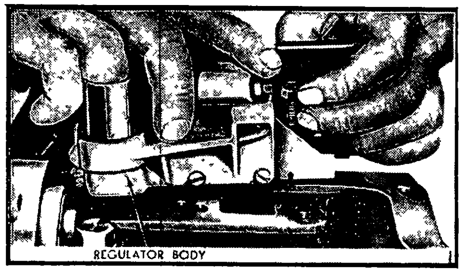


Fig. 65 Removing regulator body from case

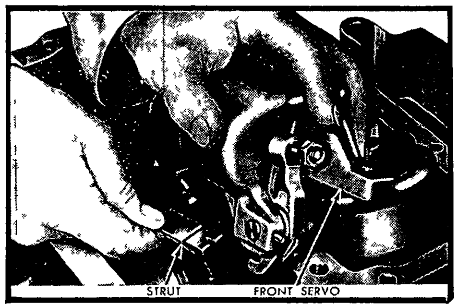


Fig. 66 Removing front servo

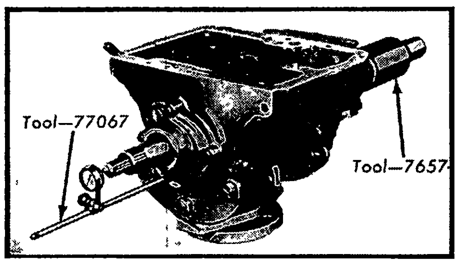


Fig. 67 Mounting dial indicator

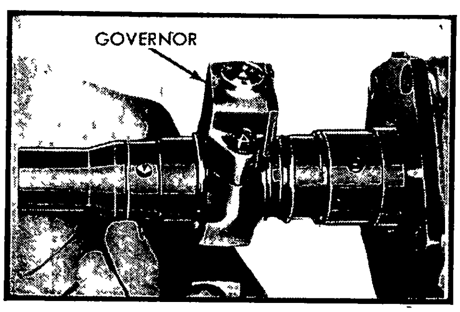


Fig. 68 Removing governor from output shaft

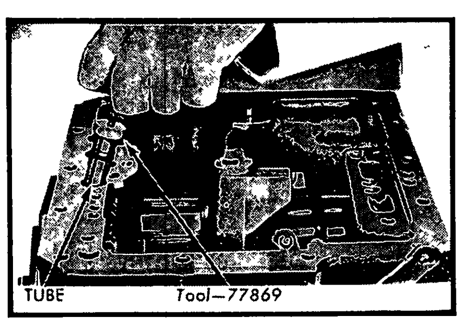


Fig. 69 Removing r ar pump discharge tube

pins in the top transmission attaching bolt holes. Mount the transmission on a jack and position it under the car. Rotate the engine to place the front pump drive lugs on the converter pump housing in a vertical position. Rotate the front pump to place the slots in the pump drive gear in a vertical position. Apply lubriplate to seal the surface on the converter pump cover hub.

Raise the transmission and move it toward the front of the car. Be sure to align the turbine shaft splines with the turbine hub splines, and to align the converter pump lugs with the slots in the front pump drive gear.

Install the two lower transmission attaching bolts. Remove the two guide pins and install the two upper attaching bolts. Tighten the bolts to 40-45 lbs. ft. torque.

Raise the engine. Install the cross member, attaching it with all but the top cross member bolts. Lower the engine onto the cross member. Install rear engine mount-to-transmission bolts. Remove the special engine support bar and install the drive shaft, lubricating the front universal slip yoke with transmission fluid to make assembly easier.

Install the parking brake and speedometer cable. Connect and adjust the manual and throttle linkages as outlined previously. Check the operation of the neutral switch.

Install the transmission drain plug. Lower the car to the floor and install the two remaining cross member bolts. Fill the transmission with fluid and recheck the fluid level with the transmission at normal operating temperature. Road test the car to check performance and shift points.

TRANSMISSION, OVERHAUL

NOTE—Cleanliness is extremely important in the repair of the transmission. Before attempting any repairs, thoroughly clean the exterior of the transmission to prevent the possibility of dirt entering the mechanism. Only a clean bench should be used for laying out parts and all parts should be carefully cleaned before reassembling. The tools which were designed specifically for working on the transmission are illustrated throughout the text and the part number of the tool is also given. These tools are available through K. R. Wilson, Buffalo 3, N. Y.

SUB-ASSEMBLIES, REMOVE

Oil Pan—Take out fluid level indicator. Place transmission in holding fixture, top end down, and remove the pan and gasket. Lift the fluid screen off the forward tube first; then off the rear tube.

Pressure Regulator Body, Servos & Control Valve Body—Remove pressure regulator spring retainer, Fig. 60. Maintain pressure on the retainer to prevent the springs from flying out. Take out the springs and remove the control pressure and converter pressure regulator valves, Fig. 61.

Loosen but do not remove the pressure regulator and control valve body attaching bolts. Remove the lubrication tube from the pressure regulator and rear pump, Fig. 62. If necessary, tap the tube with a soft hammer to remove it, but be careful not to bend or distort it.

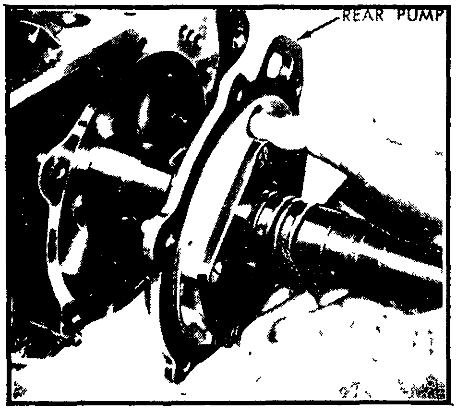


Fig. 70 Removing rear pump

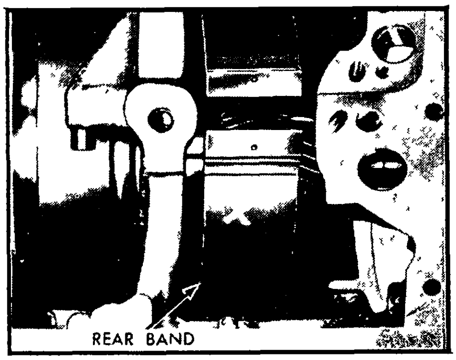


Fig. 71 Band marked for c rrect position

Lift the rear pump intake tube out of the bore in the transmission case, being careful not to bend the tube. Remove the small compensator pressure tube and the large control pressure tube, Fig. 63.

Loosen the front and rear servo band adjusting screws 5 turns. Loosen the front servo attaching bolt 3 turns. Then remove the control valve body attaching bolts.

Lift the valve body, pull it off the servo tubes and remove it from the case, Fig. 64. Unfasten the regulator body and lift it from the case as shown in Fig. 65.

Insert the control pressure valve and the control pressure regulator valve in the pressure regulator to avoid damage to valves.

Remove the front servo apply and release tubes by twisting and pulling at the same time. Take out the front servo attaching bolt, hold the strut with the fingers and lift the servo from the case, Fig. 66.

Remove the servo attaching bolts. While holding the actuating and anchor struts with the fingers, lift the servo from the case.

Check Transmission End Play—Remove one of the front pump attaching bolts. Mount the dial indicator support tool in the bolt hole and mount the dial indicator on the support so that the contact rests on the end of the turbine shaft, Fig. 67. Install the extension housing seal replacer on the output shaft as shown. Pry the front clutch cylinder to the rear of the transmission with a large screwdriver. Remove the screwdriver and pry

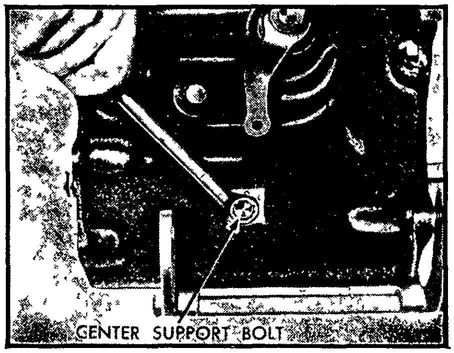


Fig. 72 Removing center support outer bolts

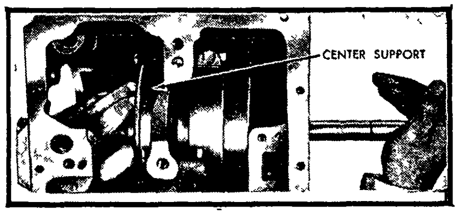


Fig. 73 Removing center support

the units toward the front of the transmission by inserting the screwdriver between the large internal gear and the transmission case.

Record the indicator reading for use during transmission assembly. End play should be .010 to .029 in. Remove the indicator support and the seal replacer.

Front Pump — After removing the remaining attaching bolts, pull the front pump carefully off the shaft to avoid damaging the oil seal.

Extension Housing — Remove the five bolts which attach the extension housing and rear pump to the case. Hold the rear pump in position and remove the extension housing from the output shaft, being careful not to damage rear oil seal.

Fluid Distributor — Remove the speedometer drive gear snap ring from the output shaft without moving the speedometer drive gear.

Place one hand under the speedometer drive gear and remove the gear, catching the drive ball as it falls out.

Unfasten the fluid distributor from the case and slide the distributor and tubes from the transmission.

Governor & Rear Pump — Remove the distributor sleeve from the output shaft. Slip the four seal rings from the output shaft with the fingers.

Remove the governor snap ring and slide the governor off the output shaft, being careful not to lose the governor drive ball, Fig. 68.

Install the tube extractor tool, Fig. 69, in the rear pump discharge tube and remove the tube. Remove the rear pump from the case, Fig. 70.

Pinion Carrier—Remove the rear pump drive key from the output shaft and slip off the bronze thrust washer. Hold the rear drum forward and remove the output shaft.

Remove the selective thrust washer

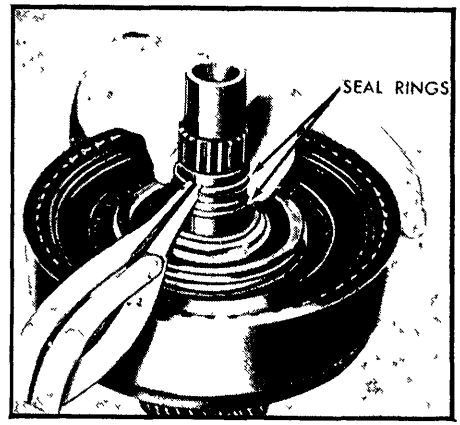


Fig. 74 Removing seal rings

from the rear of the pinion carrier. Using snap ring pliers, carefully remove the two seal rings from the primary sun gear shaft. The pinion carrier may now be removed from the case.

Primary Sun Gear Shaft—If it hasn't already come off with the pinion carrier, remove the bronze thrust washer from the sun gear shaft.

Mark the rear band position for correct assembly as shown in Fig. 71. Then squeeze the ends of the bands together, tilt it forward and remove it from case.

Remove the two center support outer bolts (one each side), Fig. 72. Exert sufficient pressure on the end of the turbine shaft to hold the clutch units together; then remove the center support from the case, Fig. 73.

Remove the front and rear clutches as a unit by holding them together during the process. Place the clutches into a bench fixture and remove the thrust washer from the front of the turbine shaft. Lift off the front clutch, being careful not to rock it as it is being removed to avoid damage to the seal rings. Remove the bronze and steel thrust washers from the primary sun gear shaft and wire them together to avoid incorrect installation. Remove the front clutch seal rings from the shaft.

Lift the rear clutch from the shaft carefully to avoid damage to the seal rings.

SUB-ASSEMBLIES, REPAIR

IMPORTANT — The proper installation of the various thrust washers used throughout the transmission and converter is one of the most important considerations of transmission build-up. Therefore, be sure each washer is installed in its proper position in the assembly.

Handle all parts with care to avoid nicking or burring the bearing or mating surfaces.

Clean all parts in clean solvent and blow dry with moisture free compressed air. Wiping cloths must not be used to dry parts as lint may get into the mechanism and improper operation will result.

Minor scores or burrs may be removed with crocus cloth. When polishing valves with crocus cloth use extreme care to avoid rounding the edges of the valve lands.

Lubricate all internal parts of the

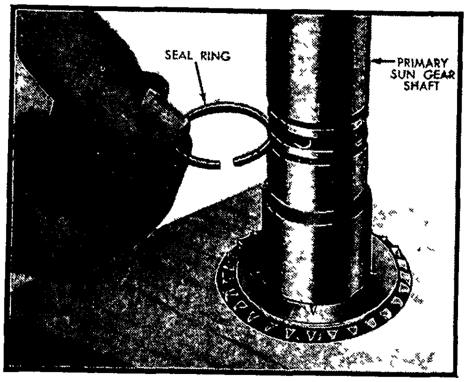


Fig. 75 Checking fit of ring in new groove

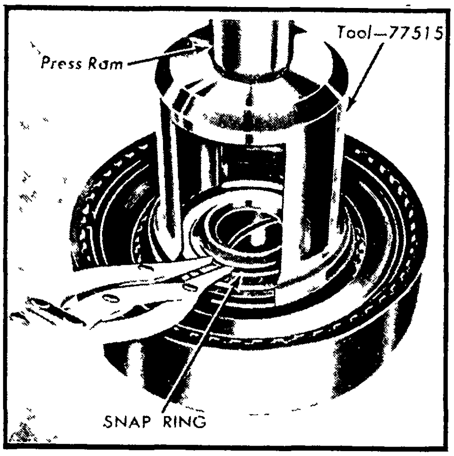


Fig. 76 Removing clutch spring snap ring

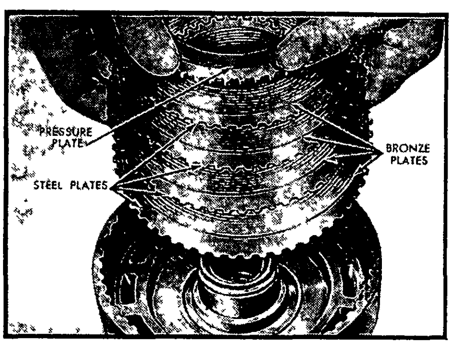


Fig. 77 Removing clutch parts

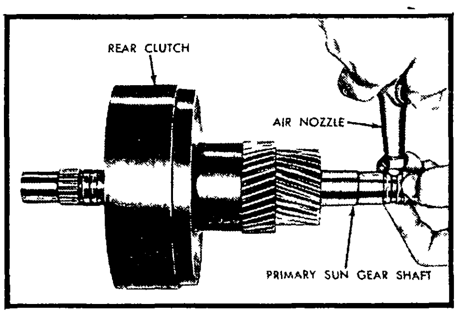


Fig. 78 F rcing clutch pist n out f bore with air pressur

transmission before assembly with automatic transmission fluid only. Gaskets and thrust washers may be coated with vaseline to make assembly easier. Always install new gaskets. Tighten all bolts and capscrews to the torque values recommended in the assembly procedure.

Primary Sun Gear Shaft—Remove the rear clutch seal rings from the shaft and take off the thrust washer.

Position the primary sun gear shaft in a clutch bench fixture. Install the bronze thrust washer against the thrust face of the primary sun gear. Check the fit of the seal rings in the grooves of the primary sun gear shaft, Fig. 75. The rings should enter the grooves freely without bind. Check the fit of the seal rings in their respective bores. Make sure a slight clearance exists between the ends of the rings. Install the seal rings on the shaft and check for freedom of movement in the grooves.

Rear Clutch—Remove the clutch release spring snap ring with an arbor press and the tool shown in Fig. 76. Guide the spring retainer while releasing the press to prevent the retainer from interfering with the snap ring groove. Remove the retainer and release spring.

Remove the clutch pressure plate snap ring and take the pressure plate from the drum. Remove the clutch plates from the drum, Fig. 77.

Position an air hose and the primary sun gear shaft on the rear clutch as shown in Fig. 78. Place the hose nozzle in one of the holes in the shaft. Block the other hole with a finger and force the clutch piston out of the drum with air pressure. Hold a hand over the piston to prevent damage.

Remove the clutch piston inner seal ring from the clutch drum. Take the clutch outer seal ring from the groove in the piston.

Check the fluid passages for obstructions. Inspect the clutch plates for scores and check their fit on the clutch hub serrations. Replace all plates that are badly scored or do not fit freely on the hub serrations.

Check the coning of the steel plates by positioning them on a flat surface and checking with a feeler gauge, Fig. 79. The plates are coned to .010 in. clearance and any plate that does not conform to this dimension should be discarded.

Inspect the clutch pressure plate for scores on the clutch plate bearing surface. If deeply scored replace the pressure plate. Check the clutch release spring for distortion and discard if bent.

To assemble the clutch, install the clutch piston inner seal ring in the groove in the drum. Install a new outer seal ring on the piston, and install the piston in the clutch drum, Fig. 80.

Install the four steel and four bronze clutch plates alternately, starting with a steel plate (convex side up), Fig. 77. Lubricate plates as they are installed.

Install the clutch pressure plate with the bearing surface down and lock in place with the snap ring, making sure it is fully seated in the groove.

Install the clutch release spring and position the retainer on the spring. Position the clutch spring compressor tool on the spring retainer and place the assembly on the bed of an arbor press. Compress the clutch spring and install the snap ring, Fig. 76.

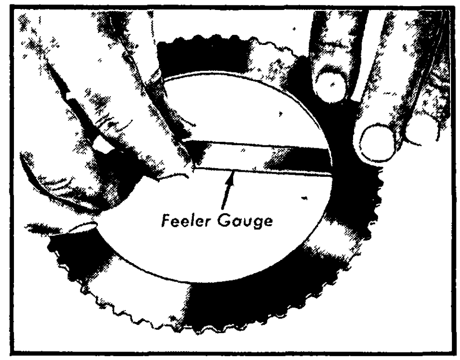


Fig. 79 Checking steel plate c ning

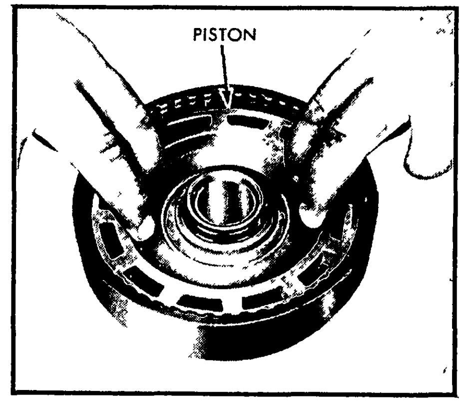


Fig. 80 Installing pist n in drum

Lubricate all parts and install the rear clutch assembly on the primary sun gear shaft, Fig. 81. Install the steel and bronze thrust washers as shown in Fig. 82. Check the seal rings for freedom in the grooves and in their respective bores. Install new rings if binding is evident.

Front Clutch—Remove the clutch cover snap ring with a screwdriver and take the turbine shaft from the clutch drum. Slip off the thrust washer. Insert one finger in the clutch hub, lift it straight up and remove the hub from the drum.

Remove the three bronze and two steel clutch plates and the pressure plate from the drum. Place the release spring compressor on the spring, position the clutch drum on the bed of an arbor press and compress the spring until the snap ring can be removed. Lift off the spring.

Install the special nozzle shown in Fig. 83 on an air hose. Place the nozzle against one of the clutch apply holes in the front clutch housing and force the piston out of the housing with air pressure. Remove the piston inner seal from the clutch housing, and remove the piston outer seal from the groove in the piston.

Check the fluid passages in the clutch cylinder for obstruction. Inspect the clutch piston for scores and replace if necessary. Check the clutch release spring for distortion or cracks and replace if necessary.

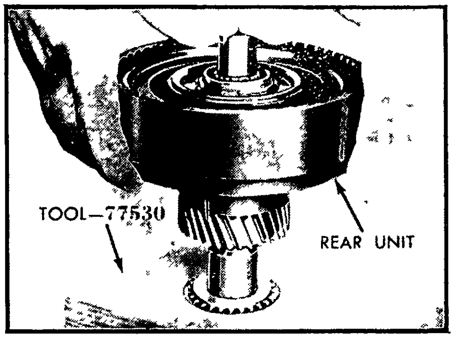


Fig. 81 Installing rear clutch n primary shaft

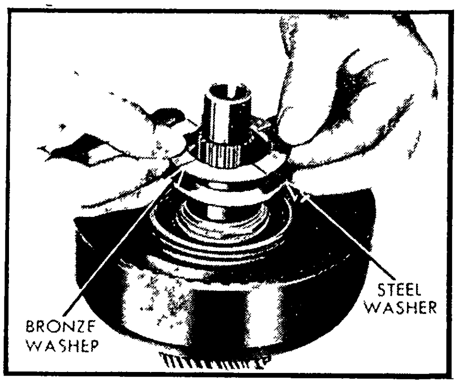


Fig. 82 Installing thrust washers

Inspect the bronze and steel clutch plates and the pressure plate for scored bearing surfaces. Replace all parts that are deeply scored. Check the clutch plates for fit on the clutch hub serrations and for flatness. Discard any plate that does not slide freely on the serrations or that is not flat.

Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear. Check the thrust washers for scores. Inspect the clutch cover bearing surfaces for scores. If excessive clearance or scores are found, discard the unit.

Check the splines on the turbine shaft for wear and replace if excessively worn. Inspect the bushing in the clutch cylinder for scores. If the bushing is deeply scored, replace the clutch drum and bushing assembly.

To assemble, install a new piston inner seal ring in the clutch cylinder. Install a new piston outer seal in the groove in the piston. Then install the piston in the clutch housing, Fig. 84. Make sure the steel bearing ring is in place on the piston.

Position the release spring in the clutch cylinder with the concave side up, Fig. 85. Place the release spring compressor on the spring, compress the spring in an arbor press and install the snap ring, being sure it is fully seated in the groove.

Install the front clutch housing on the primary sun gear shaft by rotating the clutch units to mesh the rear clutch plates with the serrations on the clutch hub. Use care to avoid breaking the seal rings.

Install the clutch hub in the cylinder with the deep counterbore down, Fig. 86. Then install the thrust washer on the clutch hub. Install the pressure plate with the bearing surface up, Fig. 88. Install the clutch plates alternately, starting with a bronze plate, Fig. 89. Lubricate the plates as they are installed. Install the turbine shaft, Fig. 90, and secure it in position with the snap ring, being sure it is fully seated in its groove. Install the thrust washer on the turbine shaft, Fig. 91.

Front Pump—Take off the pump cover with the stator support. Mark the top surface of the pump driven gear with prussian blue to assure correct assembly. Remove the gears from the pump body.

If any of the pump parts are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth.

Bolt the pump body to the transmission case; then use a suitable puller to remove the oil seal from the pump body.

If the pump body counterbore is rough, smooth it up with crocus cloth. Remove the pump body from the transmission case. Drive a new seal into the pump body so that it is firmly seated.

Place the pump driven gear into the body with the mark previously made facing upward. Install the drive gear and pump cover. When assembled, check the pump for free movement.

Pressure Regulator Body—Remove the valves from the regulator body. Then remove cover and separator plate.

After parts have been washed and blown dry, inspect the check valve for free movement, Fig. 94. Inspect the regulator body and cover mating surfaces for burrs. Check all fluid passages for obstructions. Inspect the valve bores and valves for scores. Check the valves for free movement in their bores; they should fall freely into the bores when both valves and bore are dry. Inspect the valve springs for distortion.

Use care when assembling parts to avoid damage. Position the separator plate on the regulator body. After replacing cover, install valves in body.

Control Valve Body—Extreme care must be used during the disassembly of the control valve assembly to avoid damage to valve parts and to keep them clean. Place the valve assembly on a clean shop towel while performing the disassembly operation. Do not separate the valve bodies until after the valves have been removed.

To disassemble, take out the manual valve, Fig. 95. Remove one screw attaching the separator plate to the lower valve body and take off the upper body front plate. Since the plate is spring-loaded, apply pressure to it while removing the attaching screws.

Remove the compensator sleeve and plug, and then the compensator valve spring. Take out the compensator valve, modulator valve spring and valve. Remove the two screws which attach the throttle valve return spring to the upper body and remove the spring. After removing the remaining screw, take off the upper valve body rear plate. Remove the throttle valve, modulator plug and the lower body side plate, Fig. 96. Apply pressure to the side plate while

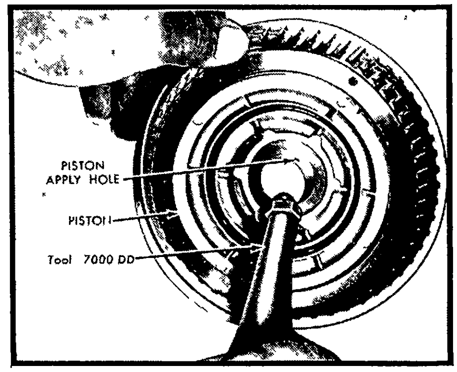


Fig. 83 Forcing clutch pist n out of housing

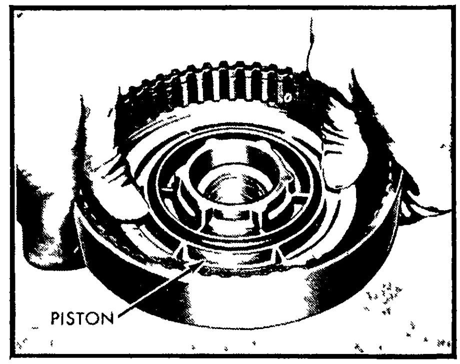


Fig. 84 Installing clutch pist n

Fig. 85 Installing clutch release spring

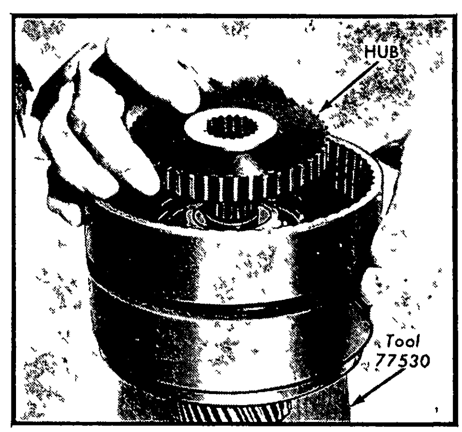


Fig. 86 Installing clutch hub

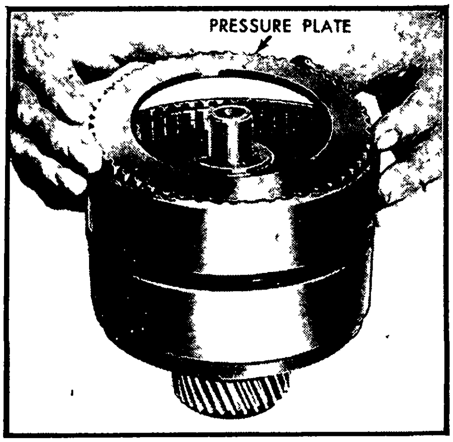


Fig. 88 Installing pressure plate

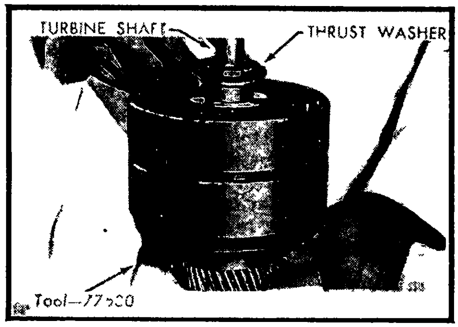


Fig. 91 Installing bronze thrust washer

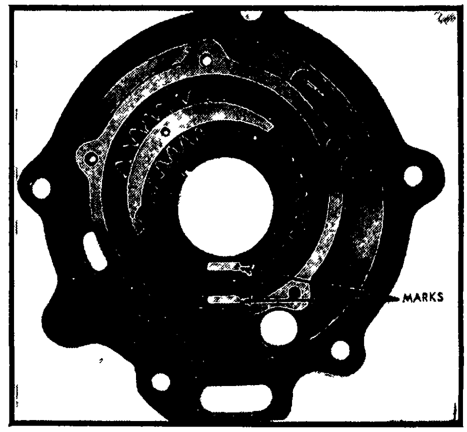


Fig. 93 Mark pump drive and driven g ars

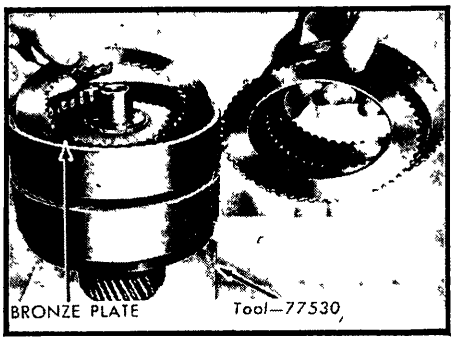


Fig. 89 Installing clutch plates

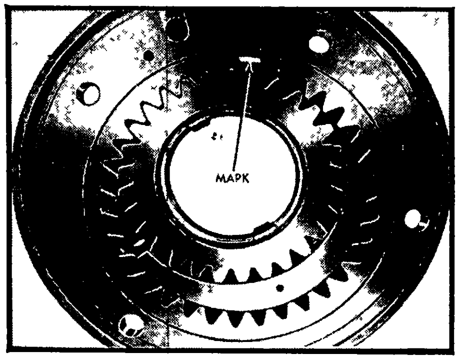


Fig. 92 Mark pump driven gear

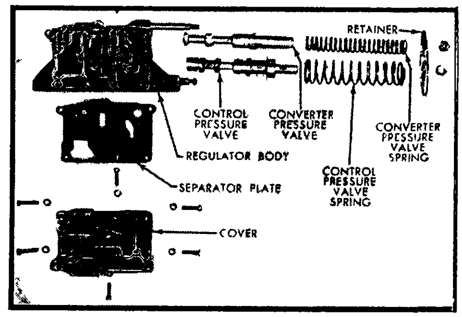


Fig. 94 Layout of pressure regulator parts

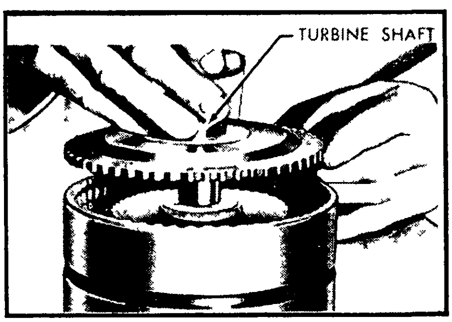


Fig. 90 Installing turbine shaft

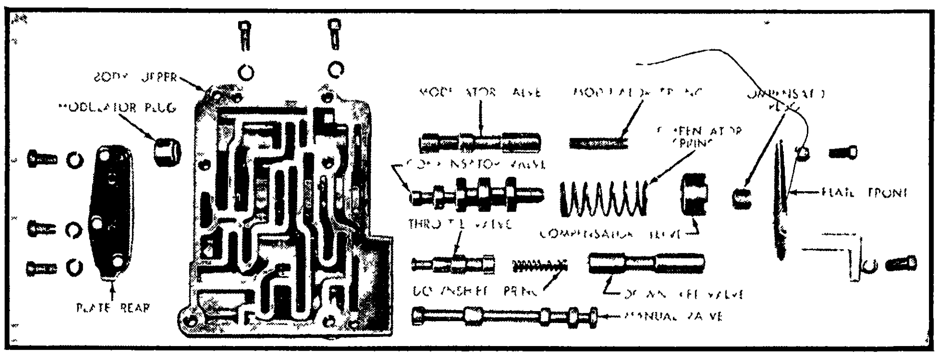


Fig. 95 Layout of control valve upper body parts

removing the attaching screws as it is spring-loaded.

Remove the parts from the control valve body in the following order: 3-2 control valve and spring; low inhibitor valve and spring; governor plug; end body; low regulator plug and shift valve plug; end body plate; shift valve outer and inner springs; shift valve; low regulator valve; transition valve; separate bodies, and remove body end cover.

Take the front servo apply regulator plug from the end body, and the front servo apply regulator valve from the cover. Remove the separator plate from the upper body, and the check valve seat from the lower body.

After all parts have been washed and blown dry, check valves and plugs in their respective bores; when dry they must fall from their own weight in their respective bores, Fig. 96. To avoid shearing edges of bores in body castings, use care when inserting valves and plugs in the bores.

Using a good light, inspect all valve body bores for scores. Check all fluid passages for obstructions. Inspect the check valve for free movement. Inspect plugs and valves for burrs and scores.

It is permissible to use crocus cloth to polish valves if care is used to avoid rounding the sharp edges of the valves and plugs.

When assembling the control valve body, use the following procedure: Arrange all parts in their correct position, Fig. 96. Use care when installing valves and plugs in their bores to avoid shearing of soft body castings. Rotate plugs and valves when entering them in their bores.

Install the separator plate on the upper body but do not tighten screws. Install the check valve seat in the lower body. Install the front servo apply regulator valve in the cover, and install the plug in cover end body. Install the end body on the cover but do not tighten the screws.

Position the lower body on the upper body and install the lower body cover. Tighten the bolts to 4-6 lbs. ft. torque. Then tighten the separator plate screws. Do not tighten bolts excessively as to do so may distort valve bodies, causing valves or plugs to stick.

Tighten cover end body screws. Then shake the valve body to check for free movement of the front servo apply regulator valve.

Install the plate on the lower end body. Install the low regulator and shift valve plugs in the end body. Install the transition valve, the low regulator valve, and the shift valve in the lower body. Install the shift valve inner and outer springs.

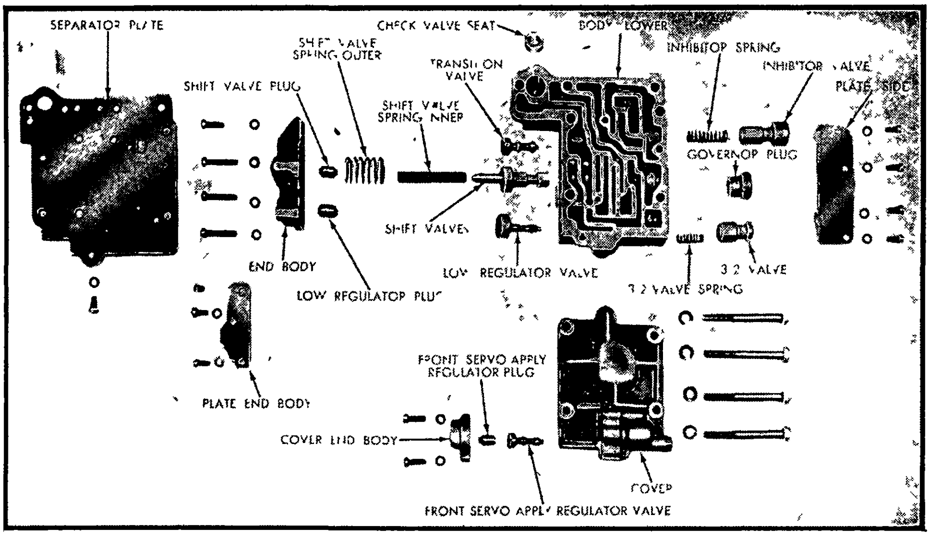


Fig. 96 Layout of control valve body parts

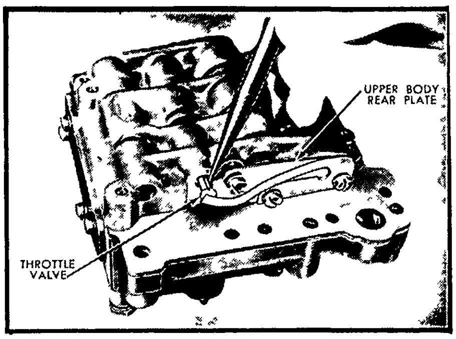


Fig. 97 Installing upper body rear plate

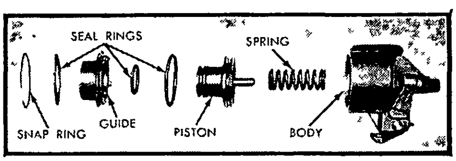


Fig. 98 Lay ut of front servo parts

Install the end cover on the lower body. Install the governor plug in the lower body. Install the low inhibitor valve spring in the valve and insert spring and valve. Install the 3-2 control valve spring into the valve and insert these parts. Install lower body side plate.

Install the modulator plug in the upper body. Install throttle valve. Position upper body rear plate on upper body, Fig. 97, with the plate between the end lands of the throttle valve. Install one screw in the hole next to the throttle valve. Position the throttle valve return spring on the plate and secure the plate in place with the remaining attaching screws.

Install the compensator valve and spring, the downshift spring and valve, and the modulator valve and spring. Install the plug in the compensator valve sleeve (castellated end out) and insert the assembly in the body. Install the upper body front plate; then install the screws attaching the separator plate to the lower body. Finally, install the manual valve.

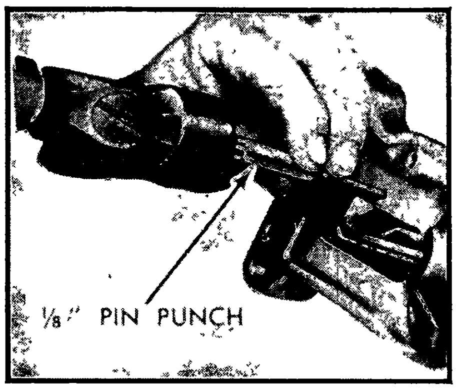


Fig. 99 Removing shaft retaining pin

Governor—Take off the governor side plate and remove the governor body from counterweight. Take valve from body.

Replace the governor if the valve or body is deeply scored. Minor scores may be removed with crocus cloth. Check for free movement of the valve in the bore. Inspect fluid passages in the governor body and counterweight for obstructions. The mating surfaces of the body and counterweight must be free of burrs and distortion.

When assembling the governor be sure to align the fluid passages in the body and counterweight.

Front Servo—To disassemble, remove the piston guide snap ring and take the guide and piston from the servo body. If necessary, tap the piston guide with a soft hammer to release it from the body.

Remove the servo spring and take the guide from the piston. Remove the seal ring from the guide, and the rings from the piston.

Inspect the servo body for cracks and the piston bore and piston stem for scores, Fig. 98. Check fluid passages for obstructions. Inspect the actuating lever for wear and for free movement. Inspect the adjusting screw threads and the threads in the actuating lever. Check the servo spring and band strut for distortion. Inspect the servo band lining for excessive wear and bond to the metal band. The band should be replaced if it is worn to a point where grooves are not clearly evident. Inspect the band ends for cracks and check the band for distortion.

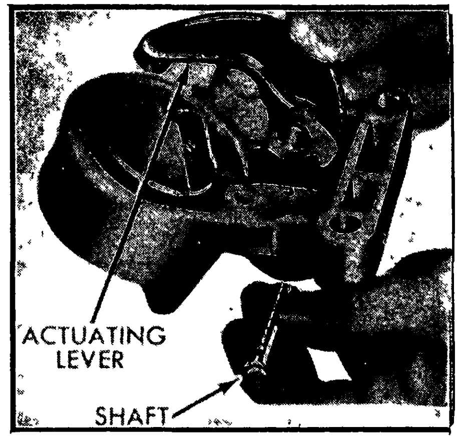


Fig. 100 Removing actuating l ver

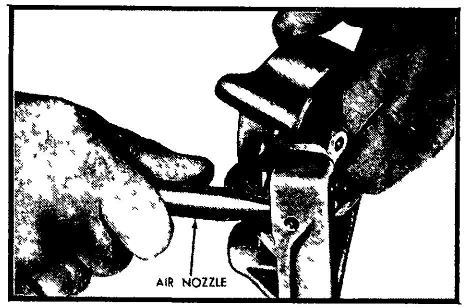


Fig. 101 Forcing serv pist n fr m body with air pressur

To assemble, install the servo spring in the body. Install new seal rings on the piston, and new seal rings on the servo guide. Install the guide on the servo piston and then place them in the servo body.

Press the piston guide down and install the snap ring, being sure it is fully seated in the groove.

Rear Servo—To disassemble, use a pin punch to remove the pin from the servo actuating lever shaft, Fig. 99. Remove shaft and actuating lever, Fig. 100. Press down on the servo spring retainer and remove the snap ring. Release the pressure on the retainer slowly to prevent the spring from flying out. Remove retainer and servo spring. Use air pressure to force the piston out of the servo body, Fig. 101. Hold hand over piston to prevent damage. Remove piston seal ring.

Inspect all parts in the same manner as for the front servo. See Fig. 102 and assemble the servo in the reverse order of disassembly.

SUB-ASSEMBLIES, INSTALL

Before assembling the transmission, wash the case thoroughly and blow out all passages, Fig. 103. Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent for obstruction and check all fluid passages for obstruction and leakage. Inspect the case

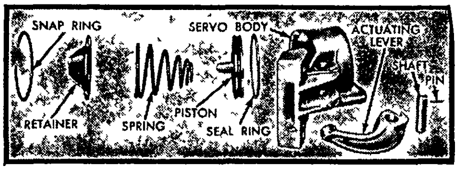


Fig. 102 Lay ut of rear servo parts

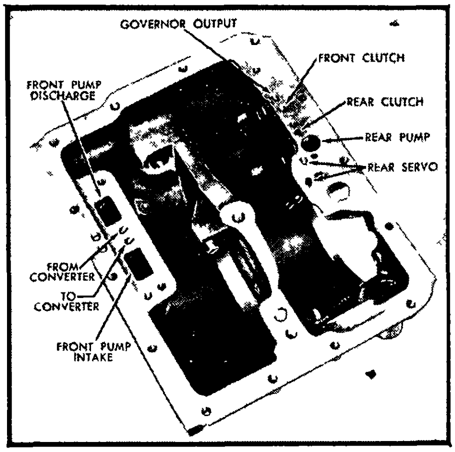


Fig. 103 Fluid passages in transmission case

bushing and center support bushing for scores.

In assembling the transmission, if mating parts do not assemble freely, do not force but examine the parts for the cause of the difficulty. Use new gaskets throughout, and apply automatic transmission fluid to lubricate parts on assembly. Under no circumstances should any other lubricant be used.

Case Linkage—Assemble the link to the pawl with the pawl link pin, washer and pawl return spring. Assemble the toggle lever to the link with the toggle link pin Position the pawl return spring over the toggle link pin and secure in place with the retainer and clip. Install the assembly in the transmission case by installing the pawl pin and toggle lever pin, Fig. 104. Install the toggle lever pin plug, and the torsion lever assembly. Use a screwdriver to position the spring on the torsion lever. Install the washer and retainer clip. Install a new manual shaft seal in case with tool shown in Fig. 105.

Install the manual lever and shaft in the case. Install the detent lever and attaching nut, tightening it to 35-40 lbs. ft. torque. Then install the detent spring and ball, Fig. 106. Use a piece of thin walled tubing to depress the ball and spring while rotating the detent lever.

Position the ends of the parking pawl torsion lever rod in the detent lever and torsion lever and secure with cotter pins. Install a new seal on the throttle lever shaft and place the outer throttle lever and shaft in the case.

Place the inner throttle lever on the inner end of the throttle lever shaft and secure it in place with the nut, tightening it to 25-28 lbs. ft. torque.

When assembled, linkage should operate freely without binding. Install the transmission vent.

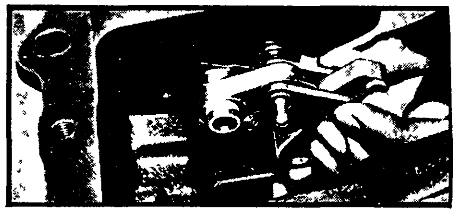


Fig. 104 Installing pawl assembly

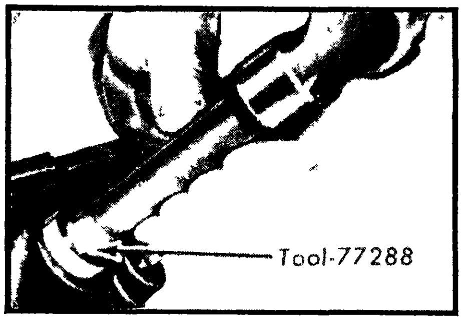


Fig. 105 Installing manual shaft seal

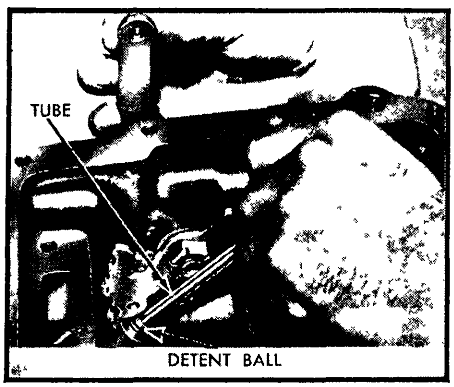


Fig. 106 Installing detent ball and spring

Pinion Carrier—Install the front servo band in the transmission case, aligning the anchor end with the anchor in the case. While holding the clutches together, install the assemblies into the rear of the transmission case while positioning the servo band on the drum. Position the center support in the case, aligning the hole in the center support with the hole in the right-hand side of the case.

Install the right and left-hand center support outer bolts and lock washers. These external tooth lock washers must be installed with the rolled edge toward the transmission case to insure a tight seal. Torque the bolts to 28 lbs. ft.

Position the rear servo band in the case with the strut ends up, being guided by the locating mark made on disassembly. Install a bronze thrust washer on the thrust face behind the primary sun gear, Fig. 107. To install the pinion carrier assembly, position the rear band over the drum while meshing the planet pinions.

Rear Pump—Install the two seal rings on the primary sun gear shaft and check for free movement in the grooves. Install the selective thrust washer on the rear of the pinion carrier. Retain the washer in place with transmission fluid, Fig. 108.

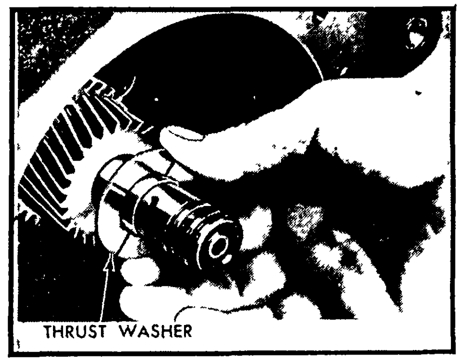


Fig. 107 Installing br nze thrust washer

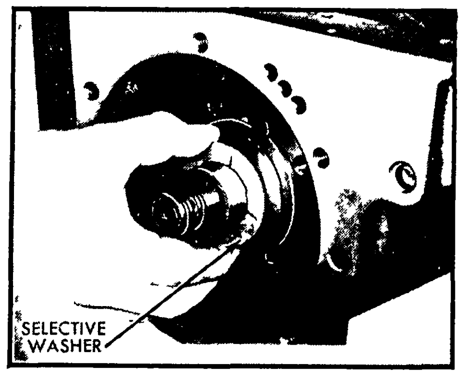


Fig. 108 Installing selective thrust washer

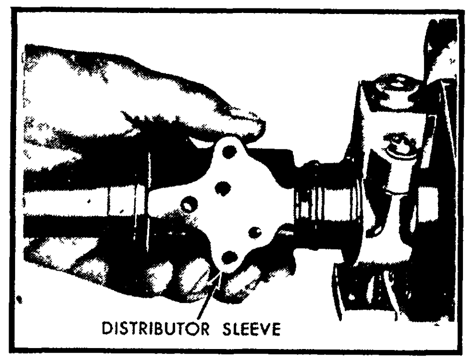


Fig. 109 Installing distribut r sle v

If the end play was not within specifiications when checked prior to disassembly, replace the selective washer with one of the proper thickness. The following selective washers are available for this installation: .063-.061, .069-.067, .076-.074, .083-.081 in.

Install the output shaft carefully, meshing the internal gear with the pinions. Position the seal rings on the primary sun gear shaft with gaps *up* to prevent breakage on installation of output shaft.

Place the four seal rings into the distributor sleeve and check the ring gap. Position the rear pump drive key in the keyway on the output shaft. Position new front and rear gaskets on the pump body. Retain the gaskets in place with transmission fluid. Install the thrust washer on the pump body with the bronze side up. Make sure to align the thrust

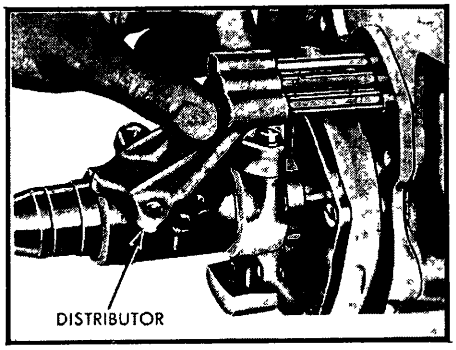


Fig. 110 Installing distributor and tubes

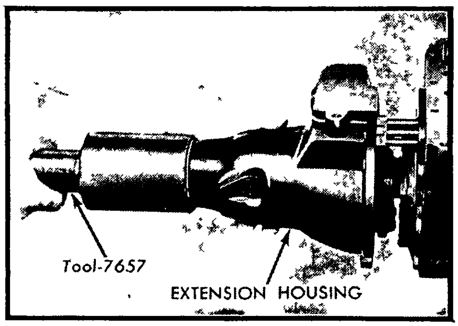


Fig. 111 Installing extension housing

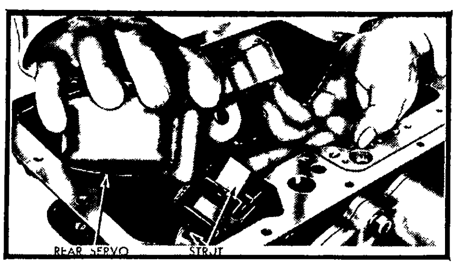


Fig. 112 Installing rear servo

washer tangs with the bosses on the pump body. Install the rear pump, using care to align the drive key with the keyway in the pump drive gear.

Governor — Position the governor drive ball in the pocket in the output shaft. Retain the ball in place with transmission fluid. Install the governor assembly, aligning the groove with the ball in the output shaft. The governor must be installed with the governor body plate toward the front of the tranmission.

Install the governor snap ring. Check the fit of the seal rings in the grooves of the output shaft. Rings should rotate freely when installed.

Distributor—Install the distributor sleeve on the output shaft with the chamfer forward, Fig. 109. Install the distributor and tubes on the sleeve, making sure fluid passages in sleeve and distributor are aligned. Install attaching bolts and lock washers finger tight. Insert distributor tubes into transmission case until the spacer on the center tube is against the case. Then tighten distributor attaching bolts to 8-10 lbs. ft. torque.

Extension Housing—Position the speedometer drive gear ball into the pocket of the output shaft. Install the speedometer drive gear with the chamfered side toward the front of the transmission, and retain in place with the snap ring. Insert the extension housing oil seal replacer and pilot in the housing. Then install the extension housing on the transmission case as shown in Fig. 111. Install the attaching bolts and lock washers and tighten bolts finger tight. Be sure the rolled edge of the washers are toward the transmission case to provide a tight seal.

Install a new seal ring on the rear pump discharge pipe. Install the rear pump dischage tube. Make sure the pipe is in position and below the upper surface of the transmission case.

Tighten the extension housing attaching bolts to 30-35 lbs. ft. torque. Install the governor inspection cover on the housing, using a new gasket.

Front Pump—Using a new gasket, install the front pump, aligning the dowel hole with the hole in the case. Install three of

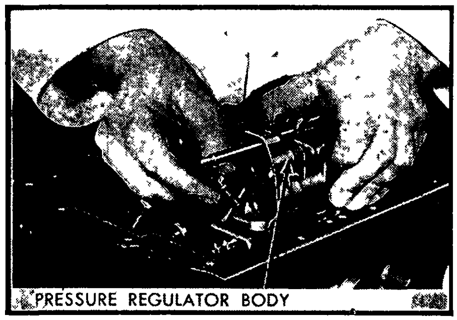


Fig. 113 Installing pressure regulator body

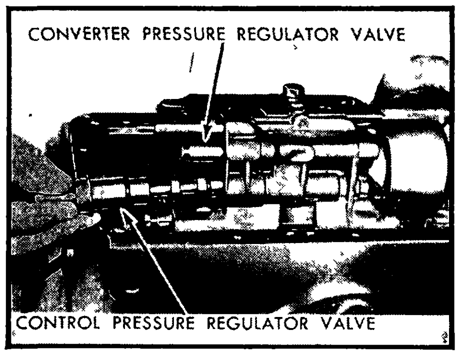


Fig. 114 Installing pressure regulator valves

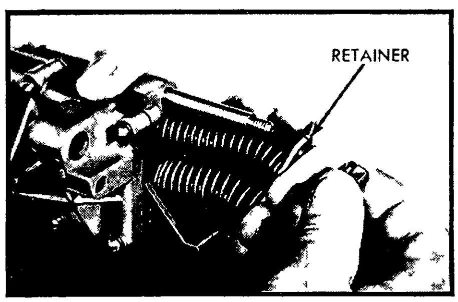


Fig. 115 Installing spring retainer

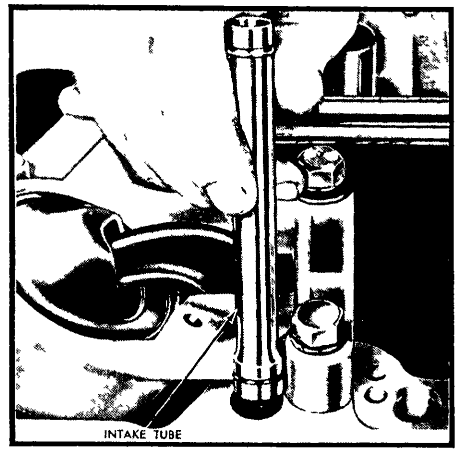


Fig. 116 Installing rear pump intake tube

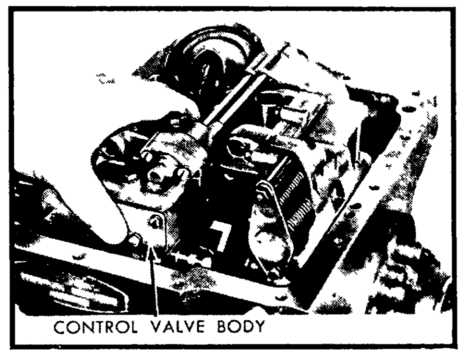


Fig. 117 Installing c ntr l valve assembly

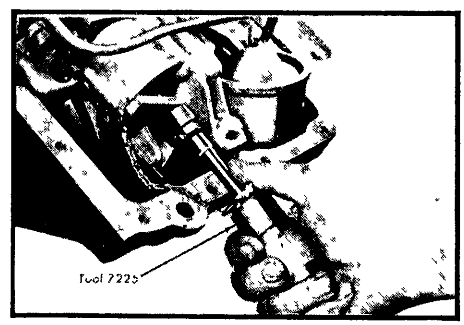


Fig. 118 Bench adjustment of front serv

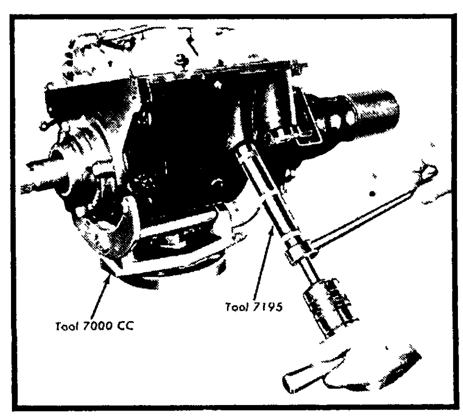


Fig. 119 Bench adjustment f r ar s rv

the pump attaching bolts and lock washers, tightening the bolts to 17-22 lbs. ft. torque.

Checking Transmission End Play—Follow the procedure for this operation as described during disassembly. If end play checks within .010-.029 in., install the one remaining pump attaching bolt, tightening it to 17-22 lbs. ft. torque. If end play is not within specifications, a new selective washer of proper thickness must be installed.

Front Servo — Position the front band forward in the case with the band ends up. Position the servo strut with the slotted end aligned with the servo actuating lever and the small end aligned with the band end.

Rotate the band, strut and servo into position, engaging the anchor end of the band with the anchor pin in the case. Locate the servo on the dowel in the case and screw in the attaching bolts only two or three threads. Then install the servo tubes.

Rear Servo — Position the servo anchor strut and rotate the rear band to engage the strut. Hold the strut in position with the fingers, Fig. 112, and position the actuating lever strut. Install servo and tighten attaching bolts to 40-45 lbs. ft. torque.

Pressure Regulator Body — Remove the two valves from the regulator body. Install regulator body and attaching bolts. Fig. 113, and tighten bolts to 17-22 lbs. ft. torque. Install the valves in the regulator body, Fig. 114.

Install the valve springs as shown in Fig. 115. Place a new seal ring on the rear pump intake tube and install the tube in the case, Fig. 116.

Control Valve Body—Install the control valve assembly, using care to align the servo tubes with the control valve, Fig. 117. Make sure to align the manual valve with the actuating pin in the manual detent lever. Do not tighten the attaching bolts.

Install the large control pressure tube into the valve body and regulator. Install the lubrication tube into the rear pump and regulator body.

Tighten the control valve body attaching bolts to 8-10 lbs. ft. torque, and the front servo attaching bolt to 30-35 lbs. ft. torque.

Front Servo Adjustment — Loosen the front servo adjusting screw lock nut and back off three turns. Loosen the adjusting screw five complete turns. Using the front band adjusting wrench shown in Fig. 118, insert a ¼ in. spacer between the lever and stem and tighten the screw until the ratchet overruns. Back out the adjusting screw one complete turn and tighten the lock nut to 20-25 lbs. ft. torque.

Rear Servo Adjustment—Loosen the adjusting screw lock nut three full turns. Back off the adjusting screw until free travel is obtained. Use the special tool shown in Fig. 119 and tighten the adjusting screw until the ratchet overruns; then back off the adjusting screw 1½ turns. Hold the adjusting screw stationary and tighten the lock nut to approximately 40 lbs. ft. torque.

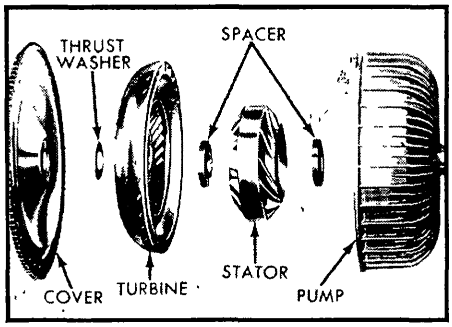


Fig. 120 Layout of torque converter

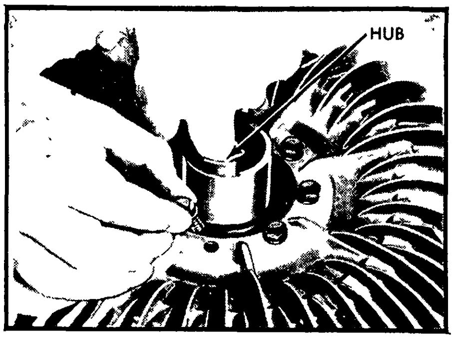


Fig. 121 Removing pump hub

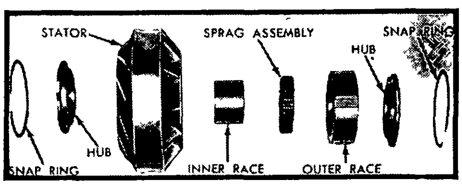


Fig. 122 Layout of stator parts

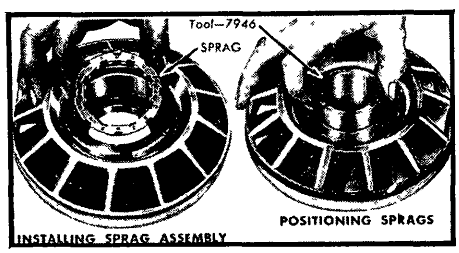


Fig. 123 Correct position of sprag in race

Fluid Screen & Pan—Position the screen over the rear pump tube and then over the front pump inlet tube. Press the screen down firmly. Install the pan, using a new gasket. Tighten the pan attaching bolts to 10-13 lbs. ft. torque. Tighten the drain plug to 20-25 lbs. ft. torque. Install the fluid level indicator.

CONVERTER, OVERHAUL

Removal From Transmission—To remove, grasp the converter cover with both hands and pull straight out. To prevent damage to the front seal, do not rock the assembly from side to side. After removing the attaching bolts, the converter housing may be taken off the transmission.

Disassembly—Place the converter in a holding fixture. Note the location of the pump and cover aligning marks, then remove the cover attaching bolts, Fig. 120.

Remove the cover and gasket. Slip the bronze thrust washer from the pump housing. Lift out the stator, noting its position in the housing. Take the thrust washer from the pump hub.

To disassemble the stator, remove the one way clutch inner race. Release the snap ring which retains the outer hub to the stator. Remove outer hub, sprag assembly and outer race. Remove the snap ring retaining the inner hub to the stator and take out the inner hub.

To disassemble the pump, remove the bolts which attach the pump hub to the pump, Fig. 121. Take out the hub and remove the seal from the groove in the hub.

Inspection—Inspect the turbine and pump blades for looseness. Inspect all thrust surfaces for scores. Check the turbine splines for burrs and wear. Inspect the seal surface and front pump driving lugs for wear. Inspect the hub to pump mating surfaces for scores. Inspect the stator thrust surfaces for scores and the stator splines for wear. Check the sprag assembly for worn or broken sprags and a broken or distorted spring. Inspect the stator inner and outer races for scores, Fig. 122.

Assembly—Install the stator inner hub and snap ring. Turn the assembly over and install the outer race in the stator. Then install the sprag into the outer race, Fig. 123. Make sure the sprags are pointed in the correct direction.

Install the outer hub and snap ring. Insert the inner race replacer (tapered side first) into the sprag assembly while rotating the tool counterclockwise to position the sprags as shown in Fig. 123.

Install the inner race with the spline section up. Guide the tool with the hand while pushing the inner race into position. Check the stator for clockwise rotation while holding the inner race.

To assemble the pump, install a new seal on the pump hub and place the hub in the pump. Install the thrust washer into the hub of the converter pump.

To assemble the converter, install the stator with "Front" up. Install the thrust washer in the hub of the turbine. Retain the washer in place with transmission fluid. Install the turbine. Place the bronze thrust washer on the turbine hub. Install the converter cover, using a new gasket. Note position of cover and pump aligning marks. Install the cover to pump body attaching bolts and tighten them to 25-28 lbs. ft. torque.

Install On Transmission—Attach the converter housing to the transmission, tightening the bolts to 40-50 lbs. ft. torque. Install the converter into the housing, being sure not to rock the assembly as it is being installed otherwise the seal may be damaged.

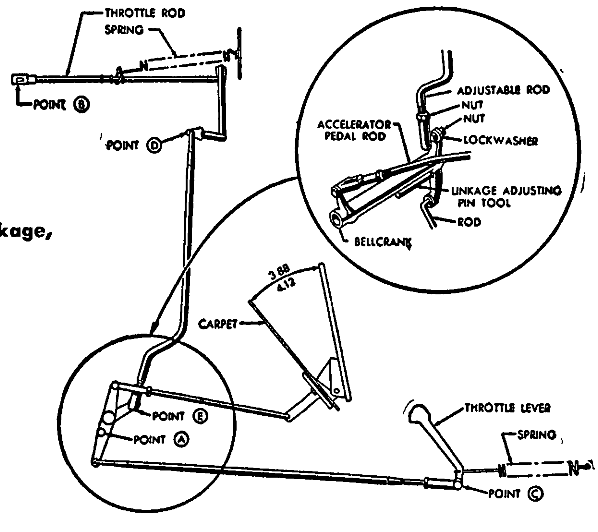


Fig. 124
Hydra-matic control linkage, 1949-52 Lincoln

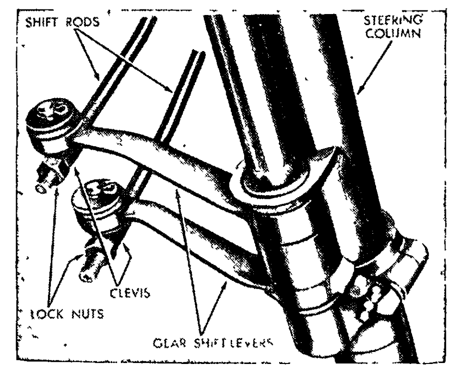


Fig. 126 1949-51 g arshift linkage

HYDRA-MATIC DRIVE

1949-52 Lincoln — A complete step-by-step service procedure is given in the *Hydra-Matic Drive* chapter on this unit. Control linkage adjustments as applied to Lincoln cars are as follows, Fig. 124.

1. Run engine until it reaches normal operating temperature (fast idle off).

2. Adjust engine idle to 375-400 rpm and shut off engine.

3. Disconnect retracting spring from dash-to-throttle rod.

4. Disconnect throttle rod at point "B".

5. Disconnect adjustable rod at point "E".

6. Disconnect throttle rod at point "C".

7. Check transmission throttle lever, using gauge J-3298. Bend lever if necessary, using tool J-3310.

8. Insert gauge pin tool J-2544 at point "A" into hole provided in bell crank and in bell crank bracket, located on side of crankcase.

9. At point "B" connect rod to carburetor arm ball. Tighten ball socket, screw in until snug on carburetor ball, then back off one or two cotter pin holes and install cotter pin. Connect retracting spring from dash to nib on throttle rod nearest to dash.

10. At point "A", using gauge pin J-2544, and with carburetor set on idle cam, install adjustable rod to fit length between points "D" and "E". Tighten check nut at ball joint with stud end of ball joint in alignment with hole in bell crank at point "E". Install lockwasher and nut.

11. With gauge pin in place at point "A" and with carburetor set on idle cam and retracting spring connected from throttle lever to frame X member, adjust throttle rod length so that clevis pin at point "C" enters clevis and throttle lever freely, then shorten rod by turning clevis 2½ turns on threads. Install clevis pin and cotter pin.

12. Adjust accelerator pedal rod length so that tip of accelerator pad is 3.88" to 4.12" from top of carpet.

13. Remove gauge pin at point "A".

14. Recheck entire linkage and control assembly to eliminate any binding condition and make sure throttle rod returns freely on low idle cam at normal engine temperature.

GEARSHIFT

GEARSHIFT, ADJUST

1940-48—Adjust the length of the rod indicated in Fig. 125 so that when the transmission gears are in neutral, the shift lever can be moved up and down freely.

1949-51—The gearshift rods, Fig. 126, are adjusted so that with the transmission gears in neutral, the two levers on the steering column are in line with each other. In this position, the shift lever can be moved up and down in neutral without binding.

When adjusting the rods, disconnect them from the steering column linkage and loosen the lock nuts. Turn the clevises in the direction required to establish the correct adjustment.

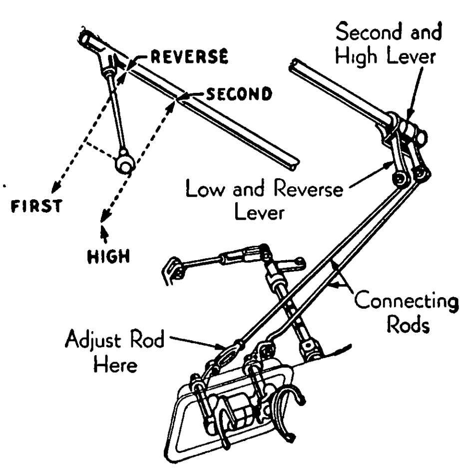


Fig. 125 1940-48 gearshift mechanism

REAR AXLE

REAR AXLE REMOVAL

1935-48—Unfasten the center of the rear spring from the frame cross member. Raise the rear end of the car until the spring is free of the cross member channel. Disconnect the hand brake cable, shock absorber links, and any other item which would prevent the axle from being removed. After disconnecting the torque ball from the transmission, slide the axle assembly out from under the chassis.

If the construction of the frame is such that it is impossible to raise the frame high enough to clear the rear spring, it will be necessary to disconnect the spring shackles. Before detaching the spring, examine the frame where the X members meet; if there is a brace riveted at this point which would prevent the frame from being raised high enough to clear the spring, it will be necessary to disconnect the spring shackles.

1949-51 Ford—It is not necessary to remove the entire rear axle assembly to perform service work on the differential assembly. After removing the axle shafts as described further on, unfasten the differential carrier from the axle housing and lift it out.

1949-51 Lincoln & Mercury—Inasmuch as the differential carrier is part of the rear axle housing, it is advisable to remove the entire rear axle assembly if necessary to overhaul the differential.

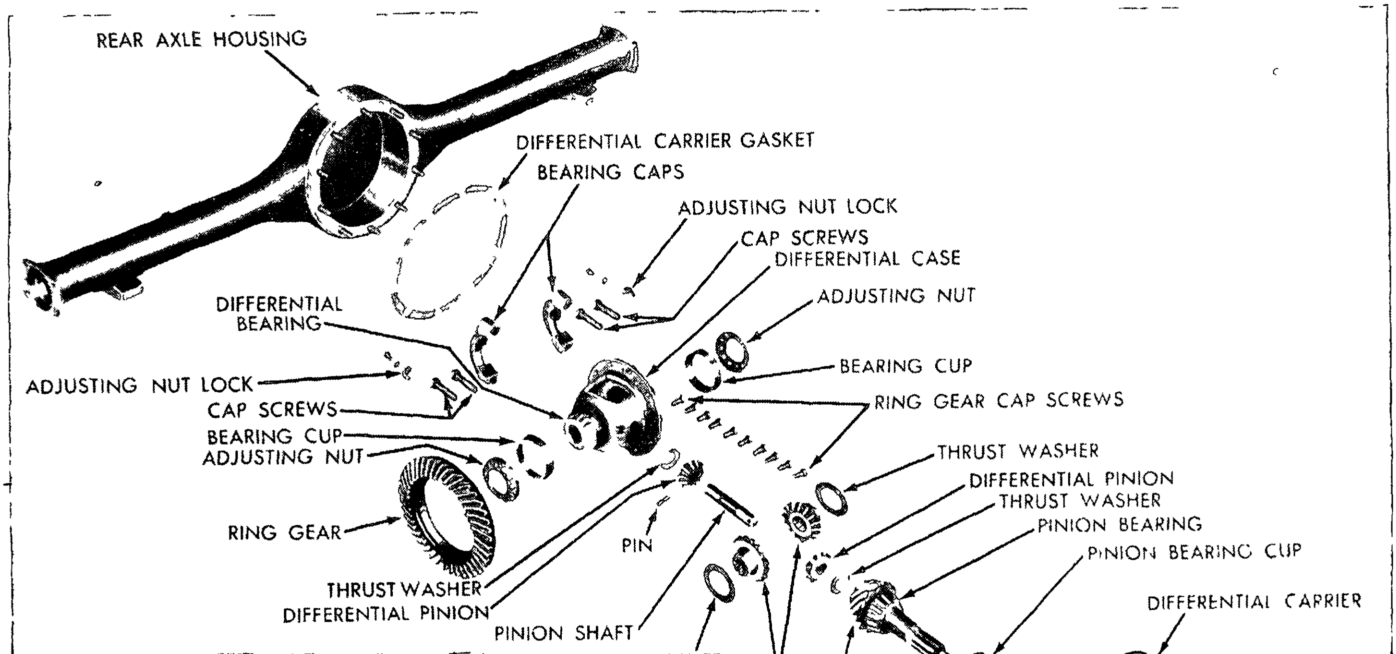
REAL AXLE SERVICE

1935-48 Ford & Mercury—After removing the axle assembly as explained above, see Fig. 127 and disassemble as follows:

Unfasten the torque tube from the differential housing and slide the torque tube from the propeller shaft. Drive out the pin which fastens the propeller shaft to the pinion shaft and separate these parts.

Unfasten the axle housings from the differential housing and slide off the axle housings. Scratch a mark across the joint of the differential case so it may be assembled in the same position, then remove the bolts and separate the case. Pick out the differential cross and pinions and withdraw the axle shafts from the inside of the differential case.

Mount the differential housing in a



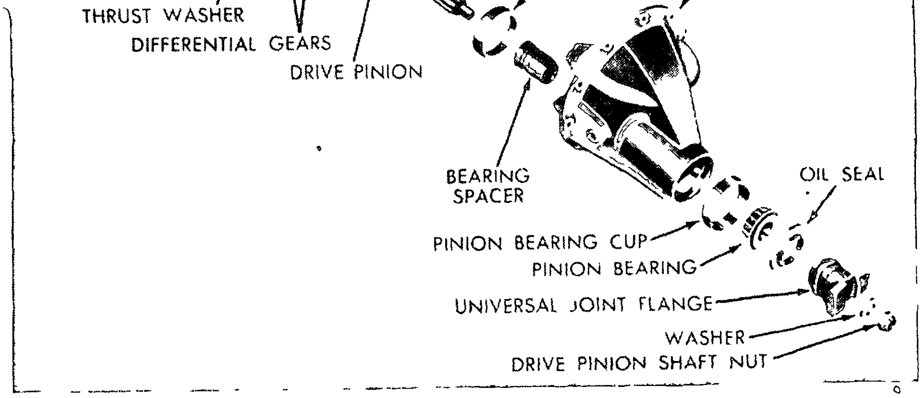


Fig. 129 1949-52 Ford rear axle assembly

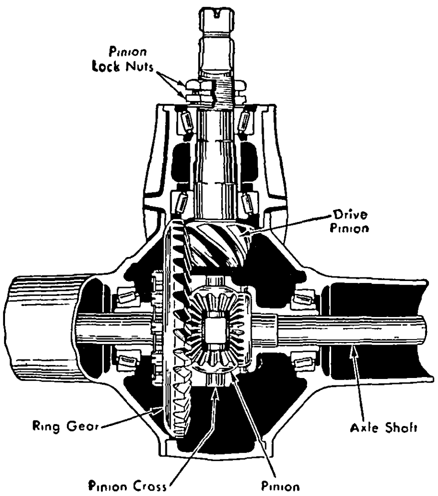


Fig. 128 1938-48 Lincoln H rear axle

vise and pull the drive pinion and bearings from the housing as a unit. Unscrew the nuts from the pinion shaft, mount the pinion in a vise and pull the bearings and sleeve from the shaft.

Inspection—The differential case should be examined for wear at the point where the backs of the pinions and side gears contact both halves of the case. If excessive wear is indicated, install a new case. If the backs of these gears are scored or show evidence of excessive wear, they should be discarded. This also applies to the pinion cross.

If the bearing surface of the pinion shaft is worn enough to permit a loose fit of the taper roller bearings, the pinion, bearings and sleeve should be replaced.

If the wheel bearing surface of the axle housing (or housings) is scored, badly pitted or worn more than .010 inch undersize, the housing (or housings) should be replaced.

Assembly—After pressing on the rear pinion bearing so that it bears against the pinion head, install the front bearing against the rear bearing, being sure the taper of both bearings are facing each other. The bearing sleeve may then be pressed into position. Install the adjusting and lock nuts, with the lock washer between them, and tighten the nuts so that the sleeve turns on the bearing cones with a heavy drag and no end play. Lock the adjustment by bending the tabs of the washer against the side of the nuts.

To install the pinion assembly and outboard bearing, the differential housing must be heated. Before doing so, however, see that the shoulder in the housing is clean and free from burrs. To heat the housing, immerse its neck in boiling water or heated oil for about two minutes. When heated, install the outboard bearing. Then, while the housing is still hot, press in the pinion assembly until the bearing sleeve is against the shoulder of the housing. This installation is made easier by coating the outer surface of the sleeve with gear lubricant.

When assembling the differential, first remove any burrs or dirt that would prevent the halves of the differential

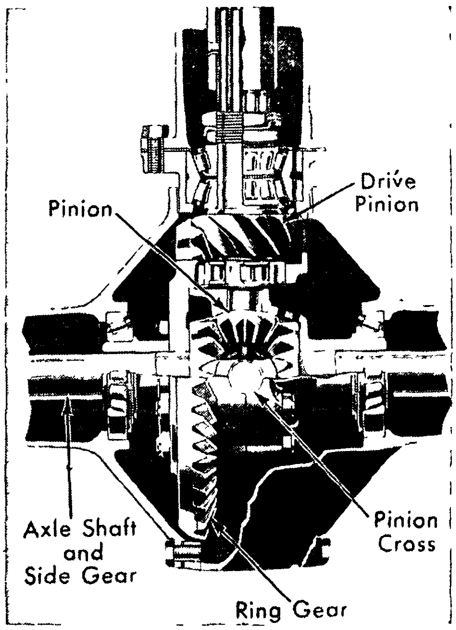


Fig. 127 1935-48 F rd and Mercury rear axle; typical f Linc ln Zephyr 1936-37

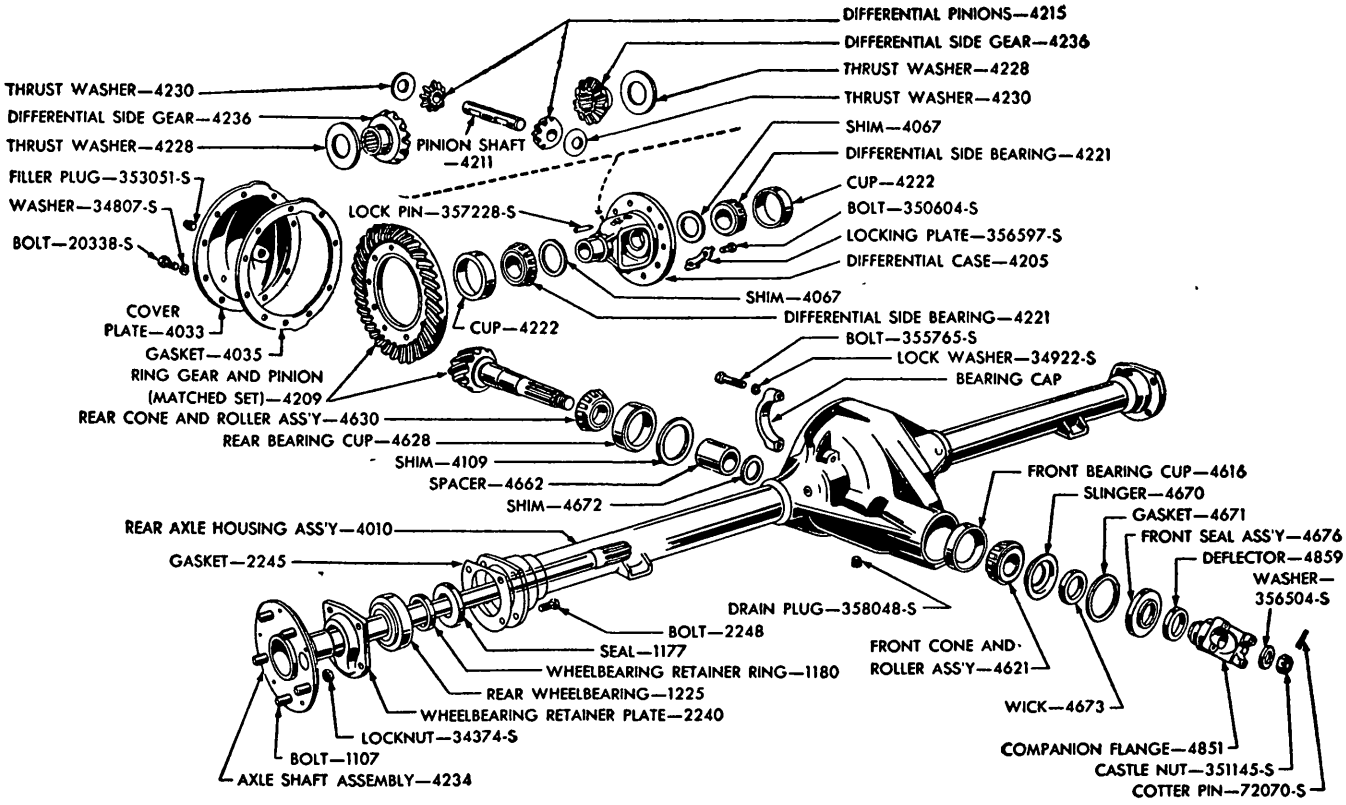


Fig. 130 1949-52 Lincoln and Mercury rear axle assembly

case from joining correctly. Then install the axle shaft in the right half of the case. Slip the pinions on the differential cross and lay the assembly in position in the case. The other axle shaft and the other half of the case (with ring gear attached) should then be installed and the whole bolted together securely.

After driving the differential bearings on the ring gear hub and on the right differential case half, assemble the left axle housing to the differential housing, using the proper gasket (.008 to .010 inch thick) between the two housings. Install the differential in the left axle housing, then, using another gasket of the same thickness, bolt these housings together securely.

The differential bearing adjustment may now be checked. Two persons are required for this operation. Each should turn one of the axle shafts in the same direction and at about the same speed. If the adjustment is correct, a heavy drag should be felt. If the shafts turn easily without apparent drag, the gasket at the *right* axle housing should be replaced with a thinner one—which is .004-.005 inch thick. Check the adjustment in the same manner and if satisfactory, check the backlash between the ring gear and pinion.

This adjustment is obtained by increasing or decreasing the gasket thickness at the *left* axle housing. However, in order that the differential bearing adjustment be preserved, whatever gasket thickness is added to the left housing should be removed from the right housing. Likewise, if the gasket thickness at the left housing is decreased, the amount by which it is decreased should be added to the right housing.

Backlash between the ring gear and pinion should be .003 to .008 inch, and is checked with a dial indicator mounted so that the movement can be observed at the splines of the pinion shaft when the shaft is rocked back and forth. If less than .003 inch, *increase* the gasket thickness at the *left* housing. If more than .008 inch, *decrease* the gasket thickness at the *same* housing.

Complete the assembly by meshing the propeller shaft with the pinion shaft so that the lock pin holes line up. Drive in a new pin and rivet the ends securely. Slide the torque tube over the propeller shaft and bolt the torque tube to the differential housing, using a new gasket between these parts. Fill the differential with the correct type and quantity of lubricant. The axle may now be installed in the chassis in the reverse order from which it was removed.

REAR AXLE SERVICE

1936-48 Lincoln H—Inasmuch as its design is quite similar to the Ford and Mercury type described above, all service work may be performed in the same manner.

With the adoption of hypoid gears in 1938, the same basic design, insofar as the differential is concerned, was retained, but, as shown in Fig. 128, a different drive pinion set-up was employed. This construction is carried on through 1948.

The differential housing, when supplied for service, includes the drive pinion and pinion bearings assembled in the housing and properly adjusted, as well as a matched ring gear. When replacement of the ring gear and pinion is required, the above assembly is furnished on an exchange basis.

The tolerance used when machining the axle parts, in most cases, permit the use of a .005 and .008 inch thick paper gasket at each side of the differential housing. This provides sufficient gaskets for adjusting the ring gear backlash in service, as well as determining the proper tightness of the differential bearings.

The ring gear furnished with each assembly is mated with the drive pinion and has a mark etched on it which indicates the proper clearance which should be allowed between the particular ring gear and pinion. The clearance indicated should be strictly adhered to in order to secure proper adjustment and quiet operation.

The drive pinion is assembled in the differential housing and endwise adjustment is accomplished by a shim back of the rear bearing cup. No shim other than that supplied with the exchange assembly furnished for service should be used.

REAR AXLE SERVICE

1949-51 FORD — Fig. 129. Before the differential carrier assembly can be taken out, the axle shafts must be removed (how this is done is explained further on).

The splined universal joint flange is fastened to the pinion shaft with a nut

which seats directly on the counterbore in the flange.

The drive pinion is mounted on taper roller bearings. Adjustment of the pinion along its axis is obtained by shims placed between the rear bearing outer race and a shoulder in the carrier. Preload of the two bearings is obtained by tightening the universal flange nut which compresses a spacer over the pinion shaft between the bearings. Both bearing outer races are pressed into the carrier, the rear race against pinion adjusting shims, the front race against the shoulder in the carrier. The rear bearing inner race is pressed onto the pinion shaft to a shoulder at the pinion end. The front bearing is a light press fit to a close sliding fit on the pinion shaft.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

Pinion & Bearings, Replace—After removing the differential unit from the carrier, unscrew the pinion flange retaining nut and pull off the flange. Press the pinion out of the front bearing and through the rear end of the carrier. The rear bearing cone and bearing spacer will come out with the pinion. The bearings may then be removed and installed with suitable pulling equipment.

Reverse the operations to assemble and, after pressing on the flange, slip on the washer and nut. Tighten the nut until the bearings have a preload drag of 22 to 28 inch pounds of torque to rotate the pinion shaft.

To adjust the preload, draw up the nut with a torque wrench until the spacer starts to buckle. This adjustment must be made every time the flange nut is removed or loosened. If the adjustment is to be made with the differential in the carrier, the rear wheels must be jacked off the floor.

Drive Pinion Position—The drive pinion position usually does not require adjustment other than the bearing preload unless a new pinion bearing cup is installed. If a new rear bearing cup is installed, check the pinion position by using a micrometer depth gauge as outlined in the *Rear Axle* chapter. If the depth of the pinion measures more than 2.000" (plus or minus .002") it will be necessary to install shims in back of the pinion shaft rear bearing cup. Shims are available in .003, .005, .010, and .020" thicknesses for this purpose.

NOTE— A new pinion bearing spacer is required when a new ring gear and pinion set is installed, when any part of either pinion bearing is changed, when a new carrier casting is used, or when pinion adjusting shim thickness is increased. When the same universal joint flange is removed and reinstalled (as when an oil seal is replaced) checking for pinion bearing preload with a torque wrench is not necessary if care is taken to tighten the nut exactly to its previous position. Should a new flange be required, a torque wrench reading should be taken before loosening the nut and the nut tightened to the same torque wrench reading.

REAR AXLE SERVICE

1949-51 Lincoln & Mercury—In this type axle, Fig. 130, the drive pinion is held in position by shoulders in the differential carrier, upon which the pinion bearing cups seat. The pinion position is maintained by shims located between the rear bearing and the rear shoulder in the differential carrier. Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings.

The shimmed type of differential bearing adjustment is employed. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

The axle tubes are pressed into the differential carrier to form a one-piece housing. To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

Pinion & Bearings, Replace—After removing the axle shafts and differential unit, unscrew the pinion flange retaining nut and pull off the flange. The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and press the pinion shaft out of the bearing. When replacing the bearing select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when being forced on the shaft.

Drive the front bearing cup and oil seal out of the forward end of the carrier. If the rear bearing cup is to be replaced or if the pinion setting is to be changed, remove the rear bearing cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used (see *Rear Axle* Chaper). After the required shims have been added or subtracted, replace the rear bearing cup.

When making a pinion adjustment, the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to retain the proper pinion bearing adjustment.

To install the pinion, support it under the head with a wood block while the pinion flange is reinstalled. The pinion oil seal should not be replaced until after the pinion setting has been checked.

Pinion Bearings, Adjust—The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearing are tight, but still permit rotating the pinion by hand.

Pinion, Adjust—After adjusting the pinion bearings, the position of the pinion may be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle* Chapter. If a correction is necessary, disassemble the pinion and, if it is to be moved toward the center of the axle, add shims between the rear bearing and rear shoulder in the carrier. If the pinion has to be moved away from the center of the axle, remove shims from this point.

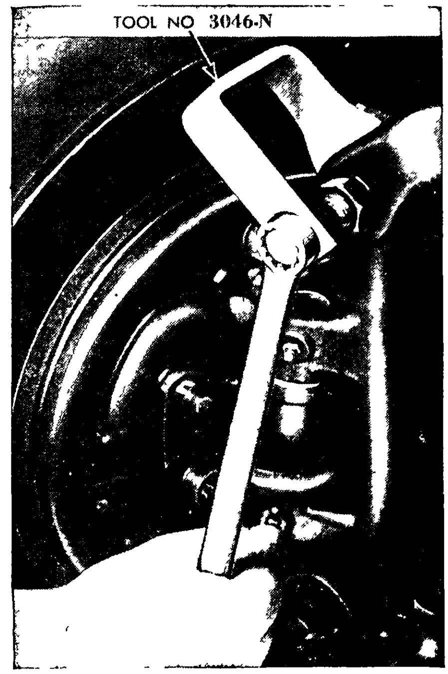


Fig. 131 1949-51 camber adjustment

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle* Chapter. After satisfactory tooth contact has been established, remove the pinion flange to install the seal.

AXLE SHAFT BEARINGS & OIL SEALS

1935-48—The bearing and outer oil seal may be removed without taking out the axle shaft, but if the inner oil seal is to be replaced, the axle shaft will have to be removed. This can only be done by dismantling the rear axle assembly and pulling the axle shaft out of the differential end of the housing, as the differential side gear is pressed on the inner end of the shaft.

To remove the bearing and outer oil seal, raise the car and remove the wheel. Unscrew the nut from the end of the axle shaft and pull off the hub and brake drum. The bearing and oil seal may then be taken off the axle shaft.

Installation is simply a matter of reversing the above operations. There is no adjustment for the bearing other than to tighten the axle shaft nut.

1949-51 — Axle shafts are mounted on sealed ball bearings pressed to a shoulder on the axle shaft, and held in place by a pressed-on bearing retainer ring. The shaft bearings are pre-lubri-

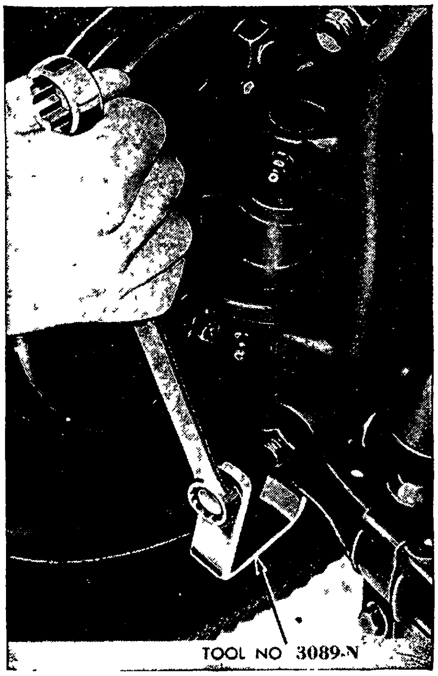


Fig. 132 1949-51 caster adjustment

cated and require no additional lubrication. The shafts are held in place in the axle housing by a retainer plate. The wheel hub and brake drum flange are forged integral with the axle shaft. The flange provides the brake drum and wheel mounting and eliminates the need for a keyed hub.

To remove an axle shaft, take off the wheel and unfasten the brake drum from the axle shaft flange. Through the hole provided in the flange, remove the nuts which secure the brake support plate to the axle housing. Then with a suitable puller, pull the shaft out of the housing, using care not to dislodge the brake support plate or damage the oil seal in the housing. Install one nut to hold the brake plate in position.

Axle shaft bearings should be removed only when necessary to install a new bearing. A bearing once removed must be discarded.

If necessary to disassemble, loosen the axle shaft bearing retainer ring and remove the retainer. The bearing may be removed with a bearing puller, after which remove the retainer plate.

To assemble, place the retainer plate on the shaft. Press the bearing up against the shoulder on the shaft. Install the bearing retainer ring and press it firmly against the bearing. Before installing the shaft examine the oil seal and replace it if necessary.

Before installing a new oil seal it should be thoroughly soaked in oil for at least ½ hour to make it soft and pliable. When installing the seal, use a suitable seal driver, driving the seal into the axle housing with the axis of the shaft and tight against the shoulder. After installing the seal, check the outer diameter for tightness in the housing to avoid possible leaks.

To install the shaft, remove the temporary nut holding the brake plate, and lubricate the bearing bore in the housing. Clean the brake plate surface and install new gaskets between the retainer plate and brake plate. Slide the shaft into the housing, using care not to damage the oil seal. Push the shaft in until its bearing is tight against the shoulder in the housing. Complete the job by tightening the axle shaft nuts to 30-35 pounds feet torque, and install the brake drum and wheel.

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1935-48—If the camber and caster angles are not according to the specifications given in the *Front End Table,* bending the axle is the only way to correct the condition. If the camber and kingpin inclination angles are out the same amount, and in the same direction, a correction can be made by bending the axle. However, if these two angles are out different amounts, it is an indication that the wheel spindle is bent and must be replaced.

1949-51—Camber adjustment is provided by an eccentric bushing at the top of the kingpin support. To adjust, loosen the lock bolt through the top of the support and place the tool shown in Fig. 131 on the hex of the bushing and turn until the top end of the support is moved toward or away from the frame to obtain the correct camber angle.

Caster adjustment is accomplished by turning the bushing at the lower end of the kingpin support. Loosen the lock nut and install the tool shown in Fig. 132 on the hex on the front end of the bushing. Turning the bushing moves the support forward or backward until the correct caster angle is obtained.

NOTE—The maximum movement of the caster adjusting bushing is ⅛" either way from center. If correct camber and caster angles cannot be obtained by bushing movement, check all the component parts for excessive wear or being bent and replace parts affected.

TOE-IN, ADJUST

1935-48—Toe-in is adjusted by loosening the clamps at either end of the tie rod and turning the rod in the desired direction to obtain the dimensions given in the *Front End Table.* The drag link should be adjusted so that the steering wheel is in its central position when the wheels are in the straight-ahead position.

1949-51—Figs. 133 and 134. Position the front wheels in their straight-ahead position. Then turn both tie rod adjusting sleeves an equal amount until the desired toe-in setting is obtained.

FRONT END SERVICE

1949-51—Fig. 135. The working parts of the suspension system are assembled directly to the car frame and cannot be removed as an assembly. Therefore to remove any part for replacement, it is necessary to disassemble the part from the car.

Lower Control Arm or Spring—To replace either of these parts, jack up the car until the wheels clear the floor and place a stationary jack under the frame. Remove the shock absorber, and stabilizer end clip. Place a jack under the lower arm pivot shaft and exert enough pressure on the jack to keep the pivot shaft tight to the frame. Unfasten the pivot shaft and lower the jack slowly. When the spring is fully extended, lift it out of the lower arm. Remove the nut from the lower bushing pin and screw out the pin. The lower arm can then be lifted out.

To install, position the lower arm, screw in the bushing pin and tighten the nut. Place the flat end of the spring upward and the lower end in the spring seat in the arm. With the jack in position under the pivot shaft, raise the lower arm to the frame. Use a drift to align the holes in the pivot shaft and cross member for easy installation of bolts. Install the shock absorber, fasten the stabilizer end with clip on lower arm and remove jacks.

Upper Control Arm—To replace the upper control arm, place a jack under the lower spring seat and raise the car. Remove the wheel. Run a strong wire from the kingpin support to the frame to avoid damage to the hydraulic brake hose from undue tension. Unfasten the upper pivot shaft from the frame. Remove the nut and bushing pin at the top of the support, and lift off the upper arm.

When assembling, install the bushing pin before attempting to fasten the pivot shaft to the frame. Install the wheel and remove the jack.

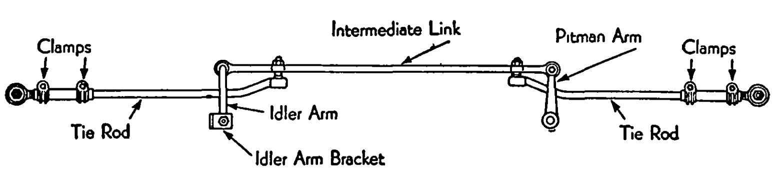


Fig. 133 Ste ring linkage, 1949-52 Ford

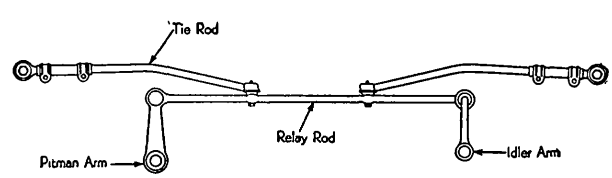


Fig. 134 1949-51 Linc ln and Mercury ste ring linkage

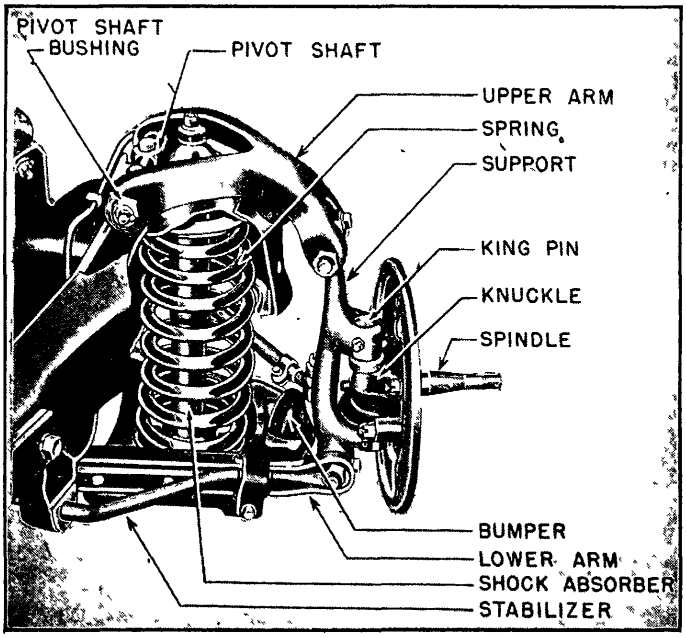


Fig. 135
Front suspension 1949-51. All 1952 Ford and Mercury

Kingpin Support—To replace this support, place a jack under the lower arm spring seat and raise the car. Remove the wheel and brake drum. Unfasten the brake support plate and fasten it with wire to the frame to prevent undue strain on the hydraulic brake hose. Drive the kingpin locking pin from the knuckle. Pry out the grease seal plug from the support. Using a soft drift, drive the kingpin from the support and knuckle, forcing out the lower grease seal at the same time. Remove the upper and lower pivot pins and lift out the kingpin support. Loosen the lock bolts at each end of the support and press out the bushings.

Kingpin Bushings—These bushings can be replaced without removing the kingpin support. After taking off the wheel, drum, brake support plate, steering arm and knuckle, press out the bushings. After pressing in the new bushings, they can be reamed from below.

Pivot Shaft Bushing—It is necessary to remove the upper control arm to replace these bushings. When screwing in the new bushings, insert a hard wood block between the ends of the arm at the pivot shaft to keep the ends in the proper position.

The lower control arm pivot shaft bushings can be replaced without removing the arm from the car.

Pivot Pin or Bushing—To replace either the upper or lower pivot pin or bushing, place a jack under the spring seat of the lower arm and remove the wheel. Remove the pivot pin nut and screw out the pin. To remove the bushing from the support, loosen the lock bolt and press out the bushing.

NOTE—After replacing any part of the suspension, check and adjust camber and caster.

STEERING GEAR

STEERING WHEEL & GEAR, REMOVE & REPLACE

1935-51—Remove the horn button, then use a suitable puller to remove the steering wheel. Unfasten the steering column from the instrument panel. Use a suitable puller to remove the pitman arm, remove the steering gear mounting bolts and pull the gear out of the chassis.

Replace the gear and wheel in the reverse order, being sure to install the pitman arm and wheel so that the car can make equal turns to right and left.

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1951	Four	513	100	In Block	3⅛ x 4⅜	134	7.00	68 @ 4000	109 @ 1800	30 @ 30
	Six	514	100	In Block	3⅛ x 3½	161	7.00	80 @ 3800	133 @ 1600	30 @ 30
1952	Vagabond & Corsair 4	523	100	In Block	3⅛ x 4⅜	134	7.00	68 @ 4000	109 @ 1800	30 @ 30
	Vagabond & Corsair 6	524	100	In Block	3⅛ x 3½	161	7.00	80 @ 3800	133 @ 1600	30 @ 30

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note C	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1951–52	Four	AN-7	.030	.020	44–47	1342	A	Positive	550		60–65
	Six	AN-7	.030	.020	35–38	153624	B	Positive	550		60–65

A—Five degrees before TDC mark on flywheel. B—TDC mark on vibration damper. C—Plus or minus .002″.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhauts
1951–52	Four	.014C	.014C	.020	45	9	12	53@2⁷⁄₆₄	.0015–.003	.0025–.0045	.3730	.3730
	Six	.014C	.014C	.020	45	5	12	50@1⅝	.0015–.003	.0025–.004	.3730	.3730

A—BTDC means before top dead center; ATDC means after top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1951–52	4-Cylinder	Above	.0045(C)	5 to 10	.008	.008	.0005–.0015	.0005–.0015	D	E
	6-Cylinder	Above	.0025(C)	7 to 12	.007	.008	B	.001 –.0025	D	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel. B—Top ring .002-.004″, second ring .0015-.0035″.
C—Feeler gauge should be ¾″ wide. D—Locked in rod. E—Thumb fit push with parts at 70° (normal room temperature).

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1951–52	Four	B	.001–.0045	1.9375 1.9380	.0005–.0025	.004–.010	50–55	2.3331– 2.3341	.0014–.0029	.004–.006	60–70
	Six	B	.001–.0045	1.8750	.0005–.0025	.002–.008	50–55	2.250	.0009–.003	.002–.008	65–70

A—Thrust is taken by the front bearing.
B—Controlled by thrust plate.

LUBRICATION AND CAPACITY DATA

Year	Mode	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	Engine: Crankcase Refill Capacity, Quarts	Engine: Grade of Oil Above +32°F.	Engine: Grade of Oil Above +10°F.	Engine: Grade of Oil Above −0°F.	Transmission: Capacity, Pounds or Pints	Transmission: Grade of Oil Summer	Transmission: Grade of Oil Winter	Differential: Capacity, Pounds or Pints	Differential: Grade of Oil Summer	Differential: Grade of Oil Winter
1951-52	Four	10¾	13	4	20	20W	10W	1½(A)	90	80	2½	90H	80H
	Six	9	13	5	20	20W	10W	1½(A)	90	80	2½	90H	80H

A—With overdrive, 2¼ pounds.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1951-52	All	.003–.006	Shims	Shims	.001–.005

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1951-52	All	Zero	+½	¼	4½

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1951-52	All	Molded		2	3/16	¼

ENGINE

FIRST SERIAL NUMBER

LOCATION: On left front door hinge pillar post.

Year	Model	
1951	K513	K513-001001
	K514	K514-001001
1952	K523(V)	K1-000001
	K524(V)	K1-000001
	K523(C)	K1-200000
	K524(C)	K1-200000

FIRST ENGINE NUMBER

LOCATION: On right side of engine stamped in block at upper front; also on plate attached to left side center of crankcase.

Year	Model	
1951	All	K1100000
	All	K2000000

ENGINE REMOVAL

1951-52—The general procedure for removing the engine is as follows:

1. Drain cooling system.
2. Disconnect battery.
3. Remove radiator, air cleaner and starter motor.
4. Disconnect generator and distributor wires.
5. Disconnect fuel lines, choke and throttle controls, oil line and water temperature gauge bulb.
6. Attach a hoist to the engine.
7. Unfasten exhaust pipe from manifold.
8. Remove engine mounting nuts.
9. Detach clutch housing from engine.
10. Lift engine out of car.
11. Reverse the above procedure to install the engine, being sure to apply a little grease to the clutch pilot bearing.

CLYINDER HEAD

1951-52—The general procedure for removing the cylinder head is as follows:

1. Drain cooling system.
2. Remove fuel line from carburetor to fuel pump.
3. Remove carburetor air cleaner.
4. Detach accelerator and choke controls at carburetor.
5. Remove carburetor.
6. If valve work is to be done, disconnect exhaust pipe from manifold and remove manifolds from engine, after first removing the crankcase ventilator valve from the intake manifold.
7. Remove upper radiator hose, spark plugs, temperature gauge bulb and cylinder head nuts.
8. Lift cylinder head from block, using lifting hooks in two of the spark plug holes. Do not use a screwdriver, chisel or other sharp instrument to drive between the head and block to loosen the head as damage may result.

Installation Notes — Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block

If possible, use a torque wrench when tightening cylinder head nuts Uneven or excessive tightening of nuts may distort cylinder bores, causing compression loss and excessive oil consumption

Tighten cylinder head nuts in the order shown in Figs 3 and 4, tightening them a little at a time in the proper sequence about three times around before final tightening to the torque values given in the *Tune Up Chart* After the engine has warmed up to operating temperature, recheck the nuts and adjust torque as required

VALVE SERVICE, 1951-52

Valve Adjustment—The valves should be adjusted while the engine is at normal room temperature

1 Raise left front end of car and support it with a stand

2 Remove left front wheel and splash shield access cover

3 Remove valve chamber covers

4 Crank engine over until valve to be adjusted is fully closed and the tappet is resting on the heel of the cam Hold the tappet body with a tappet wrench to prevent it from turning Then turn the tappet adjusting screw until clearance of 014 in (measured with feeler gauge) is established Adjust remaining tappets in the same manner

NOTE—In addition to the conventional method of adjusting tappets by locating the distributor rotor and then adjusting the tappets by following the firing order of the engine, the following method may also be used

Four-Cylinder Engines

Valves Fully Raised	Adjust Tappets
1 and 3	6 and 8
2 and 5	4 and 7
6 and 8	1 and 3
4 and 7	2 and 5

Six-Cylinder Engines

Valves Fully Raised	Adjust Tappets
1 and 3	10 and 12
7 and 9	4 and 6
2 and 5	8 and 11
10 and 12	1 and 3
4 and 6	7 and 9
8 and 11	2 and 5

Valves, Remove — After taking off the cylinder head as outlined previously, take off the valve chamber covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the valve locks Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks

Remove all valves and place them in a board with numbered holes so that they can be identified as to the valve port from which they were removed

Valve Springs — After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

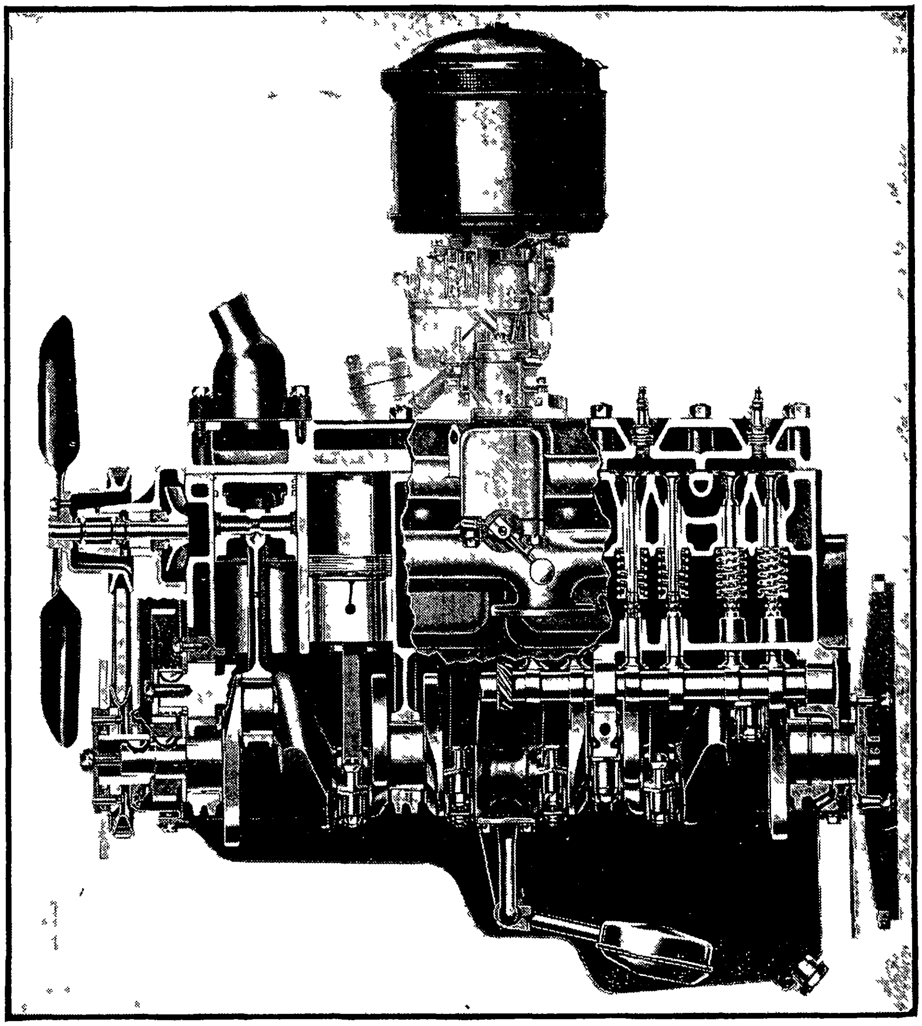


Fig. 1 1951-52 six-cylinder engine

Check the valve spring pressure on a spring testing fixture if one is available, Fig 5 If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced Likewise, any spring that stands shorter than the new spring used for comparison should be discarded

Valve Guides — Clean the valve guides with a wire guide brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems

Check the clearance between the valve stems and guides carefully The standard clearances are given in the *Valve Data* chart

Excessive clearance between valve stems and guides will cause improper seating and burned valves When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance

To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth If this check shows excessive clearance, it will be necessary to replace the valve guide If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed

If it is necessary to replace the valve guides, the old guides can be driven down and out of the valve chamber A special driver is available for this work However, in lieu of the driver, the guides can be pulled out of the block by using a suitable piece of pipe together with a long bolt and suitable washers

When replacing the guides, maximum engine performance can only be secured when the guides are installed as shown in Figs 6 and 7.

Valves, Reface—In refacing valves take off only the minimum of metal required to clean up the valve faces If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

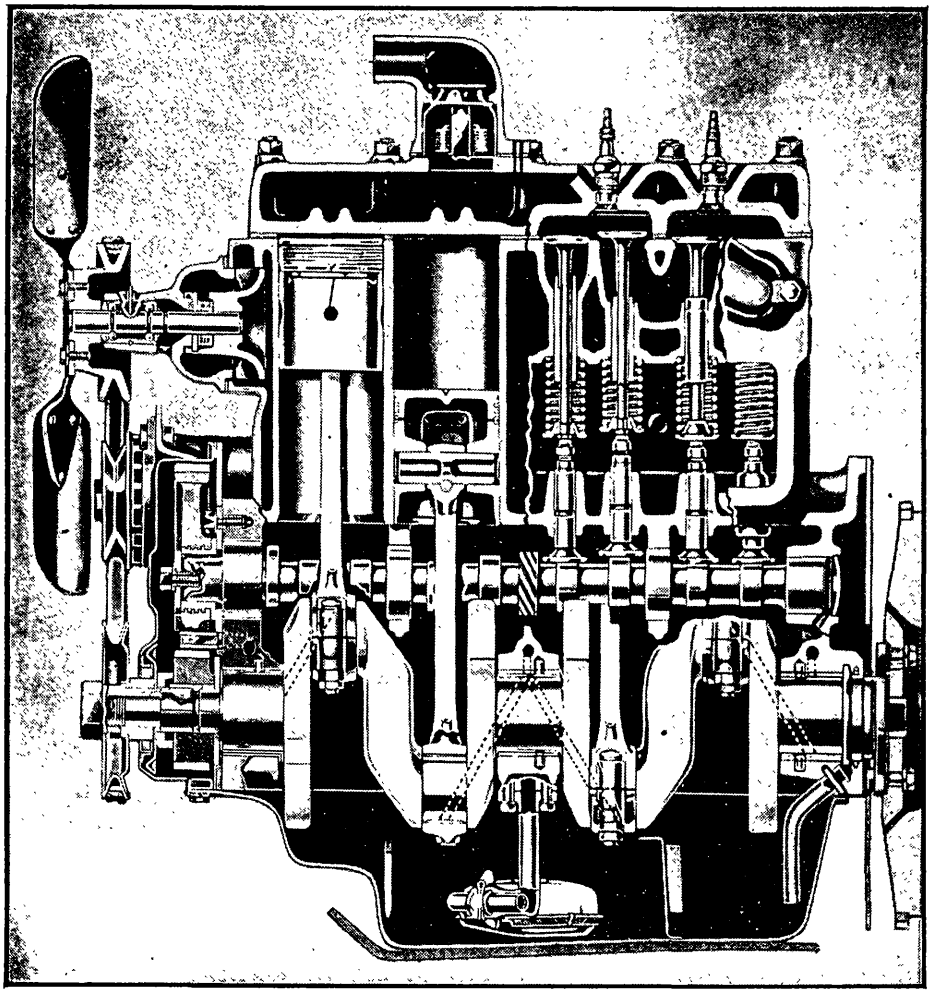


Fig. 2 1951-52 four-cylinder engine

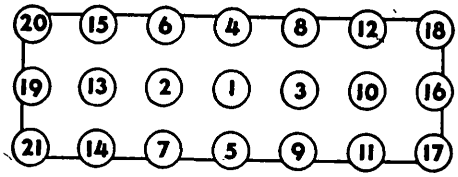


Fig. 3 Cylinder h ad tightening sequenc on 1951-52 six-cylinder engin

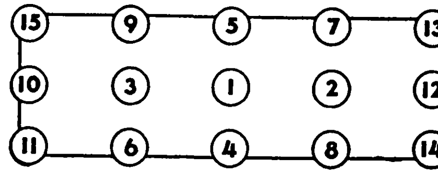


Fig. 4 Cylinder head tightening sequence on 1951-52 four-cylind r ngin

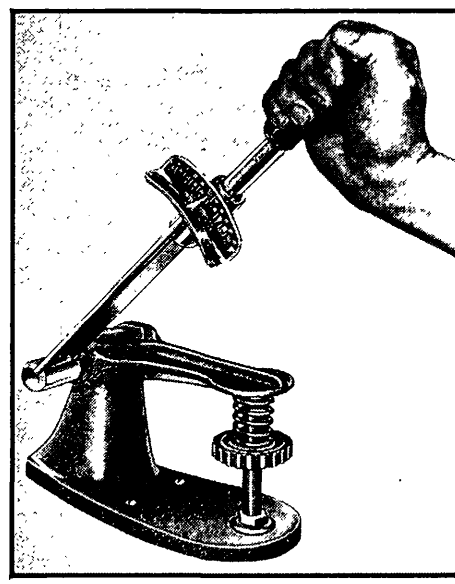


Fig. 5 Checking valve spring pressure. 1951-52

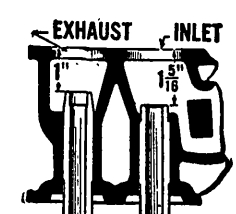


Fig. 6 Position of valv guides in 1951-52 six-cylind r engin

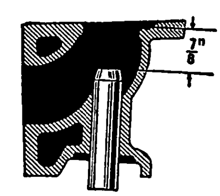


Fig. 7 P siti n f valv guides in 1951-52 f ur-cylind r ngine

Inspect the valve seats in the block for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

The valve seat width after refacing should measure not more than 5/64 in. The width may be checked by placing a scale across the face of the seat.

A simple check can be made to prove the fit of the valve in the valve seat by spreading a thin film of Prussian Blue on the valve face and then inserting the valve into the valve seat. With hand pressure, rotate the valve ¼ turn and then remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indicate an inaccurate valve and valve seat refacing operation.

Valve Lifters—These lifters are of the mushroom type operating in guide holes cast in the block. This means that the camshaft will have to be removed from engine if lifters require replacement.

Whenever the camshaft is removed, inspect the faces of the lifters where they contact the cams and replace any that are scored, rough or cracked. Check the clearance of the lifters in the guides, replacing those that have worn excessively. Oversize available is .004 in. and the guides must be reamed to accomodate them.

CAMSHAFT & GEARS, 1951-52

Camshaft & Bearings—The camshaft is mounted on four bearings but only the front bearing is replaceable, the others being machined directly in the block. The front bearing is a steel-backed babbitt liner, and when necessary to replace it, be sure to stake it in place to prevent rotation and endwise movement.

Comshaft, Remove—After draining the cooling system, proceed as follows:

1. Remove radiator, cylinder head, manifolds, valves and valve springs.
2. Remove fuel and oil pump assemblies.
3. Remove fan belt, oil pan, vibration damper, crankshaft pulley and fan.
4. Remove front engine cover and camshaft gear and the gear thrust plate.
5. Tie the valve lifters up at their highest point of travel with string wrapped around the adjusting screws and attach to manifold studs.
6. Withdraw camshaft from engine and, if necessary, take lifters out from below.
7. Inspect shaft for scores and roughness of cam and bearing surfaces.

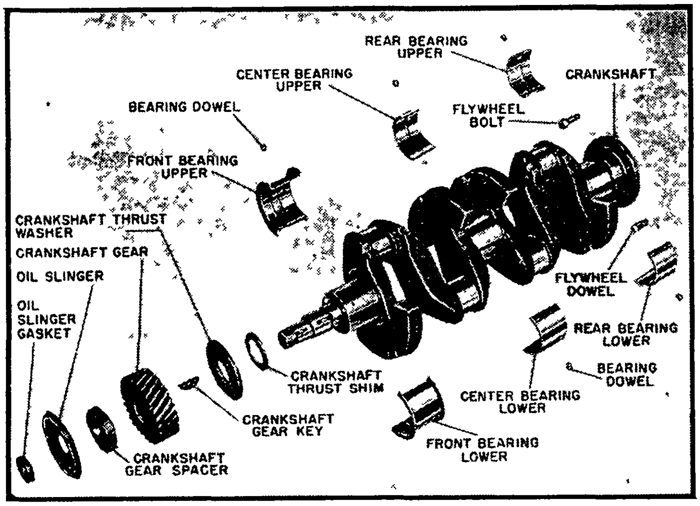


Fig. 8 Lay ut of crankshaft gear, crankshaft and main bearings n 1951-52 four-cylinder engine. Six is similar

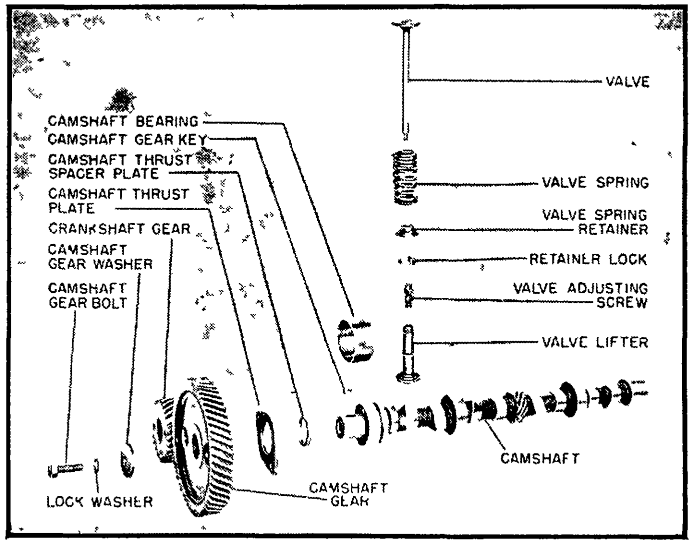


Fig. 9 Lay ut f camshaft, gears and valves n 1951-52 four-cylinder engin . Six is similar

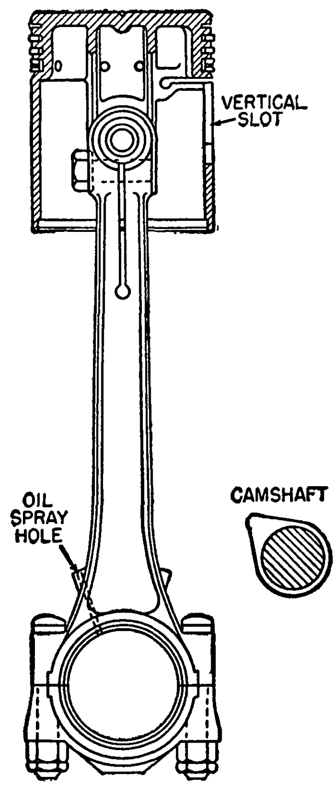


Fig. 10 Assemble rod and piston as shown. 1951-52

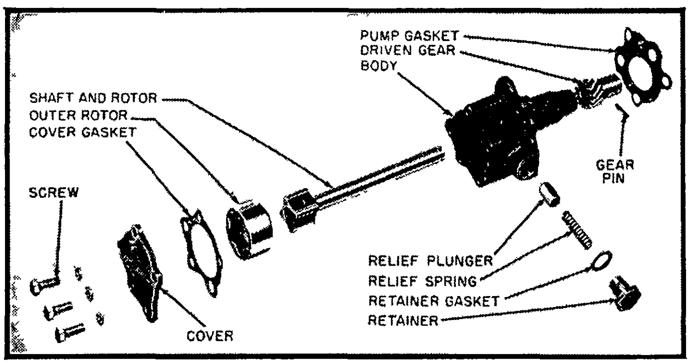


Fig. 11 Expl ded view of oil pump. 1951-52

8. Inspect the valve lifter faces where they contact the cams and replace any that are scored, rough or cracked.

9. Install the valve lifters and camshaft in the reverse order of removal, being sure the cover oil seal is in good condition.

10. When installing the oil pump, refer to the section covering the *Oil Pump* because the oil pump gear must be properly meshed with the driving gear on the camshaft to correctly couple with the distributor shaft to maintain ignition timing.

Timing Gears—The camshaft is driven by a steel gear on the crankshaft and a fibre gear on the camshaft. Lubrication is positive through a jet pressed into the crankcase directly back of the contact point of the gears. When the gears are removed, check both the jet and oil passage to make sure they are clear.

When it becomes necessary to replace the timing gears, due attention must be given to the end play of both shafts and running clearance of the gears.

End play of the crankshaft is controlled by the running clearance between the crankshaft gear and the gear thrust plate, Fig. 8. The end play is adjusted by shims placed between the thrust plate and the end of the front main bearing. Shims .002 in. thick are available for this adjustment. When the thrust plate or washer is removed, be sure it is reinstalled with the beveled inner edge toward the crankcase.

End play of the camshaft is determined by the running clearance between the camshaft gear and thrust plate. The standard clearance is .003 to .0055 in. which is determined by the thickness of the camshaft gear thrust plate spacer, Fig. 9. Should a check indicate not enough clearance, place a thin shim between the thrust plate spacer and the shoulder on the camshaft. Clearance may be reduced by dressing off the spacer slightly. Whenever the spacer is installed, make sure that the beveled inner edge is toward the rear.

End play of both the camshaft and crankshaft can best be measured with a dial indicator.

Standard running clearance between the gears is .000 to .002 in., which should be checked with a dial indicator.

Valve Timing—To set the valve timing, install the crankshaft gear followed by the camshaft gear with the camshaft positioned to allow installation with the timing gear marks meshed.

PISTONS & RODS, REMOVE

1951-52—After removing the cylinder head and oil pan, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove connecting rod caps and push pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so they can be reinstalled in original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1951-52—As shown in Fig. 10, pistons should be assembled to the connecting

rods so that the oil spray hole in the rod faces away from the camshaft side of the engine with the vertical slot in the piston facing the camshaft side

Unlike the four-cylinder rods which are offset, six-cylinder rods are not and, therefore, they are interchangeable.

PISTONS

1951-52—Standard size service pistons are high limit or maximum diameter, therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages Service pistons are also furnished in 005, 010, 015, 020 and 030 in oversizes

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin (thrust side of piston) Then select the smallest piston for the first fitting The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free

It is very important that refinished cylinder bores are trued up to have not more than 0005 in out-of-round or taper Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface During final honing each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly The dry bore should then be brushed clean with a power-driven fibre brush

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore therefore the cylinder should be allowed to cool after boring or honing and before the piston fit is checked This is important because a difference of 10 degrees between the temperature of parts is sufficient to produce a variation of 0005 in

To check the fit of pistons, use a feeler ribbon gauge ¾ in wide and the thickness listed in the *Piston & Ring Data* chart Insert the piston upside down in the cylinder bore with rings removed Locate the feeler 90 degrees from the piston pin hole, between the thrust face of the piston and cylinder wall Hook the feeler to a spring scale If the force required to pull the feeler out of the cylinder with the scale is as specified in the chart, the piston fit is correct If too tight, the cylinder must be honed out until the proper clearance is obtained.

PISTON RINGS

1951-52—When new piston rings are to be installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter This is done with a "Glazebuster" or with a hone equipped with the finest grade of stones

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive Piston rings are not furnished in oversize widths to compensate for ring groove wear

See the *Piston and Ring Data* chart for ring groove clearances and end gap clearances

To check the end gap of rings, place the ring in the cylinder in which it will be used Square it in the bore by tapping with either end of the piston, then measure the gap with feeler gauges If necessary to increase the gap, file the ends of rings carefully with a smooth file

PISTON PINS

1951-52—Piston pins are locked in the rods and fitted with a clearance of 0001 to 0005 in which is equivalent to a light thumb push fit with the parts at normal room temperature No oversize pin is available as it is impossible to ream the connecting rod satisfactorily due to the clamp slot, and also because the piston plating should not be removed from the piston pin bore

CONNECTING ROD BEARINGS

1951-52—Connecting rod bearings consist of two half shells, the upper shell having an oil spray hole which communicates with the oil hole in the rod

When the shells are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning *The ends of the shells must never be filed flush with the parting surface of the rod and cap*

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment Under no circumstances should the rod or cap be filed to adjust bearing clearance

Service bearings are furnished in standard size and several undersizes, including undersizes for reground crankshafts

The clearance of connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber and full instructions for its use are furnished with the envelope in which it is contained

Lacking Plastigage, however, clearance may be checked with a 002 in test shim ¾ in square Place the shim between the bearing and shaft journal Install the cap, tightening the nuts to the recommended torque A locked bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed Do not overlook removing the shim

The connecting rod nuts are locked with stamped nuts which should not be reused when once removed Install these nuts with the flat face toward the connecting rod nut Turn the locking nut finger tight and then tighten it only a half-turn more

CRANKSHAFT & MAIN BEARINGS

1951-52—When necessary to remove the crankshaft the engine will have to be removed from the chassis And since the main bearings on the four-cylinder engine are held in place by dowels, the engine will have to be removed when their replacement becomes necessary

Main bearings on the six-cylinder engine may be removed and installed without removing the engine

The bearings are made to size and do not require line reaming or adjustment

When it is necessary to install new bearing shells it is advisable to measure the shaft journals with a micrometer for being out-of-round If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or connecting rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft Undersize bearings of 010 and 020 in are available

Before installing the shaft and bearings, use a rifle brush to clean the oil passages thoroughly in both the shaft and crankcase If possible blow out the holes with compressed air Be sure the journals are not nicked or scored and that all parts are thoroughly clean

After installing the bearings, check the running clearance to be sure it is standard (see *Engine Bearing Data* chart) Use Plastigage or a 002 in test shim about one inch square Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct Do not overlook removing the test shim

CRANKSHAFT END PLAY

1951-52—End play of the crankshaft is adjusted by shims placed between the crankshaft thrust washer and the face of the front main bearing The end play is adjusted as outlined under *Timing Gears*

REAR BEARING OIL SEAL

1951-52—The rear main bearing is sealed against external leakage in the following manner.

1. An oil slinger machined on the crankshaft rotates in a groove formed in the crankcase and bearing cap just to the rear of the bearing
2. Braided fabric seals are pressed into the grooves formed in the crankcase and bearing cap to the rear of the oil collecting groove
3. Rubber packings are installed be-

tween the bearing cap and crankcase. These protrude about ¼ in. from the case. However, when the oil pan is installed it will force the packings tightly into the holes and effectively seal any opening between the bearing cap and crankcase.

The braided fabric seal can be installed in the crankcase only when the crankshaft is removed. However, the seal can be replaced in the bearing cap whenever the cap is removed. Remove the old seal and place the new seal in the groove with both ends projecting above the parting surface of the cap. Force the seal into the groove by rubbing down with a hammer handle or smooth wood stick until the seal projects above the groove not more than $\frac{1}{16}$ in. Cut the ends off flush with the surface of the cap, using a sharp knife or razor blade.

Operate the engine at slow speed when first started after a new braided seal is installed.

ENGINE OILING

OIL PAN

1951-52 Four — Removing the oil pan from these engines presents no complications.

1951-52 Six—The procedure for removing the oil pan is as follows:

1. Drain radiator and remove upper and lower hose.
2. Unfasten engine front end plate from front support insulators.
3. Raise and support front of car in a suitable manner.
4. Drain engine oil.
5. Disconnect tie rod from pitman arm.
6. Loosen rear engine support insulator-to-crossmember bolts just enough to prevent distortion of the rear insulator when the front of the engine is raised.
7. Using a suitable hoist attached to the front cylinder head bolt, carefully lift front of engine until sufficient clearance is evident between the bottom of the oil pan and the front crossmember to provide for the removal and installation of the pan.
8. Remove right-hand front engine support bracket. Then remove the pan.

OIL PUMP

1951-52—The oil pump is located externally on the left side of the engine. When necessary to remove the pump, first remove the distributor cap and note the position of the rotor so that the pump may be reinstalled without disturbing the ignition timing.

To install the pump without disturbing the timing, the pump gear must be correctly meshed with the camshaft driving gear to allow engagement of the driving key on the distributor shaft in the pump shaft driving slot without moving the distributor rotor. Assembly can be made only in one position because the slot and driving key are machined off-center.

To disassemble the pump, Fig. 11, remove the cover and gasket. Hold a hand over the cover opening and, with the pump upside down, turn the shaft until the outer rotor slips out. Drive out the pin securing the drive gear to the shaft. Press the shaft out of the gear and slide the shaft and inner rotor out of the body.

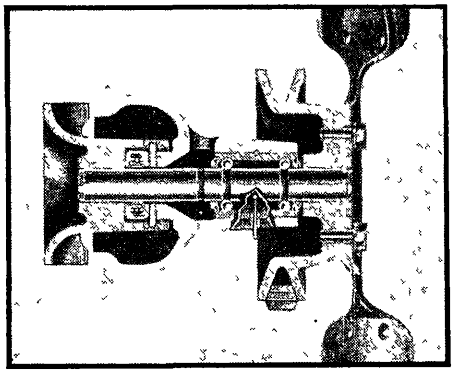


Fig. 12 1951-52 four-cyl. water pump

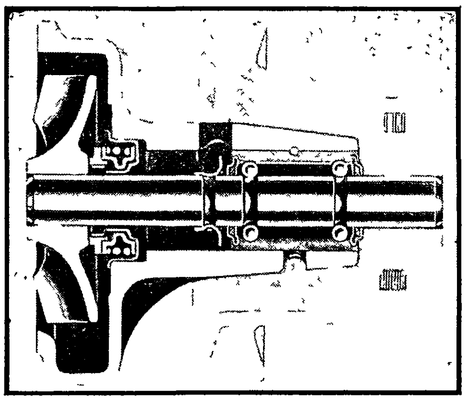


Fig. 13 1951-52 six-cyl. water pump

Failure of the pump to operate at full efficiency may usually be traced to excessive clearance between the rotors. The clearance between the outer rotor and pump body should also be checked.

End play of the rotors is controlled by the thickness of the cover gasket which is made of special material which can only be slightly compressed. Never use other than a standard factory gasket.

In checking the pump for wear, follow the procedure outlined and illustrated in the Chrysler chapter for the rotor type pump.

CRANKCASE VENTILATION

1951-52 — These engines are equipped with positive sealed type crankcase ventilation which reduces to a minimum condensation and the formation of sludge. The correct operation of the system depends upon the free flow of air from the carburetor air cleaner through the oil filler tube and engine to the control valve mounted in the intake manifold.

Be sure there is no air leakage at the tube connection, and that the oil filler tube cap gasket is in good condition. Always keep the cap locked securely.

Be sure that the ventilator valve, mounted in the intake manifold operates at all times. Should the valve become clogged with carbon the ventilating system will not operate and a pressure will build up in the engine crankcase which may cause oil loss at the rear main bearing or by the piston rings.

Should the valve fail to seat it will be impossible to make the engine idle satisfactorily. When the valve operates correctly, a slight vacuum is present in the crankcase which is of material assistance in oil control.

Clean the ventilator valve each time the valves are ground or the engine tuned.

OIL PRESSURE REGULATOR

1951-52—The pressure of the oil pump is controlled by an oil relief valve built into the pump, Fig. 11. The pressure can be altered by installing or removing shims from between the retainer and the spring. Adding shims increases pressure only at higher speeds but not at idle speed.

The pressure at which the relief valve opens is approximately 30-35 lbs. at 30-40 mph. This gives an engine idle speed pressure of approximately 10 lbs.

COOLING SYSTEM

RADIATOR, REMOVE

1951-52—Drain the cooling system, disconnect the upper and lower hose, unfasten the radiator from its mounting and life it out. On four-cylinder engines, it is necessary to remove or move back the radiator shroud.

WATER PUMP, REMOVE

1951-52—Remove the fan belt and blades. Unfasten the water pump from the engine and lift it out.

WATER PUMP, OVERHAUL

1951-52—To disassemble the pump, Figs. 12 and 13, pull out the bearing retainer wire and press the shaft through the impeller and pump body. Remove the seal washer and seal. Place the pump shaft and pulley assembly in a press in such a position that the bearing will clear the opening in the press bed and press the shaft from the pulley.

To reassemble the pump, install the long end of the shaft in the pump body from the front end until the outer end of the bearing is flush with the front end of the body. Dip the seal and washer in brake fluid and install them in the impeller. Place the impeller on the bed of a press and press the long end of the shaft into the impeller until the end of the shaft is flush with the impeller. Support the assembly on the impeller end of the shaft and press the fan pulley on the shaft so that the end of the shaft is flush with the face of the fan pulley. Move the shaft in the body so that the grooves in the bearing and pump body line up, then lock in position with the bearing retainer wire.

ELECTRIC SYSTEM

IGNITION TIMING

1951-52—Turn the engine over to bring No. 1 piston up on its compression stroke and, after removing No. 1 spark plug, continue cranking the engine until the

"IGN" mark on the flyweel appears in the center of the opening in the flywheel housing.

Rotate the distributor so that it is ready to fire No. 1 cylinder—with the points just breaking. Mount the distributor on the engine and, when the end of the shaft enters the driving collar, rotate the distributor by means of the rotor back and forth until the driving lug on the end of the distributor shaft enters the slot in the coupling. Then push the distributor down and install the hold-down screw.

Connect the primary wire to the distributor and rotate the distributor body until the points are just breaking and lock in place with the clamp screw.

For best results, check the timing with a timing light or a test lamp. Advance or retard the distributor to compensate for the grade of fuel used. For best performance and fuel economy, the ignition setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

CLUTCH

CLUTCH PEDAL, ADJUST

1951-52—When checking the clutch linkage and making adjustments to provide correct free pedal travel, see Fig. 14 and proceed as follows:

1. Disconnect the spring which acts as a return and pedal assist spring and the clutch pedal adjusting rod.
2. Check the clearance between the rounded forward end of the release fork adjusting rod and the clutch housing when the release bearing is just contacting the clutch release levers. This clearance should be ⅝ in.
3. If clearance is less than ½ in., adjust the release fork adjusting rod length to provide ⅝ in. clearance. The rod can be made more accessible by removing the bellcrank from its pivot with the rod still attached. Grease the bellcrank pivot before reassembling.
4. Connect and adjust the length of the pedal adjusting rod to obtain the proper pedal travel of one inch, measured at the pedal pad.
5. Connect the clutch pedal combination return and assist spring.

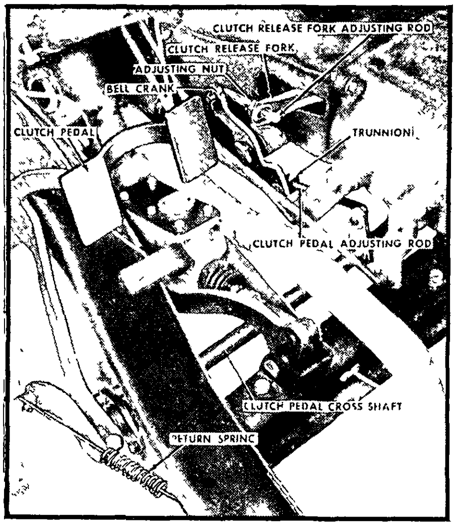


Fig. 14 1951-52 clutch linkage

6. Check clutch linkage operation. If stiffness or binding occurs, lubricate thoroughly and recheck pedal free travel to be sure adjustment was made correctly.

CLUTCH REMOVAL

1951-52 — Remove the transmission as outlined further on, and take off the clutch housing. Mark the clutch cover and flywheel so the original balance will be maintained upon reassembly. Loosen the capscrews holding the clutch to the flywheel a little at a time progressively until clutch spring pressure is relieved. Remove the screws and lift out the clutch.

The clutch may be serviced as outlined in the *Clutch Chapter.*

TRANSMISSION

TRANSMISSION REMOVAL

1951-52—The following sequence of removal covers the transmission and overdrive. To remove a standard transmission without overdrive, disregard operations listed for the overdrive.

1. Disconnect shift rods at transmission.
2. Disconnect two wires from overdrive solenoid. Tag wires and terminals for reassembly.
3. Disconnect two wires at overdrive rail switch. Tag wires and terminals for reassembly.
4. Disconnect front universal joint at transmission.
5. Disconnect speedometer cable at transmission. Use an ordinary cork of suitable size to close cable opening to prevent leakage of lubricant.
6. Disconnect overdrive control cable and conduit.
7. Unfasten rubber mountings from transmission.
8. Remove overdrive governor.
9. Place a jack under the flywheel housing and raise it sufficiently to be tight under the housing.
10. Remove frame cross member with rubber mountings attached.
11. Place jack under engine so it is supported when transmission is removed.
12. Unscrew the four screws attaching the transmission to the clutch housing as far as possible and yet support the weight of the transmission. Pull transmission back as far as the bolt heads, which will provide about ¾ in. opening between the two housings and at the same time relieve the pressure on the clutch release fork. Use a long screwdriver through the opening in the side of the clutch housing to pry the clutch release fork from engagement with the release bearing carrier.
13. Complete removal of four transmission screws, and pull the transmission back until the clutch shaft clears the clutch housing. Transmission may then be removed with the clutch release bearing carrier mounted on the main drive gear bearing retainer.

TRANSMISSION, OVERHAUL

1951-52—Figs. 15 and 16 illustrate the construction of both the standard and overdrive transmission. The overdrive transmission is in reality two separate assemblies. The transmission proper is the same as the standard unit without overdrive except for the mainshaft which is longer and extends into overdrive case.

Overhaul routine as outlined below refers to the transmission section of the unit. For details on the overdrive, see the *Overdrive Chapter.*

1. Remove cover, front flange and snap rings from main drive gear bearing.

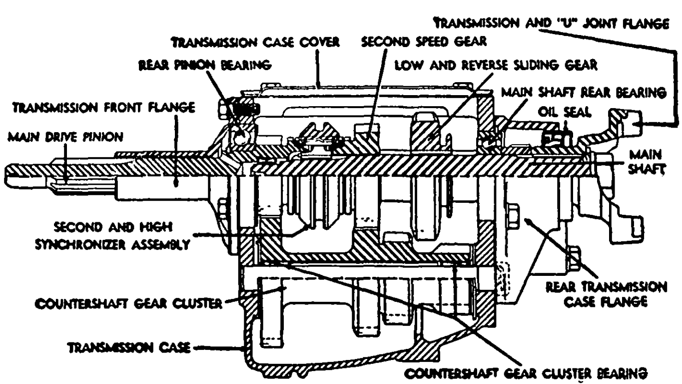


Fig. 15 1951-52 standard transmissi n

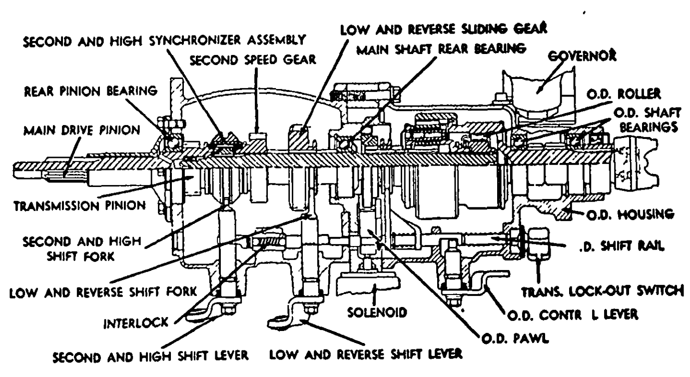


Fig. 16 1951-52 verdrive transmissi n. F r detailed s rvice n verdriv se v rdrive Chapter

2. Use puller to remove main drive gear bearing. Use a synchronizer ring protector to take up the thrust and prevent possible damage to the synchronizer.

3. Pull off the companion flange, remove the rear bearing retainer and oil seal and slide the speedometer drive gear off the shaft.

4. Mark the synchronizer blocker rings, gear and sleeve so that these parts may be reassembled in their original position.

5. Raise the main drive gear over the countershaft gear from the case.

6. Cock the mainshaft to the side as far as possible, disengage and remove the shift forks.

7. Release the synchronizer snap ring, grasp the mainshaft parts and slide the shaft through these parts and out through the rear of the case.

8. Remove the lock plate and drive the countershaft out forward.

9. Lift out the cluster gear and washers, noting the position of these parts.

10. Drive out the shaft and lift out the reverse idler gear.

11. Remove the shaft locating pins and take out the shaft levers, shafts and oil seals.

12. Assemble the transmission in the reverse order, being sure to use new gaskets, oil seals and snap rings.

GEARSHIFT

GEARSHIFT, ADJUST

1951-52—Refer to Fig. 17 and adjust the linkage as outlined below:

1. With the shift lever below the steering wheel in neutral, loosen the trunnion lock nuts at each lever on the steering column.

2. Remove the cap from the shift lever housing and install special Gauge KF-69 in the housing.

3. Run the lock nuts up against the pivots and tighten, being careful not to spring the levers.

4. Remove the gauge and install the cap.

REAR AXLE

REAR AXLE SERVICE

1951-52—In this type axle, Fig. 18, the drive pinion is held in position by shoulders in the differential carrier, upon which the pinion bearing cups seat. The pinion position is maintained by shims located between the rear bearing and the rear shoulder in the differential carrier. Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings.

The shimmed type of differential bearing adjustment is employed. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle Chapter*.

The axle tubes are pressed into the differential carrier to form a one-piece housing. To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

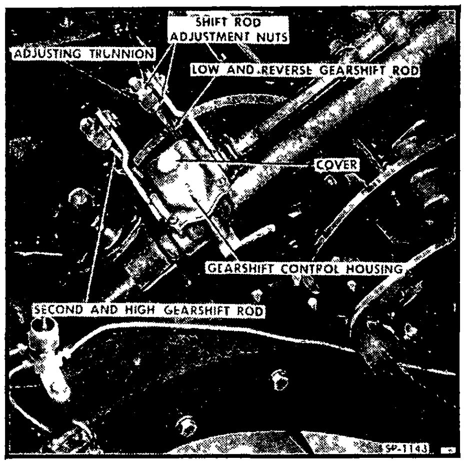


Fig. 17 1951-52 gearshift mechanism

Pinion & Bearings, Replace—After removing the axle shafts and differential unit, unscrew the pinion flange retaining nut and pull off the flange. The pinion may then be removed from the carrier with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and, with a bearing remover, press the pinion shaft out of the bearing. When replacing the bearing, select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when being forced on the shaft.

Drive the front bearing cup and oil seal out of the forward end of the carrier. If the rear bearing cup is to be replaced or if the pinion setting is to be changed, remove the rear bearing cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used (see *Rear Axle Chapter*). After the required shims have been added or subtracted, replace the rear bearing cup.

When making a pinion adjustment, the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to retain the proper pinion bearing adjustment.

To install the pinion, support it under the head with a wood block while the pinion flange is reinstalled. The pinion oil seal should not be replaced until after pinion setting has been checked.

Pinion Bearings, Adjust—The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearing are tight, but still permit rotating the pinion by hand.

Pinion, Adjust—After adjusting the pinion bearings, the position of the pinion may be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the pinion and, if it is to be moved toward the center of the axle, add shims between the rear bearing and rear shoulder in the carrier. If the pinion has to be moved away from the center of the axle, remove shims from this point.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*. After satisfactory tooth contact has been established, remove the pinion flange to make the installation of the oil seal. Using a compressing collar and the pinion flange retaining nut, press the new oil seal in place. Install the pinion flange, tighten the nut solidly in place and lock it with a new cotter pin.

AXLE SHAFTS, BEARINGS & OIL SEALS

1951-52—To remove an axle shaft, Fig. 19, jack up the wheel and pull off the hub and brake drum. Block the brake pedal in such a manner that it cannot be depressed. Disconnect the hydraulic brake line from the wheel cylinder. Remove the mounting screws and take off the outer oil seal, shims and brake support. The shaft and bearing may then be pulled out of the housing. The inner oil seal may be removed at this time.

Replace the shaft and bearings in the reverse order. If the old parts are replaced and the shims have not been disturbed, the end play should be correct when the parts are assembled. However, if a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

Axle shaft end play can be checked when all parts have been replaced except the wheel and hub. To make the check, rap each axle shaft after the nuts are tight to be sure the bearing cups are seated. Then mount a dial indicator on the axle housing with its contact button touching the end of the

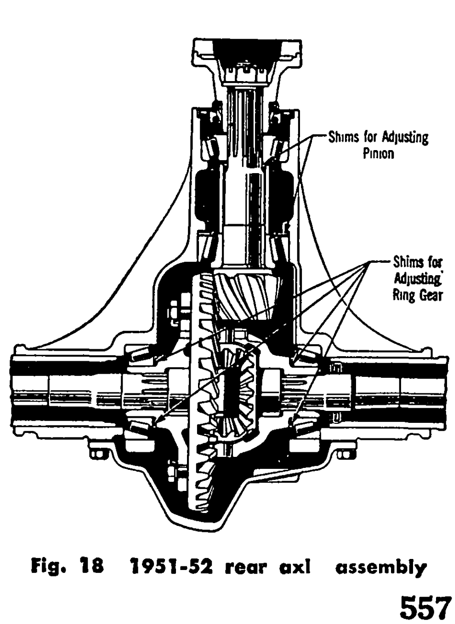


Fig. 18 1951-52 rear axl assembly

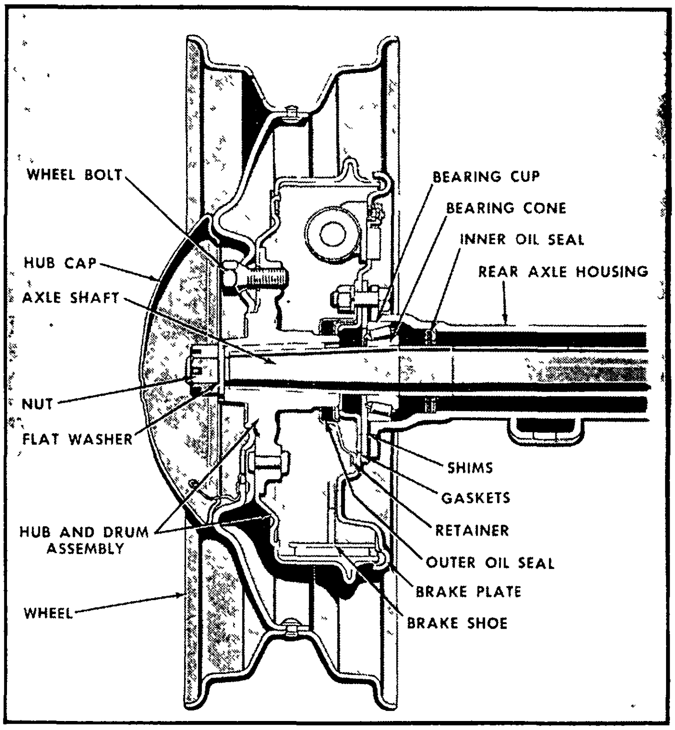


Fig. 19 1951-52 rear wheel and hub

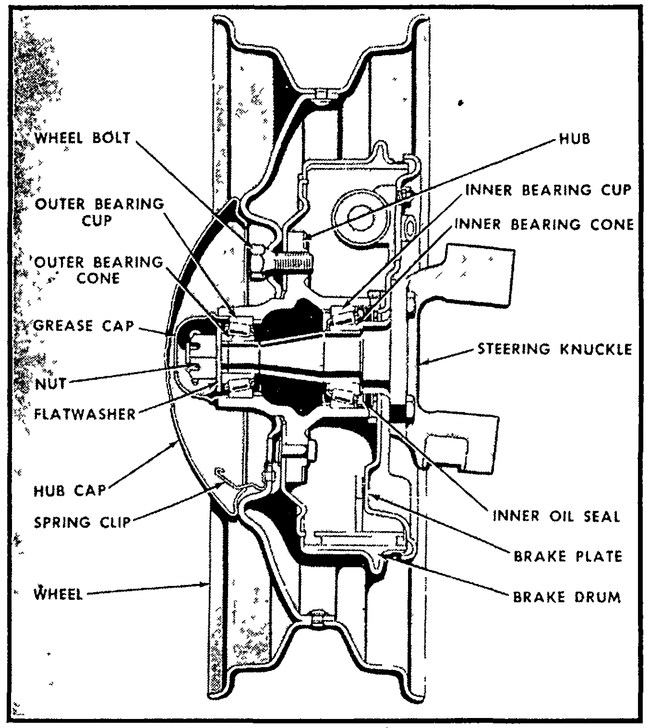


Fig. 21 1951-52 front wheel and hub

shaft. Work the shaft in and out by hand and note the reading on the indicator. If an adjustment is necessary, remove the oil seal and brake support and add or remove shims as required to bring the end play within the limits given in the *Rear Axle Data* table.

When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain the central postion of the axle shafts.

WHEEL ALIGNMENT

CASTER ADJUSTMENT

1951-52—A split or half shim is used to adjust the caster angle. The shim is mounted at one end of the inner pivot, Fig. 20. Adding the shim at the rear bolt of the inner pivot will tilt the kingpin backward creating a positive caster angle. Installing a shim at the front bolt will tilt the kingpin forward creating a negative caster angle.

CAMBER ADJUSTMENT

1951-52—A whole shim is used to adjust the camber angle, Fig. 20. Removing a shim between the upper shock absorber support and inner pivot will tilt the wheel outward at the top. Installing a shim will tilt the wheel inward.

TOE-IN ADJUSTMENT

1951-52—To adjust the toe-in, locate the steering gear in the center of its travel. Then increase or decrease the length of the right-hand tie rod until the wheel is in the straight-ahead position, being careful not to change the position of the steering gear. Then increase or decrease the length of the left-hand tie rod until the left wheel is straight ahead.

Adjust the tie rods by turning each sleeve an equal amount until the desired toe-in is obtained. Be sure to tighten the two clamp bolts on each adjusting sleeve.

FRONT END SERVICE

1951-52

Front Wheel Bearing Adjustment—With front wheels jacked up and brakes released, check for end play of the wheel on the steering knuckle by grasping the tire at the top and pushing and pulling alternately. If the bearings are loose, there will be perceptible end play or side movement of the wheel.

If the bearings are not loose, rotate the wheel to check for tightness—the wheel should turn freely without drag. If the wheel drags make sure it is not the brakes dragging instead of tight wheel bearings. If bearings are too tight, overheating will result. If too loose, it will cause pounding.

To adjust the bearings, see Fig. 21 and proceed as follows:

1. Release brakes and jack up wheels.
2. Remove hub cap, grease cap, and cotter pin which locks the hub nut.
3. Turn the hub nut up tight on the steering knuckle spindle to seat the bearings. Then back off the nut until end play is evident and tighten again until there is no end play. Back off the nut only enough to permit installation of the cotter pin.
4. Install the grease cap (without grease) and hub cap. Check the adjustment and remove the jack.

Kingpin & Bushings—The steering knockles are fitted with floating split-type, steel backed bushings. These bushings are a free fit and do not require driving, reaming or burnishing—they may be pressed out by hand.

1. Remove front wheel with hub and drum assembly.
2. Remove brake plate and steering arm from knuckle. Do not disconnect brake hose but support brake plate out of the way to avoid strain on hose.
3. Drive out kingpin lock pin.
4. Remove upper welch plug from

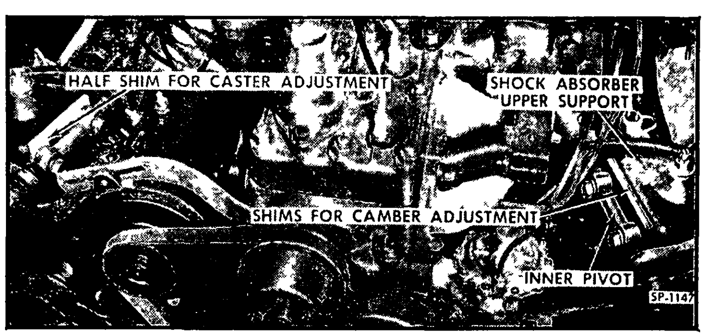


Fig. 20 1951-52 caster and caster adjustments

knuckle by piercing it with sharp pointed punch and prying out.

5. Drive kingpin down and out, which will drive lower welch plug from knuckle.

6. Remove thrust bearing and shims and push the bushings out of the knuckles.

7. To install, coat the outside of the bushings with lubricant and press the bushings in by hand. The oil groove runs out at one end. Install the bushing with this end toward the steering knuckle support. In this position the closed end of the oil groove in each bushing will be next to the welch plugs in the knuckle.

8. To install the knuckle, place it on the knuckle support. Insert the thrust bearing, open side down, between the lower face of the support and the steering knuckle. Fit shims between the top face of the support and knuckle as required to provide 0 to 5 pounds pull measured with a spring scale attached to the cotter pin hole at the outer end of the spindle. These shims are available in thicknesses of .003, .010 and .030 in. The kingpin must be installed before making this check.

9. Complete the assembly in the reverse order of disassembly.

Upper Control Arm, Remove—

1. Raise car with a jack under frame side rail until front wheel is off the floor and remove wheel and tire assembly.

2. Place another jack under lower control arm to hold arm and coil spring in position while upper arm is removed.

3. Place block under brake drum, or fasten steering knuckle support to coil spring with strong wire to hold support upright while upper control arm is removed. This will prevent top end of support swinging outward due to weight of hub and brake drum and to prevent damage to brake hose.

4. Remove two bolts which attach inner pivot to shock absorber support. If shims are used between pivot and support, set them aside and be sure they are used when installing the arm.

5. Turn pivot pin out of knuckle support, remove seals and lift off control arm.

Upper Control Arm, Repair—Be sure control arm is not disturbed or cracked and that new bushings will fit tight in holes in arm. When bushings are installed in new arm they cut threads in the arm and fit tight. New bushings used in an old arm already threaded must also fit tight. Discard bushings and seals if worn, replacing with new parts.

1. Turn the two pivot bushings out of the inner end of control arm.

2. Move pivot seals away from arm to permit moving pivot endwise enough to clear arm at one end. When one end is free, pull other end out of arm.

3. To install inner pivot, place new rubber seals on pivot, one on each end with cupped side out. Fit pivot into control arm and mount arm in a vise.

4. Start threads of the two bushings in arm. Use a large wrench and turn bushings slowly. Do not use cutting lubricant.

5. A special control arm spreader gauge should be used to establish the proper spacing between the sides of the arm. The arms should be spread apart 1/16 in. from the normal position.

6. Turn both bushings into the control arm and onto the pivot until the hex head bottoms against control arm.

7. Check the pivot to be sure it will move freely in the bushings. If the fit is correct it will resist slightly any effort to turn the pivot by hand. Do not rotate the pivot as this will change the centered position of the pivot in relation to the control arm.

8. Remove the two rubber seals on the pivot until each seats against the flange at the bushing hole in the arm. Install the grease fitting in the end of each bushing.

Upper Control Arm, Install—

1. Fit the upper control arm in place, being sure the camber adjusting shims are installed between the shock absorber support and inner pivot. Use same thickness of shims as previously removed. If shims were not used originally do not install any. Need for use of shims can be positively determined only when adjustment for proper camber is made.

2. Attach outer end of pivot in reverse order of removal.

Front Spring, Replace—

1. Place jack under lower control arm, raise wheel off floor and remove wheel and tire assembly.

2. Disconnect stabilizer link from lower control arm.

3. Remove shock absorber retaining nut from lower side of spring seat.

4. Support car frame by another jack.

5. Unfasten lower control arm shaft from frame crossmember.

6. Slowly lower jack under control arm until spring is loose and can be taken out. It is not necessary to remove shock absorber.

7. Reverse the foregoing operations to install the spring.

Lower Control Arm Service—Check the control arm for distortion or cracks and be sure new bushings fit tight in the arm. When bushings are installed in a new arm they cut threads in the arm and fit tight. New bushings installed in an arm already threaded must also fit tight.

1. Remove front spring as outlined previously. Then remove lower control arm from knuckle support. Do not remove bushing from lower end of knuckle support unless it is worn or loose and needs to be replaced.

2. Turn inner pivot bushings off ends of pivot shaft and out of control arm.

3. Move pivot seals away from arm to permit moving shaft endwise enough to clear the arm at one end. Then pull the other end out of the arm.

4. Place new rubber seals on the shaft, one on each end with cupped side out.

5. Fit pivot shaft into arm and mount arm in a vise close to the end to prevent springing or distortion.

6. Start bushings in control arm. Use a large wrench and turn bushings slowly. Do not use cutting oil.

7. Use a suitable spreader tool between inner ends of arm so bushings will screw on pivot shaft properly and so pivot shaft bolt holes will line up with holes in frame crossmember.

8. Turn bushings into arm and onto pivot shaft until hex heads of bushings bottom against control arm.

9. Remove spreader gauge and move seals on pivot shaft and over ends of bushings and against side of arm. Do not turn pivot shaft after removing spreader gauge or the equalized spacing between the sides of the arm and the bolt holes in the pivot shaft will change, causing it to be incorrect.

10. Install a grease fitting in the end of each bushing and install the control arm on the car in the reverse order of its removal.

Front Shock Absorber, Replace—Front shock absorbers may be removed without taking out the coil springs. The procedure is as follows:

1. Raise front end of car with a jack under the frame side rail to relieve tension of the front spring.

2. Unfasten the shock absorber from the lower spring seat. Prevent turning of lower end of shock absorber during this operation by holding with pliers between coils of front spring.

3. Compress shock absorber until stud in lower end clears spring seat and shock absorber lower support.

4. Remove support which sets on top of spring seat by pulling it out between coils of spring. This will permit withdrawal of shock absorber through opening in lower spring seat after removing the retaining nut from the upper end of the shock absorber.

5. Reverse the foregoing operations to install the shock absorber.

STEERING GEAR

STEERING WHEEL, REPLACE

1951-52—First pry the medallion (button) out of the horn ring or horn button. Then remove the wheel as follows:

1. Turn the contact plate 1/3 turn to the left and lift it out of the spacer.

2. Disconnect cable at lower end of steering gear inside engine compartment.

3. Pull cable out through top end of steering column.

4. Unscrew steering wheel nut.

5. Lift horn button bezel or horn ring from steering wheel and remove rubber cushion ring.

6. Use a suitable puller to remove steering wheel.

7. The horn blowing mechanism parts assembled to the horn button bezel or horn ring are disassembled by removing three attaching screws.

8. Reverse the foregoing operations to install the steering wheel.

STEERING GEAR, REPLACE

1951-52—To remove the steering gear, first take off the steering wheel as outlined previously. The steering column jacket with gearshift mechanism attached is pulled upward through the toeboard into the inside of the body, and the steering gear, including the column, is moved forward toward the radiator and removed by lifting it out of the engine compartment.

HUDSON & TERRAPLANE

INDEX OF SERVICE OPERATIONS

HUDSON & TERRAPLANE

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Terraplane Special 6	G	112	In Block	3 x 5	212.1	6.00	88 @ 3800		A
	Terraplane De Luxe 6	GU	112	In Block	3 x 5	212.1	6.00	88 @ 3800		A
	Big Six	GH	116	In Block	3 x 5	212.1	6.25	93 @ 3800		A
	Special 8	HT	117	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	De Luxe 8	HU	117	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	Special 8	HTL	124	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	De Luxe 8	HUL	124	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	Custom 8	HHU	124	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
1936	Terraplane De Luxe 6	61	115	In Block	3 x 5	212.1	6.00	88 @ 3800		A
	Terraplane Custom 6	62	115	In Block	3 x 5	212.1	6.00	88 @ 3800		A
	Custom 6	63	120	In Block	3 x 5	212.1	6.25	93 @ 3800		A
	De Luxe 8	64	120	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	Custom 8	65	120	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	De Luxe 8	66	127	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
	Custom 8	67	127	In Block	3 x 4½	254.5	6.00	113 @ 3800		A
1937	Terraplane Business 6	70	117	In Block	3 x 5	212.1	6.25	96 @ 3900		A
	Terraplane Business 6	78	124	In Block	3 x 5	212.1	6.25	96 @ 3900		A
	Terraplane De Luxe 6	71	117	In Block	3 x 5	212.1	6.25	96 @ 3900		A
	Terraplane Super 6	72	117	In Block	3 x 5	212.1	6.25	96 @ 3900		A
	Custom 6	73	122	In Block	3 x 5	212.1	6.25	101 @ 4000		A
	De Luxe 8	74	122	In Block	3 x 4½	254.5	6.25	122 @ 4200		A
	Custom 8	75	122	In Block	3 x 4½	254.5	6.25	122 @ 4200		A
	De Luxe 8	76	129	In Block	3 x 4½	254.5	6.25	122 @ 4200		A
	Custom 8	77	129	In Block	3 x 4½	254.5	6.25	122 @ 4200		A
1938	Terraplane Business 6	80	117	In Block	3 x 5	212.1	6.25	101 @ 4000	160 @ 1300	A
	Terraplane Business 6	88	124	In Block	3 x 5	212.1	6.25	101 @ 4000	160 @ 1300	A
	Terraplane De Luxe 6	81	117	In Block	3 x 5	212.1	6.25	101 @ 4000	160 @ 1300	A
	Terraplane Super 6	82	117	In Block	3 x 5	212.1	6.25	96 @ 3900	170 @ 1300	A
	Six "112"	89	112	In Block	3 x 4⅛	175.0	6.50	86 @ 4000	138 @ 1400	A
	Custom 6	83	122	In Block	3 x 5	212.1	6.25	101 @ 4000	170 @ 1300	A
	De Luxe 8	84	122	In Block	3 x 4½	254.5	6.25	122 @ 4200	200 @ 1800	A
	Custom 8	85	129	In Block	3 x 4½	254.5	6.25	122 @ 4200	200 @ 1800	A
	Country Club 8	87	129	In Block	3 x 4½	254.5	6.25	122 @ 4200	200 @ 1800	A
1939	Six "112"	90	112	In Block	3 x 4⅛	175.0	6.50	86 @ 4000	138 @ 1400	A
	Business 6	98	119	In Block	3 x 4⅛	175.0	6.50	86 @ 4000	138 @ 1400	A
	Pacemaker	91	118	In Block	3 x 5	212.1	6.25	101 @ 4000	168 @ 1200	A
	Six	92	118	In Block	3 x 5	212.1	6.25	96 @ 3900	160 @ 1200	A
	Country Club 6	93	122	In Block	3 x 5	212.1	6.25	101 @ 4000	168 @ 1200	A
	Country Club 8	95	122	In Block	3 x 4½	254.5	6.25	122 @ 4200	198 @ 1600	A
	Custom Country Club 8	97	129	In Block	3 x 4½	254.5	6.25	122 @ 4200	198 @ 1600	A
1940	Traveler 6	40T	113	In Block	3 x 4⅛	175.0	7.00	92 @ 4000	138 @ 1400	A
	De Luxe 6	40P	113	In Block	3 x 4⅛	175.0	7.00	92 @ 4000	138 @ 1400	A
	Business 6	40C	113	In Block	3 x 4⅛	175.0	7.00	92 @ 4000	138 @ 1400	A
	Super 6	41	118	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Country Club 6	43	125	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Big Boy Sedan 6	48P	125	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Big Boy Business 6	48C	125	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Eight	44	118	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	De Luxe 8	45	118	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Country Club 8	47	125	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1941	Traveler 6	10T	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	De Luxe 6	10P	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	Business 6	10C	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	Super 6	11	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 6	12	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Big Boy Sedan 6	18P	128	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Big Boy Business 6	18C	128	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 8	14	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore Custom Coupe 8	15	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore Custom Sedan 8	17	128	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A

Year	Model Designation		Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1942	Traveler 6	20T	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	De Luxe 6	20P	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	Business 6	20C	116	In Block	3 x 4⅛	175.0	7.25	92 @ 4000	138 @ 1400	A
	Big Boy Business 6	28C	128	In Block	3 x 5	212.0	6.50	102 @ 4000	138 @ 1400	A
	Super 6	21	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 6	22	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 8	24	121	In Block	3 x 4½	254 5	6.50	128 @ 4200	198 @ 1200	A
	Commodore Custom Coupe 8	25	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore Custom Sedan 8	27	128	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1946	Super 6	51	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 6	52	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commercial 6	58	128	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Super 8	53	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore 8	54	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1947	Super 6	171	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commodore 6	172	121	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Commercial 6	178	128	In Block	3 x 5	212.0	6.50	102 @ 4000	168 @ 1200	A
	Super 8	173	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore 8	174	121	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1948	Super 6	481-P	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	121 @ 4000	200 @ 1600	40 @ 30
	Commodore 6	482	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	121 @ 4000	200 @ 1600	40 @ 30
	Super 8	483	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore Custom 8	484	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1949	Super 6	491-P	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	121 @ 4000	200 @ 1600	40 @ 30
	Commodore 6	492	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	121 @ 4000	200 @ 1600	40 @ 30
	Super 8	493	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore Custom 8	494	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1950	Pacemaker 6	500	120	In Block	3⁹⁄₁₆ x 3⅞	232.0	6.70	112 @ 4200	175 @ 1600	40 @ 30
	Pacemaker 6	500A	120	In Block	3⁹⁄₁₆ x 3⅞	232.0	6.70	112 @ 4200	175 @ 1600	40 @ 30
	Super 6	501	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	123 @ 4000	200 @ 1600	40 @ 30
	Commodore 6	502	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.50	123 @ 4000	200 @ 1600	40 @ 30
	Super 8	503	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
	Commodore 8	504	124	In Block	3 x 4½	254.5	6.50	128 @ 4200	198 @ 1600	A
1951	Pacemaker 6	4A	119	In Block	3⁹⁄₁₆ x 3⅞	232.0	6.70	112 @ 4000	175 @ 1600	40 @ 30
	Super 6	5A	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.70	123 @ 4000	200 @ 1600	40 @ 30
	Commodore 6	6A	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.70	123 @ 4000	200 @ 1600	40 @ 30
	Hornet 6	7A	124	In Block	3¹³⁄₁₆ x 4½	308.0	7.20	145 @ 3800	257 @ 1800	40 @ 30
	Commodore 8	8A	124	In Block	3 x 4½	254.5	6.70	128 @ 4200	198 @ 1600	A
1952	Pacemaker 6	4B	120	In Block	3⁹⁄₁₆ x 3⅞	232.0	6.70	112 @ 4000	175 @ 1600	40 @ 30
	Wasp 6	5B	120	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.70	127 @ 4000	200 @ 1600	40 @ 30
	Commodore 6	6B	124	In Block	3⁹⁄₁₆ x 4⅜	262.0	6.70	127 @ 4000	200 @ 1600	40 @ 30
	Hornet 6	7B	124	In Block	3¹³⁄₁₆ x 4½	308.0	7.20	145 @ 3800	257 @ 1800	40 @ 30
	Commodore 8	8B	124	In Block	3 x 4½	254.5	6.70	128 @ 4200	198 @ 1600	A

Note A: Splash Lubrication System. 4-12 lbs. pressure.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935–47	All	B	.0015	3 to 4	.009	.009	.0015–.002	.001–.0015	D	E
1948–52	Six	Above	.0015	3 to 4	.006	.006	.0015–.002	.001–.0015	D	E
	Eight	C	.0015	3 to 4	.004	.004	.0015–.002	.001–.0015	D	E

Year	Model	Spark Plugs Type	Spark Plugs Gap, Inch	Breaker Gap, Inch Note F	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M. Synchromesh Transmission	Engine Idle Speed, R. P. M. Automatic Transmission	Cylinder Head Torque, Lbs. Ft.
1935–37	Six	CH-J8	.025	.020	35–38	153624	A	Positive	600		40
	Eight	CH-J8	.025	.017	27–30	16258374	A	Positive	600		45
1938–40	Six	CH-J9	.032	.020	35–38	153624	A	Positive	600		40
	Eight	CH-J9	.032	.017	27–30	16258374	A	Positive	600		45
1941–42	Six	CH-J9	.032	.020	35–38	153624	B	Positive	600	600	40
	Eight	CH-J9	.032	.017	27–30	16258374	A	Positive	600	600	45
1946–47	Six	C	.032	.020	35–38	153624	B	Positive	600	600	40
	Eight	C	.032	.017	27–30	16258374	A	Positive	600	600	45
1948–49	Six	C	.032	.020	35–38	153624	D	Positive	600	600	70
	Eight	C	.032	.017	27–30	16258374	E	Positive	600	600	45
1950–51	Six	CH-H8	.032	.020	35–38	153624	D	Positive	600	500	70
	Eight	CH-H8	.032	.017	27–30	16258374	E	Positive	600	500	45
1952	Six (Exc. Hornet)	CH-H8	.032	.020	35–38	153624	D	Positive	560	540	70
	Hornet	CH-H11	.032	.020	35–38	153624	D	Positive	560	540	70
	Eight	CH-H8	.032	.017	27–30	16258374	E	Positive	560	540	45

A—TDC mark on flywheel.
B—1/2 inch before TDC mark on flywheel.
C—For cast iron heads, Champion J9; for aluminum heads, Champion H10.
D—UDC 1-6 mark on flywheel.
E—UDC 1-8 mark on flywheel.
F—Plus or minus .002".

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935–40	All	.006H	.008H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	C	C
1941	Six	B	B	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
	Eight	.006H	.008H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
1942	20	B	B	.010	45	28.5	32.5	40@2	.0015–.003	.003–.005	.3412	.3397
	21, 22	B	B	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
	Eight	.006H	.008H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
1946–47	Six	.010H	.012H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3417	.3407
	Eight	.006H	.008H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
1948–49	Six	.010H	.012H	.010	45	7.3	7.7	77@2 3/16	.0015–.003	.002–.004	.3417	.3397
	Eight	.006H	.008H	.010	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
1950–51	Six	.008H	.010H	.008	45	7.3	7.7	77@2 3/16	.0015–.003	.002–.004	.3417	.3407
	Eight	.008H	.010H	.008	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3412	.3397
1952	Six	.008H	.010H	.008	45	26.7	40.3	77@2 3/16	.0015–.003	.002–.004	.3417	.3412
	Eight	.008H	.010H	.008	45	10.7	18.7	40@2	.0015–.003	.003–.005	.3407	.3397

A—BTDC means before top dead center; ATDC means after top dead center.
B—With unmarked valve cover plates, intake .006", exhaust .008". Marked cover plates read intake, .010", exhaust .012".
C—1935 5/16"; 1936-37 3/8"; 1938-40 11/32".

← PISTON AND RING SPECIFICATIONS - NOTES

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Removed from above on sixes; above or below on eights.
C—Above or below.
D—Floating type. Pins retained by snap rings in piston bosses.
E—Palm push fit in piston and rod but with piston heated.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note C	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-37	All	.001-.003	.0015	1.935-1.936	.0003-.0006	.007-.013	40	B	.0007-.001	.006-.012	75
1938-47	All	.001-.003	.002-.0035	1.935-1.936	.0003-.0006	.007-.013	40	B	.0007-.001	.006-.012	75
1948-49	Six	.001-.003	.002-.0035	2.1244-2.1254	.0005-.0015	.007-.013	45	2.4988-2.4998	.0005-.0015	.003-.009	75
	Eight	.001-.003	.002-.0035	1.935-1.936	.0003-.0006	.007-.013	45	B	.0007-.001	.006-.012	75
1950-52	Six	.003-.005	.0015-.002	2.1244-2.1254	.0005-.0015	.007-.013	45	2.4988-2.4998	.0005-.0015	.003-.009	75
	Eight	A	.0015-.002	1.935-1.936	.0003-.0006	.007-.013	45	B	.0007-.001	.006-.012	75

A—Controlled by spring loaded thrust button.

B—On Six-cylinder Engines: Front, 2.341 to 2.342. Center, 2.373 to 2.374. Rear, 2.404 to 2.405.
On Eight cylinder Engines: Front, 2.279 to 2.280. No. 2, 2.311 to 2.312. No. 3, 2.341 to 2.342. No. 4, 2.373 to 2.374. Rear, 2.404 to 2.405.

C—Thrust taken by center bearing on 1935–47 models and by No. 3 bearing on 1948–52 models.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	Engine: Crankcase Refill Capacity, Quarts	Engine Grade of Oil: Above +32°F.	Engine Grade of Oil: Above +10°F.	Engine Grade of Oil: Above −10°F.	Transmission: Capacity, Pounds or Pints	Transmission Grade of Oil: Summer	Transmission Grade of Oil: Winter	Differential: Capacity, Pounds or Pints	Differential Grade of Oil: Summer	Differential Grade of Oil: Winter
1935	G	18	11	6	20	20W	10W	3	90EP	80EP	3	90EP	90EP
	GU	18	15½	6	20	20W	10W	3	90EP	80EP	3	90EP	90EP
	GH	18	15½	5	20	20W	10W	3	90EP	80EP	3	90EP	90EP
	Eight	23	15½	7	20	20W	10W	3	90EP	80EP	3	90EP	90EP
1936-37	Six	13	16½	5	20	20W	10W	3	90EP	80EP	3	90EP	90EP
	Eight	20	16½	7	20	20W	10W	3	90EP	80EP	3	90EP	90EP
1938	Six	12½	(A)16½	5	20	20W	10W	3	90EP	80EP	2¾	90EP	90EP
	Eight	17½	16½	7	20	20W	10W	3	90EP	80EP	2¾	90EP	90EP
1939	Six	12½	(A)16½	4½	20	20W	10W	2¼	90EP	80EP	2¾	90EP	90EP
	Eight	17½	16½	7	20	20W	10W	2¼	90EP	80EP	2¾	90EP	90EP
1940	Six	13	(A)16½	4½	20	20W	10W	2¼ (B)	90EP	80EP	2¾	90EP	90EP
	Eight	18	16½	7	20	20W	10W	2¼ (B)	90EP	80EP	2¾	90EP	90EP
1941-47	Six	13	16½	4½	20	20W	10W	2 (C)	90EP	80EP	2¾	90EP	90EP
	Eight	18	16½	7	20	20W	10W	2 (C)	90EP	80EP	2¾	90EP	90EP
1948-49	Six	17	20	7	30	20	20W	2 (C)	90EP	80EP	3½	90H	90H
	Eight	18	20	7	30	20	20W	2 (C)	90EP	80EP	3½	90H	90H
1950	Six	19	20	7	30	20	20W	2 (C)	90EP	80EP	3½	90H	90H
	Eight	17	20	7	30	20	20W	2 (C)	90EP	80EP	3½	90H	90H
1951-52	All	18½	20	7	30	20	20W	2 (C)	E	E	3½	90H	90H

A—12½ gallons for models 89, 90, 40.
B—With overdrive, 3 pints.
C—With overdrive, 3¼ pints. For Hydra-Matic transmission, 11 quarts.
D—Model 500, 18, Models 501 and 502, 19.
E—For standard transmission and overdrive 90EP in summer and 80EP in winter; for Hydra-Matic transmission, use Hydra-Matic fluid only.
EP—Extreme pressure (mild) lubricant.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	Terraplane	+3 1/2	+1 1/4	1/16	7
	Hudson	+4 1/4	+1 1/4	1/16	7
1936	All	+4	+1 1/4	1/16	7
1937	All	+1 1/2	+1 1/4	1/16	7
1938	Terraplane	+1 1/2	+1 1/4	1/16	7
	Hudson	+2 1/4	+1 1/4	1/16	7
1939	All	+1 1/2	+1 1/4	1/16	7
1940–41	All	Zero	+ 1/2	1/32	4 2/5
1942–47	All	+1	+1	1/32	4 2/5
1948–52	All	+1	+1	1/32	3 3/5

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935–38	All	.001–.004	Shims	Shims	.004–.010
1939–47	All	.001–.004	Shims	Shims	.002–.004
1948–52	All	.004–.006	Shims	Shims	.002–.004

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	Except HHU	Molded	19 3/16	1 3/4	5/32	1/4
	HHU	Molded	23 13/16	1 3/4	5/32	1/4
1936-37	Six	A	22 1/8	1 3/4	7/32	1/4
	Eight	A	24	1 3/4	7/32	1/4
1938-42	Six	A	22 1/8	1 3/4	3/16	1/4
	Six "112"	A	19	1 3/4	3/16	1/4
	Eight	A	24	1 3/4	3/16	1/4
1946-47	Six	A	19 27/32	1 3/4	3/16	1/4
	Eight	A	21 19/32	1 3/4	7/32	1/4
1948-49	Six	Molded	B	C	11/64	1/4
	Eight	Molded	B	C	11/64	1/4
1950-52	Pacemaker	Molded	20 7/8	1 3/4	11/64	1/4
	Except Pacemaker	Molded	B	C	11/64	1/4

A—Primary shoe, molded. Secondary, woven.
B—Front wheel 21 1/3. Rear wheel 20 7/8.
C—Front wheel 2 1/4. Rear wheel 1 3/4.

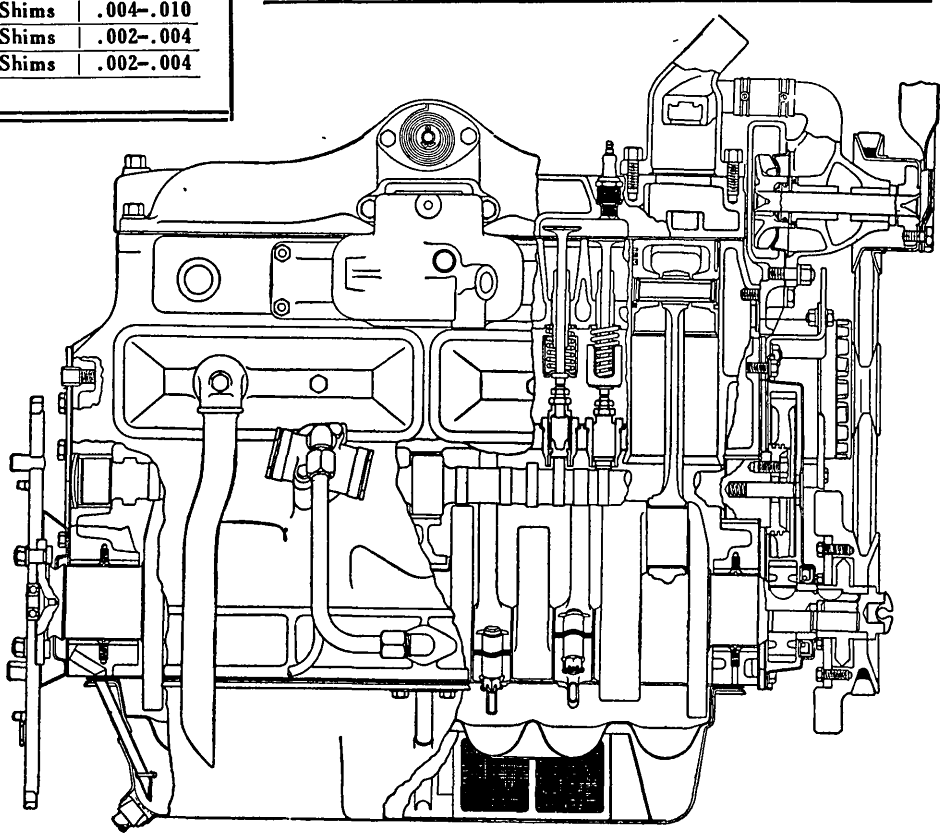


Fig. 1 Engine. Typical of all 1935-47 six-cylinder

ENGINE

ENGINE MARKINGS

1935-52—Engines are marked in production with code letters to indicate the exact diameter of cylinder bores and pistons to aid in selective fitting of pistons on the assembly line. Code letters are placed on the cylinder block along the lower face of the valve chamber and on the head of the pistons. These code letters have little value in service because some change usually has taken place in cylinder bore dimensions after the engine has been in service for some time.

All the cylinders in a given engine are not necessarily the same size and, therefore, all cylinders must be carefully measured at the bottom, below the ring travel area, before ordering new pistons and rings to make certain that the proper size pistons and rings are installed.

Some engines likewise do not have standard size main and connecting rod bearings and this is indicated by letters stamped on the underside of the block at the front left hand corner in front of the oil pan gasket. It is not necessary to remove the oil pan to see these markings. Always check for these markings, or, better still, measure the diameter of the chankshaft to prevent the possibility of installing the wrong size bearings. The letter system is as follows:

PU—Indicates .010 in. undersize rod bearings.

MU—Indicates .010 in. undersize main bearings.

PMU—Indicates .010 in. undersize main and rod bearings.

ENGINE, REMOVE & REPLACE

1935-47—Drain the cooling system and remove the hood, front seat cushion, accelerator pedal, front floor mat, transmission hole cover, clutch housing to engine bolts, engine ground strap, horns, all radiator hose, radiator tie rods and after detaching the radiator core from the frame, lift out the core.

Disconnect the wires at the generator, starter, temperature gauge and remove the wiring harness attached by clips on the left side of the engine. Disconnect the fuel pump flexible connection at the pump and remove the fuel line running from the fuel pump to the carburetor. Detach the throttle linkage, windshield wiper hose at the manifold, and the wire at the oil check valve. Unfasten the wires at the spark plugs and remove the distributor cap and high tension wires.

Remove the carburetor and air cleaner and disconnect the exhaust pipe at the manifold. Take out the front engine

FIRST SERIAL NUMBER

LOCATION—1935-36: On front of dash. 1937-51: On right front door pillar.

Year	Model		Year	Model		Year	Model		Year	Model	
1935	G	51101	1938	80	80150	1941	10T, P, C	10101	1947	171	171101
	GU	52101		88	88174		11	11201		172	172118
	GH	53101		81	81119		12	12202		178	1784476
	HT	54101		82	82153		18P	1812548		173	173186
	HU	55101		89	8928566		18C	1812548		174	174104
	HTL	57101		83	83131		14	14203	1948	481-P	481101
	HUL	58101		84	84101		15	1515490		482	482101
	HHU	56101		85	85160		17	17205		483	483101
1936	61	61101		87	87161	1942	20T, P, C	20101		484	484101
	62	62101	1939	90	90101		28C	28101	1949	491-P	491101
	63	63101		98	982995		21	211324		492	492101
	64	64101		91	9132576		22	221322		493	493101
	65	65101		92	92107		24	241318		494	494101
	66	66101		93	93104		25	255755	1950	500	500101
	67	67101		95	95106		27	271319		50A	50A-101
1937	70	70101		97	97105	1946	51	31101		501	501101
	78	78101	1940	40T, P, C	40101		52	32101		502	502101
	71	71101		41	41250		53	33101		503	503101
	72	72101		43	43370		54	34101		504	504101
	73	73101		48P	48101		58	38101	1951	4A	4A1001
	74	74101		48C	48101					5A	5A1001
	75	75101		44	44294					6A	6A1001
1937	76	76101		45	4551572					7A	7A1001
	77	77101		47	47167					8A	8A1001

Note: On models 10 and 20, if letter "L" is used in combination with the serial number, the car is equipped with the optional 3" x 5" engine.

FIRST ENGINE NUMBER

LOCATION—1935-50: On top of cylinder block. 1951 Six: On upper right front corner of block. 1951 Eight: On top of block.

Year	Model		Year	Model		Year	Model		Year	Model	
1935	G	103000	1937	71	250000	1939	90	90101	1941	12	12202
	GU	103000		72	250000		98	982995		18P	1812548
	GH	70000		73	90000		91	9132576		18C	1812548
	HT	55000		74	18000		92	92107		14	14203
	HU	55000		75	18000		93	93104		15	1515490
	HTL	55000		76	18000		95	95106		17	17205
	HUL	55000		77	180000		97	97105	1942	20T, P, C	20101
	HHU	55000				1940	40T, P, C	40101		28C	28101
1936	61	157000	1938	80	360000		41	41250		21	211324
	62	157000		88	360000		43	43370		22	221322
	63	79000		81	360000		48P	48101		24	241318
	64	1001		82	360000		48C	48101		25	255755
	65	1001		89	90101		44	44294		27	271319
	66	1001		83	98000		45	4551572			
	67	1001		84	35000		47	47167			
1937	70	250000		85	35000	1941	10T, P, C	10101			
	78	250000		87	35000		11	11201			

1946-51 engine numbers are the same as the serial numbers.

support bolts. Attach a hoist to the engine and lift it out of the chassis, moving it forward carefully while it moves away from the transmission. Remove the generator, distributor, fuel pump and clutch.

NOTE—Reverse the order of the above procedure to replace the engine. But before installing the engine, wrap a single strand of soft wire around the leather seal of the clutch throwout bearing to prevent it from curling over when the engine is being placed in the chassis. Twist the wire and place the long ends upward through the clutch housing and twist off after the engine is in place. The engine should be lowered carefully and over the clutch shaft so as to engage the splines in the clutch driving disc.

1948-52 — The engine and transmission are removed as one unit with electrical units and carburetor attached. The procedure is as follows:

1. Remove hood.
2. Drain cooling system.
3. Disconnect fuel line at junction of flexible hose and steel gas line.
4. Disconnect exhaust pipe from manifold.
5. Remove radiator hoses.
6. Disconnect remote control cable from steering column by removing hairpin lock at steering column and leave attached to transmission.
7. Disconnect starter solenoid wire.
8. Disconnect wire at starter and remove cable from battery.
9. Disconnect temperature gauge wire from side of cylinder block.
10. Disconnect oil gauge light wire.
11. Disconnect vacuum tube from windshield wiper motor.
12. Remove two generator lead wires.
13. Disconnect coil wire.
14. Remove crankcase breather.
15. Remove radiator core.
16. Drain transmission oil.
17. Drain oil from engine.
18. Remove propeller shaft center

bearing support to allow rearward movement of the drive line to clear companion flange at transmission.

19. Disconnect front propeller shaft at transmission flange.

20. Detach exhaust pipe from engine rear end plate.

21. Remove clutch cross shaft.

22. Remove gearshift control rod from transmission and leave rod attached to frame.

23. Attach a lifting rig to engine and lift it out of the chassis.

NOTE—When installing the engine, loosen the bolts holding the front engine mountings to the crossmember to allow proper front alignment when the engine is entered into the chassis. Be sure the shift lever at the steering wheel and transmission are in neutral before connecting the mechanism.

CYLINDER HEAD

1935-51—Before the cylinder head can be removed on 1935 models, it is necessary to take off the upper hose connections and fan belt or to remove the three cap screws which attach the water pump to the cylinder head.

On all models, the cylinder head has lugs cast along the left side to allow a pinch bar to be used to pry it loose from the gasket. The seal between the head and gasket can usually be broken by cranking the engine with the starter after the spark plug wires have been removed—with the ignition off.

In rare cases, it may be necessary to lift the head off with a chain hoist and two eye bolts screwed into the spark plug holes. If it is necessary to strike the head with a hammer in order to ease it off the studs, use a rawhide hammer only.

Install the gasket with the letters facing upward and tighten the head nuts in the order shown in Figs. 2 and 3, drawing them down gradually and evenly until all are normally tight. After the engine has been run sufficiently long to bring all the parts to normal operating temperature, a final tightening should be made.

VALVE CLEARANCE, ADJUST

1935-47—Valve clearance should be adjusted to the specifications given in the *Valve* table with the engine at normal operating temperature.

On 1940-47 models, jack up the front end of the car and remove the right front wheel. Unfasten the horn mounting bolts and push the horn forward out of the way. Remove the fender dust shield.

1948-52 — To adjust valves, remove the right front wheel, and the fender side shield and its extension. Take off the valve covers and breather pipe. Then adjust the tappets to the clearance given in the *Valve Data* table.

VALVE & SPRINGS

1935-52 — To remove the valves, drain the water from the radiator and remove the cylinder head and gasket. Remove the right front wheel and fender dust shield on 1940-52 models. Take off the valve cover plate and, using a suitable

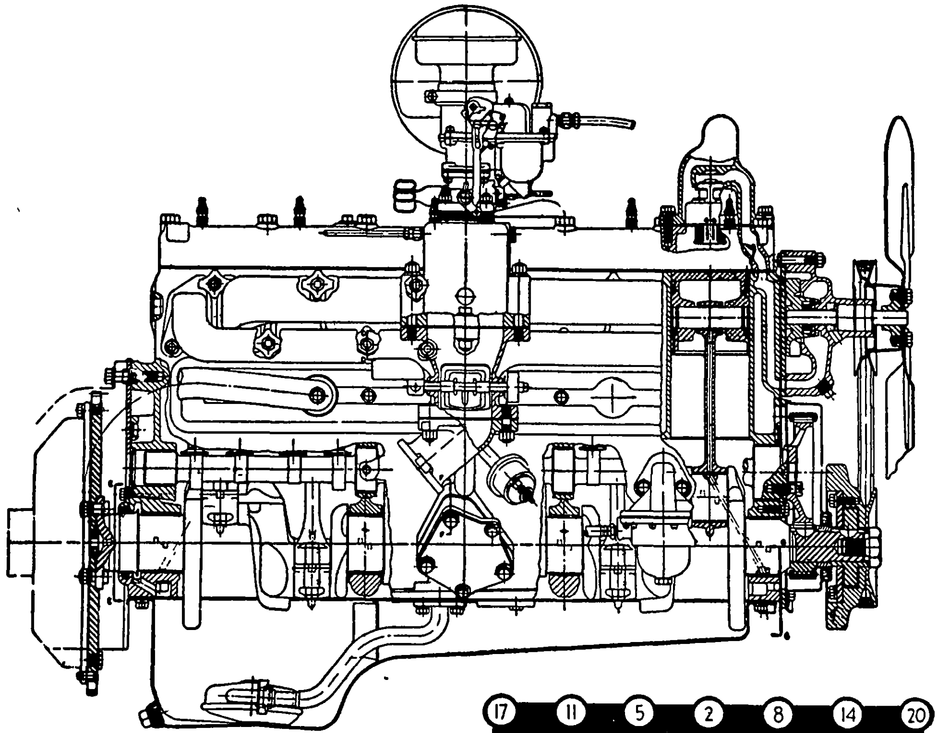


Fig. 1A 1948-52 six-cylinder engine

valve lifter tool, compress the valve springs, remove the valve locks and lift out the valves.

NOTE—Whenever valve springs are removed, they should be checked for proper tension according to the specifications given in the *Valve* table. If not within the limits specified, they should be replaced.

VALVE STEM GUIDES

1935-47—Valve stem guides are driven out from the top. When replacing guides in the six-cylinder engine, drive in the guide so that the top is $1\frac{1}{16}$″ from the top of the block. On the eight-cylinder engine, the distance from the top of the block should be $\frac{15}{16}$″.

Special tools are available to remove and replace the guides and are so designed that when the replacing tool is used, the correct position of the guides is maintained.

After the guides are pressed into the cylinder block, they should be reamed with a solid type reamer to give a clearance within the limits given in the *Valve* table. Valve guides that are worn more than .005″ oversize should be replaced.

1948-52 — Valve guides that are worn more than .005″ oversize should be replaced. Valve guides can be removed without taking out the tappets. The guides can be driven out with a suitable driver into the valve chamber or pulled out through the top with a suitable puller.

When installed, new guides on the eights should be driven in so that the top of the guide is $\frac{15}{16}$″ below the top face of the block. On the six-cylinder engine, the exhaust guides should be

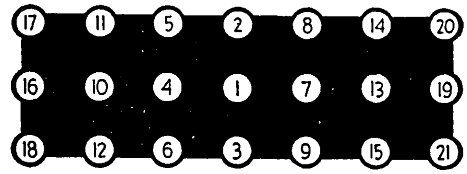


Fig. 2 Cylinder head tight ning sequence, 1935-52 six

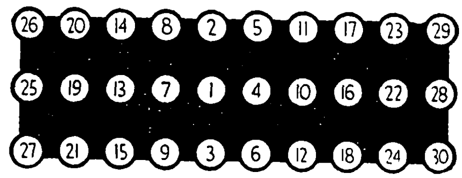


Fig. 3 Cylinder head tight ning sequence, 1935-52 ight

driven in so that there is $1\frac{3}{32}$″ from the top of the guide to the top of the block; on the intake guides this dimension should be $1\frac{7}{16}$″.

VALVE LIFTERS & GUIDES

1935-47—The valve lifter and guide assemblies can be removed without removing the cylinder head, although if the complete set is to be replaced, time can be saved by removing the cylinder head and valves and then remove the lifters.

To remove them without taking off the cylinder head, unfasten the valve chamber covers, loosen the tappet adjusting screw, remove the spring seat retainer, tappet adjusting screw and tappet guide clamp, after which, lift out the lifter and guide assembly.

1948-52—On eight-cylinder engines, valve lifters and guides are removed in the same manner as described for 1947 models.

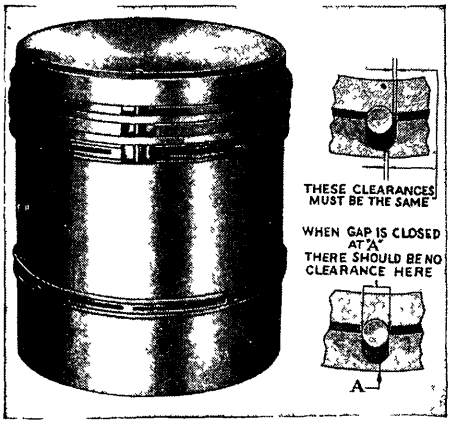


Fig. 4 Pist n and rings, 1935-52

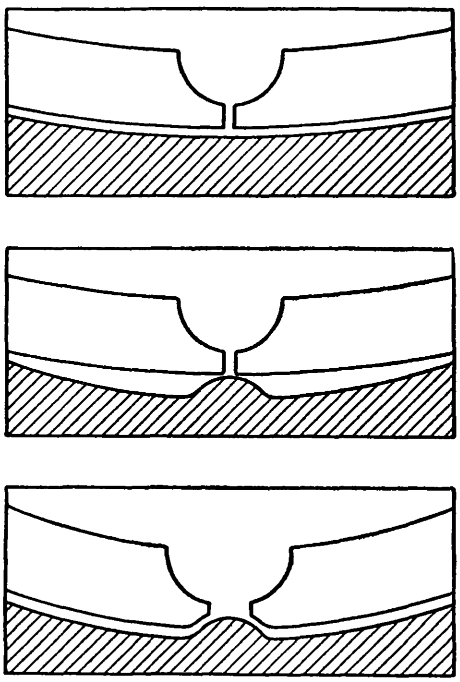


Fig. 5 1935-51 pin-milled rings. When installing new rings always hone out vertical ridge form d at ring joint position in cylind r. B tt m view shows how ridge is f rm d. C nter view shows how new rings ar held ff wall if ridge is not removed. T p vi w sh ws how new rings hug wall wh n ridge is honed out.

On the six-cylinder engine, since the valve lifters are the mushroom type operating in guides cast in the block, it is necessary to remove the camshaft and oil pan in order to remove the valve lifters. Perform these operations as described under camshaft and oil pan.

VALVE TIMING

1935-47—The crankshaft gear is keyed to the crankshaft and can be installed in only one position. The camshaft gear fits over the flange of the camshaft and is held by three unequally-spaced cap screws so that it can be located in only one position.

Correct timing is had by meshing the punch-marked tooth of the crankshaft gear between the two punch-marked teeth of the cam gear.

To check the valve timing, set No. 1 intake valve to the clearance for timing as given in the *Valve* table. Slip a .002" feeler between the tappet adjusting screw and the end of the valve stem. Then crank the engine until the intake valve commences to open which will be indicated when the feeler is gripped. The timing is correct if the valve opens when the mark on the flywheel approximately 4 teeth before the U. D. C. 1-6 or U. D. C. 1-8, lines up with the pointer in the left front face of the rear engine support plate.

1948-52—On eight-cylinder engines, valve timing is the same as given above for 1947 models.

On six-cylinder engines, valve timing is correct when there are 14 chain pins between the sprocket marks with No. 1 piston on top center in its firing position.

TIMING CASE COVER

1935-52—The timing gear cover has a leather oil seal which fits closely around the vibration damper spacer to prevent oil from leaking at this point. Before installing a new oil seal, apply a coating of red or white lead in the recess in the cover and press the oil seal tightly in place.

When installing the timing gear cover, always replace the two special bolts in exactly the same holes from which they were removed. These two bolts are located at the lower-left-hand corner of the cover.

TIMING GEARS

1935-47—Timing gear backlash should be from .002" to .004" on the six-cylinder engines and from .004" to .005" on the eights. A special .008" oversize camshaft gear is available for service replacement and may be identified by a spot of yellow paint on the front face of the gear.

To remove the gears, take off the vibration damper and timing gear cover. Crank the engine until the timing marks on the face of the gears are meshed. Remove the three screws which fasten the camshaft gear and take off the gear, after which the crankshaft gear may be pulled off.

To replace, reverse the order of the above procedure, bearing in mind that correct valve timing is obtained when the punch-marked tooth of the crankshaft gear is meshed between the two punch-marked teeth of the camshaft gear.

1948-52 — To remove the gear cover, drain the cooling system. Disconnect the hoses and remove the radiator. Remove fan blade, pulley and belt. Remove the vibration damper and gear cover.

To remove the gears, crank the engine until the timing marks line up. Then, on the eight-cylinder, remove the camshaft gear and thrust plunger. Use a suitable puller to remove the crankshaft gear.

On six-cylinder engines, it is necessary to remove the camshaft sprocket and timing chain before the crankshaft sprocket can be removed.

To install new gears on eight-cylinder engines, use a suitable pusher tool to install the crankshaft gear. Then install the camshaft gear, meshing punch-marked tooth of the crankshaft gear between the two punch-marked teeth of the camshaft gear. Install the camshaft screws and lock wire. Gear backlash should be .002" to .004".

On six-cylinder engines, after installing the crankshaft sprocket, place the timing chain on the camshaft sprocket and install both, at the same time engaging the chain with the crankshaft sprocket. When correctly assembled, there should be 7 full links between the marks on the sprockets with No. 1 piston on top dead center in firing position.

CAMSHAFTS & BEARINGS

1935-47—To remove the camshaft, take off the hood, radiator, starting crank jaw, vibration damper, fan blades, fan belt, timing gear cover, camshaft gear, valve chamber cover, valves and tappets, oil pump, fuel pump and distributor. The camshaft may now be withdrawn through the front. With the camshaft removed, the bearings may be pressed out after first removing the oil pan.

When replacing bearings, they should be installed with the locating notch at the top and with the light chamfer at the front and the $\frac{1}{16}$" chamfer at the back of the bearing. The $\frac{1}{16}$" chamfer aids in the installation of the bearings in entering the crankcase hole.

Factory reamed oversize bearings are available so that when pressed into place, they will be the proper dimensions for a running fit, thus eliminating the need for scraping or reaming. Standard size bearings with sufficient wall thickness for reaming are also available. These bearings should be line-reamed to provide a clearance of .001".

Camshaft end thrust is controlled by a compression spring in the front end of the shaft and holds the shaft against a thrust washer under the head of the shaft. This washer should be inspected for wear whenever the timing gear cover is removed. A service thrust washer is available that can be split and installed without removing the camshaft.

1948-52—The camshaft may be removed from these engines without removing the cylinder head and valves by using suitable metal jacks under the valve spring retainers to hold the valves open. These jacks can be made with ordinary strip steel. Without the jacks, the procedure for removing the camshaft is as follows:

1. Remove radiator.
2. Remove cylinder head.
3. Remove right front wheel and fender shield.
4. Disconnect vacuum pump line, windshield wiper hose, and fuel pump.
5. Remove distributor.
6. Remove oil pump.
7. Remove valve covers.
8. Remove ignition coil.
9. Remove valves.
10. On eight-cylinder engines, remove valve springs, tappets and guides.
11. On six-cylinder engines, tappets should be raised and secured by spring type clothes pins, wire or other means, sufficiently to allow removal of the camshaft.
12. On all models, remove right hand upper, lower and intermediate grille baffle and mouldings.
13. Place block of wood between oil pan and head of jack, and raise engine

1½ inches so camshaft will clear front splash guard upon removal.

14. Remove vibration damper and cover.

15. Align gear markings and remove camshaft gear or chain and sprocket.

16. Withdraw camshaft carefully to prevent damage to bearings.

NOTE—When installing camshaft, use a bronze drift through the oil pump, distributor and fuel pump holes to guide the camshaft through the bearings. On six-cylinder engines, timing chain and sprockets should be installed with No. 1 piston on top center in firing position with marks on sprockets 7 full chain links apart.

PISTONS & RODS, REMOVE

1935-52—The pistons and rods are removed from above on six-cylinder engines, whereas on the eights, they may be removed from either above or below.

PISTON & ROD, ASSEMBLE

1935-52—When assembled in the cylinders, the connecting rod oil scoop (except 1948-52 six) should face the camshaft side of the engine and the T-slot side of the piston should face away from the camshaft.

PISTONS

1935-52—Before fitting pistons cylinder bores should be carefully measured and refinished, if necessary. Cylinders that are not badly scored but need a "cleaning up" to bring them within satisfactory working limits may be reconditioned with a hone. The bore should be checked with an accurate gauge to determine whether or not it is out-of-round or tapered. A good job should show measurements of not more than .0005" out-of-round or taper. If cylinders are scored badly or out-of-round excessively, they should be bored first with a reliable boring tool and then polished with a hone.

CAUTION — When reconditioning cylinders, the crankshaft and main bearings should be covered to prevent cuttings and abrasives from getting into the bearings and timing case. After completing the reconditioning job, the engine should be cleaned thoroughly, being sure to remove all traces of chips, dirt or other foreign matter from the cylinder walls.

PISTON RINGS

1935-52—Piston rings are furnished in standards as well as oversizes of .003", .005", .010" and .020". Rings are of the square end type, Fig. 4, and are pinned to prevent rotation on the piston. The rings are cut and notched to fit this pin so that the clearance on the pin is equal to the gap between the ends of the ring. in other words, if the ring is compressed so the ends come together, there will be no clearance on the pin.

If the ends of the ring are filed in fitting, it is necessary to file an equal amount in the pin notch to maintain the pin clearance. Filing, however, should not be necessary, as these rings are supplied in exact sizes to give a minimum gap of .005" when the ring is compressed.

NOTE — With this type ring, there is always a portion of the cylinder walls which is not worn. Therefore, if new rings are fitted, extreme care must be exercised to see that the gap ends do not rest on the unworn portion, Fig. 5, otherwise the rings will be lifted off the worn portions of the cylinder. It is advisable to hone these cylinders slightly in order to avoid this condition.

Always use standard size rings in cylinder bores that are standard at the bottom, regardless of the amount of taper. Before removing pistons, the ridge at the top of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder wall, never try to remove the last traces of the ridge; this can be done afterward with a hone.

NOTE — When necessary to hone or otherwise recondition the cylinders, they should be brought to an exact size for which piston rings are available. For example, a cylinder may clean up at .009" oversize. Since no ring is available in this size, it is advisable to hone the cylinder to .010" oversize rather than file the gaps of a set of .010" oversize rings to permit their use in a .009" oversize cylinder.

PISTON PINS

1935-52—Piston pins are furnished in standard as well as oversizes of .002", .005" and .010". The piston pins and piston pin bushing should be replaced when necessary by selecting the proper size pin and then reaming bushing to size.

When replacing pins, they should be selected so that they can be pushed into the piston boss with the heel of the hand when the piston has been heated to 200 degrees F. Heat the piston in boiling water or an electric furnace. Heating with a blow torch or other concentrated heat or driving the pin in or out of the bosses will distort the piston.

After the proper size pin is selected, replace the connecting rod upper bushing and ream or burnish to .0003" larger than the pin. If this fit is correct, the connecting rod will just turn on the pin under its own weight when the rod is held in the porizontal position.

CONNECTING RODS & BEARINGS

1935-52—On all engines except 1948-52 Sixes, rod bearings are an integral part of the rod. On 1935-37 rods, loose bearings can be taken up by removing shims. No shims are provided on 1938 and later engines using this type rod and, therefore, when bearings become worn, new or rebuilt rods should be installed.

On 1948-52 Sixes, bearing inserts are used and, when worn, new inserts can be installed simply by removing the bearing caps and slipping in the new inserts.

MAIN BEARINGS

1935-52—On 1935-40 engines, bearing adjustments can be made by removing the bearing caps and taking off sufficient shims to obtain the clearance as specified in the *Engine Bearing Table*. On 1941-52 engines, when bearings become worn to the point where the clearance is too great, new, factory-reamed bearings should be installed as no shims are used to effect an adjustment. Bearing caps should never be filed to reduce clearance.

NOTE—Set screws are used to retain the main bearings on all eight-cylinder engines and on six-cylinder engines prior to 1948. Therefore, in order to replace these bearings it will be necessary to remove the crankshaft.

CRANKSHAFT END THRUST

1935-52—Crankshaft end thrust is controlled by flanges on the center main bearing. Through normal wear, the clearance will seldom become excessive but whenever new bearings are fitted, check the end play by forcing the crankshaft forward to the limit of its travel, insert a shim between the end of the bearing cap and the side of the adjacent thrust flange, noting the thickness of shim required to eliminate clearance. The permissible end play is given in the abovementioned table, with the minimum figure desired.

If the clearance is insufficient, the bearing flanges may be dressed down but if the clearance is too great, install a new bearing.

CRANKSHAFT OIL SEALS

1935-52—Vertical and horizontal packing holes are used in the front bearing caps and a leather oil seal is recessed in the timing gear cover. (See *Timing Gear Cover* for installation instructions.) Vertical packing holes are used in the rear bearing caps. After the bearing caps have been tightened, drive cotton wicking into vertical packing hole in the front bearing cap, then drive the cotton wicking into the horizontal holes of the front and the vertical holes in the rear bearing caps.

After the rear main bearing cap has been installed on 1935-47 engines, the lower half of the oil retainer, Fig. 6, should be checked to see that it fits tightly against the upper half. A gap between the two halves of the retainer will permit loss of oil. The rear main bearing oil return tube is soldered in the rear of the reservoir and registers with the main bearing drain hole. Be sure the gaskets used between the reservoir and dip trough tray, and also between the tray and crankcase, have holes in line with the drain tube. If these holes are not open, oil will be lost out of the rear main bearing oil slinger. A flapper valve is located on the bottom of the oil return tube to prevent oil from being thrown up the tube and out of the rear main bearing. When the reservoir is level, this valve should be slightly open. Check the valve to see that it moves freely against the end of the tube.

ENGINE OILING

OIL PAN

1935-47—To remove the oil pan, drain the engine oil and, as soon as the pan is empty, replace the drain plug and tighten it securely. Take out the oil

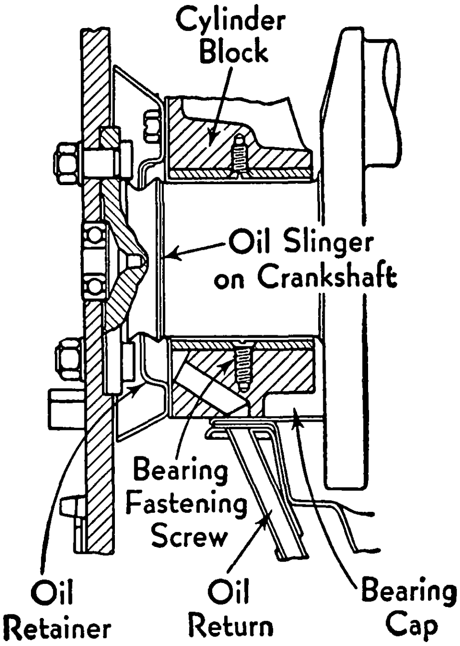


Fig. 6 R ar main bearing oil seal, 1935-52 (Except 1948-52 Six)

level indicator and, after removing the oil pan cap screws, drop the oil pan and clean it thoroughly.

1948-52 Eights—To remove the pan:

1. Raise front of car and place jacks under each side at No. 3 frame crossmember.
2. Drain oil from engine.
3. Place jack under center of No. 2 frame crossmember and raise it until pressure is exerted against the member sufficiently to hold the member in place against coil spring expansion pressure when attaching studs are removed.
4. Remove one bolt and loosen the second bolt in each shock absorber anchor plate which will allow the shock absorbers to slide out of the anchor plates.
5. Remove the outer bolt (each side) of No. 2 crossmember at front of coil springs and insert ½″-20 x 6″ special studs.
6. Remove two bolts (each side) from No. 2 crossmember at rear of coil springs and insert 4 special bolts same size as above.
7. Remove other four bolts holding crossmember at front of springs.
8. Release pressure from jack under No. 2 crossmember slowly and allow crossmember to settle on heads of six special studs.
9. Remove flywheel dust cover.
10. Remove oil pan.

NOTE — The special bolts mentioned above must be made so that the 6″ dimension under the head must be precisely followed since a longer bolt could not be used. The bolts should not be threaded more than 1″ from the bolt end to avoid having the suspension hanging up on the threads. The clearance gained by dropping the No. 2 crossmember will be 5 inches which is ample to clear the oil pan and trough.

To install the oil pan, place two quarts of recommended oil in oil pan troughs. Place oil pan against engine, using two screws on each side to hold the pan until all screws have been entered. After screws are tightened, raise the jack until the No. 2 crossmember dowels are located and insert two front suspension attaching bolts (each side). Remove the six special bolts and install remaining standard bolts. If the work is done properly, the front suspension alignment will not have been disturbed. The balance of the installation is the reverse procedure of removal. Refill the engine with the proper amount of oil.

1948-52 Six — To remove the pan from these engines, proceed as follows:

1. Raise car and place jacks under No. 2 frame crossmember.
2. Remove three bolts attaching the center steering arm support bracket to No. 2 frame crossmember, allowing the steering linkage to drop.
3. Remove flywheel dust cover.
4. After draining oil, remove oil pan.

OIL PUMP

1935-47—This pump, Fig. 7, is an oscillating plunger type driven by a gear on the camshaft. The rotary oscillating motion imparted to the plunger by the eccentric on the drive shaft, together with its reciprocating motion, causes slots in the plunger alternately to register with ports in the pump body which are connected to the oil inlet and outlet. The plunger is really a combination of a double-acting piston and sleeve valve.

The pump is mounted on the outside of the engine and after disconnecting the inlet and outlet lines and removing the two mounting screws, the pump can be withdrawn from the engine.

To disassemble, remove the end caps and gaskets, and the dowel screw from the pump mounting shaft. Withdraw the shaft and plunger. Wash all parts and blow dry.

When assembling, dip the shaft and plunger in engine oil for initial lubrication and priming. And after replacing the pump, check the connections at the cylinder block to be sure they are tight. Leakage at these points will cause air to be sucked into the system and the flow of oil will be reduced and possibly stopped.

1948-52—On eight-cylinder engines, the oil pump is the same as 1947 models.

On six-cylinder engines, a centrifugal operating rotor type pressure pump is used. To remove the pump and still maintain the correct ignition timing, lift off the distributor cap and rotate the crankshaft until the distributor rotor is in the firing position for No. 1 cylinder. Keep the engine in this position while the pump is removed. Unfasten the pump from the engine and lift it off.

To disassemble, remove the cover. Hold a hand over the cover opening and with the pump upside down, turn the drive shaft until the outer rotor slips out. Drive out the straight pin which holds the drive gear to the shaft. Press the shaft out of the gear. The inner rotor and shaft may then be taken out of the pump housing.

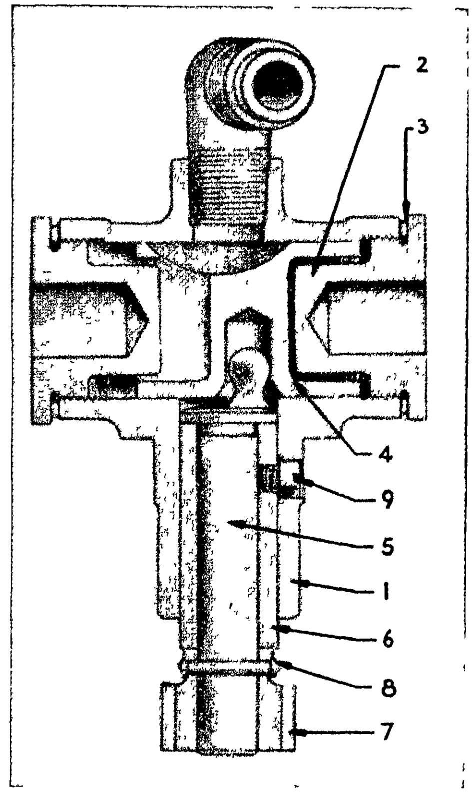


Fig. 7 Plunger type il pump, 1935-47 All & 1948-52 Eight

1 — Body
2 — Plug
3 — Plug gasket
4 — Plunger
5 — Shaft
6 — Bushing
7 — Gear
8 — Gear pin
9 — Screw

When assembling the pump, press on the drive gear so that there is from .004 and .008″ clearance between the hub of the gear and the pump housing.

NOTE — If the crankshaft has been moved from the No. 1 firing position while the pump was off, turn the engine over to this position and set the distributor rotor on No. 1 and install the pump, maintaining the same position for the rotor. Then reset the ignition timing.

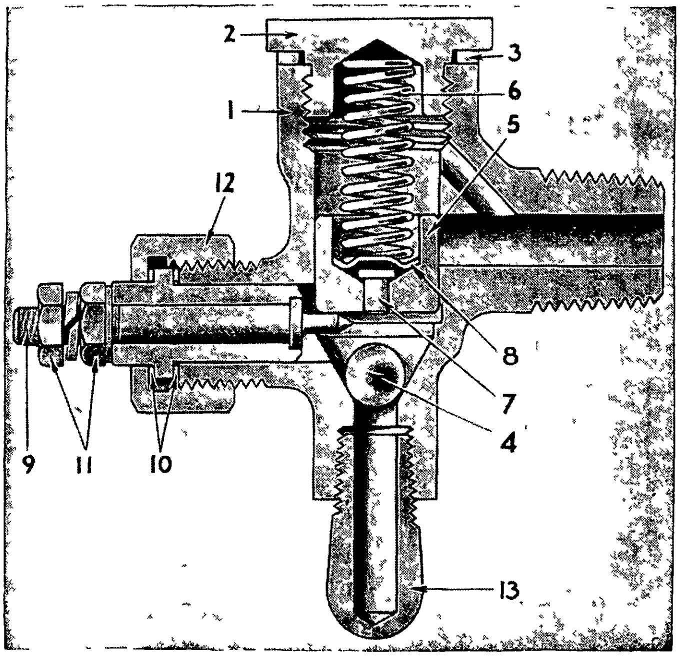
OIL CHECK VALVE & SIGNAL

1935-47 All & 1948-52 Eights—The oil check valve, Fig. 8, located on the outside of the engine near the rear, builds up enough pressure to operate the signal on the instrument panel to indicate oil flow. The valve consists of a housing in which a plunger operates against the pressure of a spring.

When there is no oil flowing and therefore no pressure, the plunger is pushed down by the spring and contacts an insulated pin which is the ground for the signal light on the dash. The light will burn until sufficient oil pressure is developed to raise the plunger.

A bleed hole is provided in the plunger to allow a small quantity of oil to pass by the piston to the outlet. *This hole must be kept clean or the lamp will not light immediately when the oil flow stops.*

Fig. 8 Oil check valve, 1935-47 All & 1948-52 Eight
1 — B dy
2 — Plug
3 — Plug gasket
4 — Ch ck ball
5 — Plunger
6 — Spring
7 — Pin
8 — Pin retainer
9 — Pin
10 — Gasket
11 — Nut
12 — Nut
13 — Elb w



COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-38 (Except Model 89) — Drain the cooling system and remove the hood, radiator hose, fan blades and water pump. Unbolt the core from the shell and lift the core carefully over the top of the engine.

1938 Model 89—Drain the cooling system. Remove three cap screws and tapping plate which fastens the hood top panel to the front hinge. Detach the hood support anti-rattle springs and clevis pins attaching the hood to the support, then lift off the hood. Remove the cotter pins and washers at both ends of the hood support lower rod and unhook the coil springs, after which take off the hood support.

Unfasten the hood handle tie bar clamp bolts and nuts at both ends of the rod and remove the rod. Take out the four cap screws from the top edge of the hood side panel and the three screws along the lower edge of the hood side panel in the engine compartment on both sides, then remove the side panels.

Disconnect the headlamp wires at the connector on the left side of the radiator core, then remove successively the upper and lower radiator hose, one bolt at the bottom of the radiator shell at the front end, front engine splash guard, two radiator anchor bolt nuts from underneath the car, radiator core, shell and headlamps as an assembly. Finally, remove the core from the shell by taking out one bolt and nut from each side of the core.

1939 Models 90, 98 — Follow the exact procedure described in the first paragraph for model 89, then proceed as follows: Remove the upper and lower hose. Loosen the generator mounting bolts and swing the generator toward the engine. Remove the water pump and fan belt and disconnect the core from the shell. Take out the front engine splash shield, remove the two radiator anchor bolts and lift out the core.

Reverse the order of the above procedure and check the hood alignment.

1939 Models 92, 93, 95, 97—Follow the same procedure as described in the first paragraph for model 89, then proceed as follows: Disconnect the radiator shell from the core and the shell extension from the hood side panels. Remove all water hose, loosen the generator mounting bolts and swing the generator toward the engine. Remove the water pump, fan belt and engine splash guard. After taking off the radiator anchor bolts nuts, lift out the radiator core by slightly spreading the radiator shell extensions.

1940-47—To remove the core on all these models, drain the cooling system, remove the upper and lower hose connections, disconnect the radiator tie rod bolts at the radiator, remove the two radiator mounting bolts and lift out the core.

1948-52—To remove the radiator:

1. Disconnect hood lock conduit; pull wire at lower hood lock support.
2. Remove nine cap screws from fender tie panel and hood lock support panel and take off tie panel.
3. Remove four bolts attaching radiator to channel. Remove the nuts located inside the radiator channel.
4. The radiator may now be lifted up and forward out of the channel.

WATER PUMP, REMOVE

1935-47—Remove the fan belt by loosening the generator bracket pivot bolt. Loosen the pump hose connections, remove the pump mounting bolts and lift out the pump.

1948-52—It is not necessary to remove the radiator to remove the pump.

1. Remove the fan belt.
2. Disconnect hose from water pump inlet.
3. Unfasten pump from block and take off pump.

WATER PUMP, OVERHAUL

1935-47 — After the unit has been removed, remove the fan blades, pulley and impeller housing. Cut the burr from the impeller end of the shaft and press the shaft out of the housing. It is essential to service the bushings in this type pump with special equipment as the material of which they are made does not allow for reaming or cutting. A special set of tools is available (J-733) for this work. With the puller and driver, remove the front bushing through the front and the rear bushing through the rear of the housing. Remove the oil seal retaining ring and disassemble the oil seal. Examine the oil seal and thrust washer and assemble in the following order: Tension spring, oil seal, thrust washer and retaining ring. Install the front and rear bushings. With a burnishing tool, polish the bushings until the surface is free from burrs, dents or scratches. Install the shaft assembly and a new impeller. Place the pulley flange on a solid surface and peen the end of the shaft until a clearance of from .005" to .010" for 1936 and from .010" to .014" on later cars is obtained between the pulley flange and the front bushing. Assemble the housing to the body and install the fan blades and pulley. Fill the unit with water pump grease and install on engine.

1948-52—This pump, Fig. 9A, features a permanently lubricated ball bearing and non-adjustable packing. The permanent seal consists of a graphite washer backed with a neoprene seal and brass spring and retainer for maintaining constant contact on these two units. The graphite washer is prevented from turning in the impeller and housing by means of four ears which are retained by four corresponding slots in the impeller. The neoprene seal stops any fluid which might pass between the graphite washer and impeller.

To disassemble the pump, pull out the wire retainer which retains the shaft in position. Remove the cover. Mount the

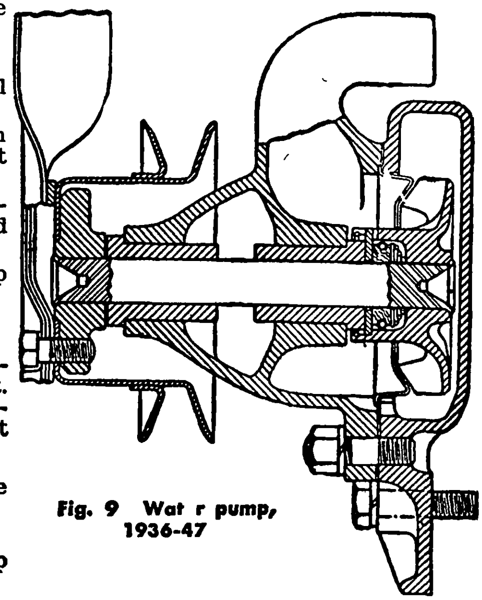


Fig. 9 Wat r pump, 1936-47

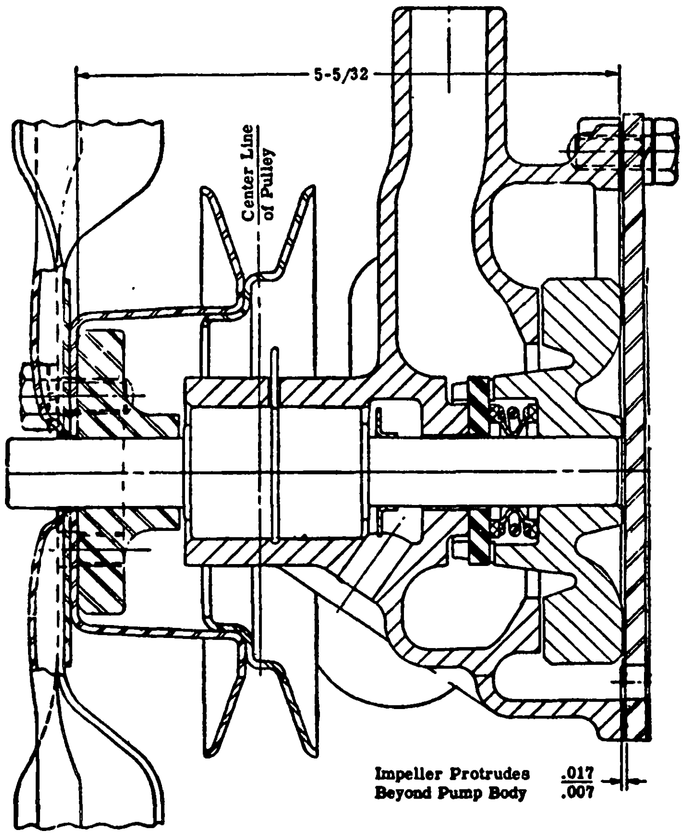


Fig. 9A 1948-52 six-cylind r wat r pump

pump in a press and press out the shaft and bearing with the pulley hub attached.

The bearing and shaft is serviced as an assembly only. The pulley hub is not part of the shaft and must be removed from the old shaft and installed on the new shaft.

Check the pump body bore with an inside miscrometer. If this dimension is greater than 1.1015", replace the body. Also check the pump body at the impeller area. If there is an indication that the impeller has been scraping the body, replace the complete pump assembly.

Check the water pump shaft and if its diameter is less than .6255", replace the shaft and bearing. If the shaft has worn grooves, it should be replaced.

When assembling see that the bearing is a slight press fit in the body. It should be assembled so that the outer race is aligned with the retainer wire slot in the pump body bore. When pressing the bearing and shaft in the housing, press against the face of the outer ring, not against the shaft.

The proper position of the pulley hub when installed is $5\frac{5}{32}$" from the outside edge of the hub to the cover face of the pump body. The impeller must protrude .007 to .017" beyond cover face of pump body.

ELECTRIC SYSTEM

IGNITION TIMING

1935-52 — With the breaker gap set to the clearance given in the *Tune Up Chart,* crank the engine to bring No. 1 piston up on its compression stroke and stop when the pointer on the flywheel housing is in line with the specified timing mark on the flywheel—given in the *Tune Up Chart.*

Locate No. 1 spark plug wire on the distributor cap, place the cap in position on the distributor and mark the housing opposite No. 1 terminal so that its relative position will be known when the cap is removed.

Loosen the distributor body clamp and rotate the distributor until the points close. Then rotate the distributor in the opposite direction until the points just begin to open, after which tighten the clamp bolt.

NOTE — For best results, use a Neon timing light or a suitable test lamp to check the timing. Advance or retard the octane selector to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low vehicle speed.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-52—The length of the rod which connects the clutch pedal to the cross shaft lever, Fig. 10, should be adjusted so that the center of the clutch pedal clamp bolt is 1½" from the toe board.

CLUTCH, LUBRICATE

1935-52—Hudsonite clutch lubricant should be drained and replaced every 5,000 to 15,000 miles. To drain, turn the engine until one of the plugs in the front of the flywheel is in the timing inspection opening at the left side of the engine support plate, and remove the plug with a special wrench. Turn the engine slowly, approximately ⅓-revolution, until the star on the flywheel is in line with the pointer on the timing inspection hole. This brings the drain hole to the bottom. Turn the engine until the drain hole is in the timing opening and insert ⅓-pint of Hudsonite.

Then, if clutch engagement is not smooth or disengagement is not complete, it is probable that some substitute fluid has been used and that the corks have become glazed and the pores closed. If this condition is encountered the clutch should be flushed with kerosene and relubricated with Hudsonite, which will, after a few hundred miles of driving, clean the corks and give normal clutch action.

CLUTCH REMOVAL

1935-47—Remove the transmission as described under that heading and proceed as follows: Loosen all the clutch cover to flywheel bolts gradually to release the tension of the pressure springs, and after taking out all the bolts, lift off the clutch. Reverse the procedure to install.

1948-52—To remove the clutch, proceed as follows:

1. Take out the front seat cushion, seat back and base.
2. Disconnect the accelerator pedal at the accelerator rod.
3. Remove the brake pedal from the brake lever.
4. Pull the steering column hole rubber cover up out of the way.
5. Remove the floor mat.
6. Take out the Hudson Weather Control (heater).
7. Remove the floor opening cover.
8. Disconnect the propeller shaft at the transmission flange.
9. Unfasten the propeller shaft center support bracket and move the propeller shaft rearward to clear the transmission companion flange.
10. Unhook the clutch pedal lever return spring.
11. Remove the clutch cross shaft bracket.

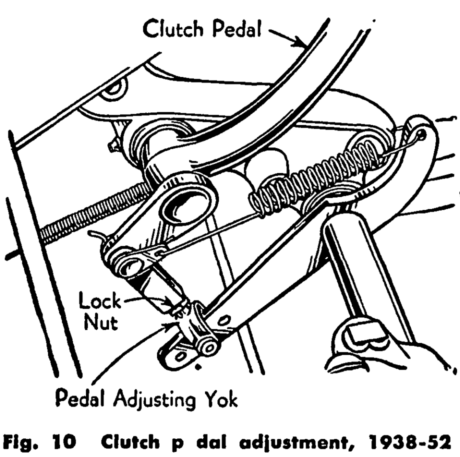


Fig. 10 Clutch p dal adjustment, 1938-52

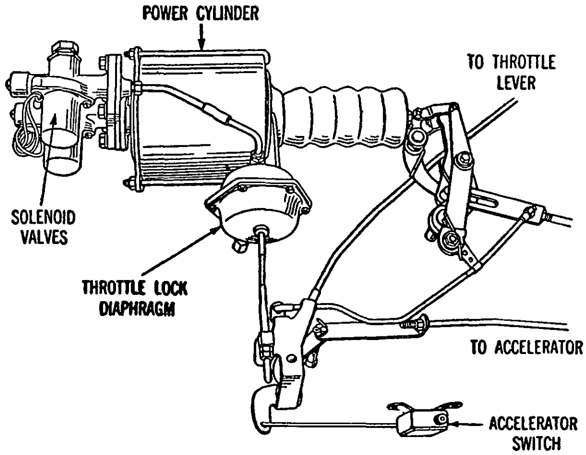


Fig. 11 Clutch power unit, 1942-47. Typical of later models

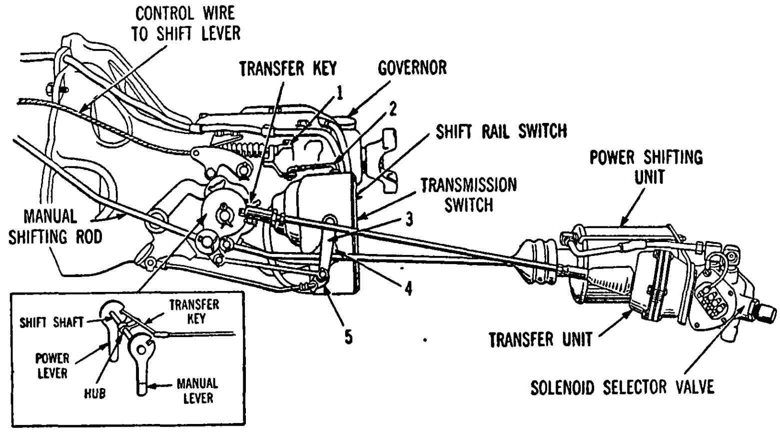


Fig. 12 Drive-Master automatic shifting units, 1942-47. Th numbered levers operate (1) transmission crossover, (2) transfer switch, (3) selector switch, (4) neutral and limit switches, (5) clutch switch

12. Unhook the clutch control link clevis.

13. Disconnect the linkage which attaches the shift mechanism to the transmission.

14. Remove the flywheel under pan.

15. Remove the two engine rear mounting bolts at the third cross-member.

16. Jack rear of engine about ½" off the frame. Place a block of wood under head of jack to prevent damage to the oil pan.

17. Disconnect speedometer cable at transmission and insert wood plug.

18. Remove two top screws holding clutch housing to engine end plate and install two long headless screws to support the transmission until the balance of the screws are removed.

19. Remove the breather pipe bracket from the clutch housing, and bolt attaching breather pipe and rear valve cover.

20. Pull the transmission and clutch housing back toward the rear and up through the floor opening.

21. Loosen all clutch cover-to-flywheel screws slightly to release the tension of the clutch engaging springs. Remove the screws and lift off the clutch assembly.

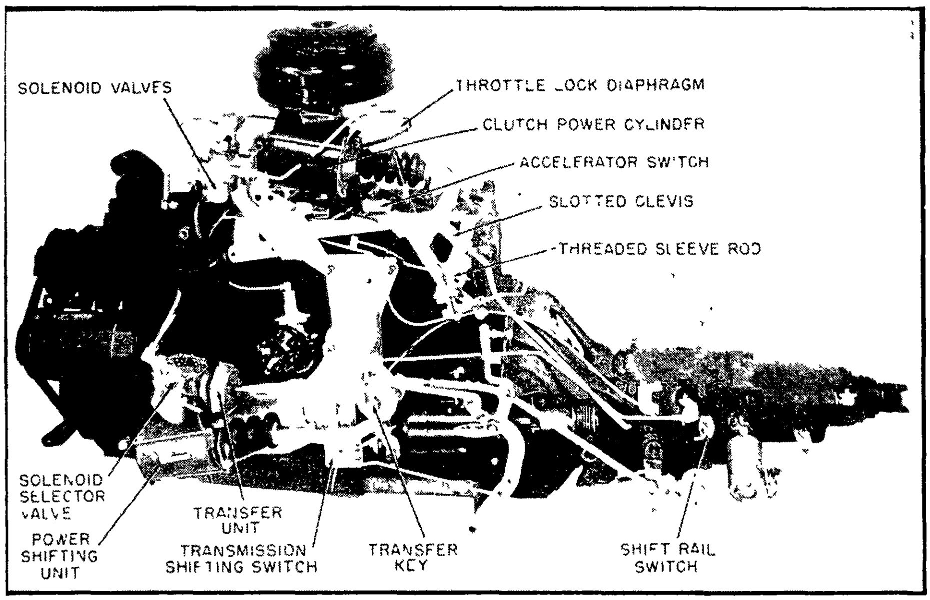


Fig. 13 Drive-Master controls, 1948-51

DRIVE-MASTER

1942-51—The Drive-Master is a system of controlling automatically the operation of a conventional clutch and transmission. Automatic clutch actuation is provided by a vacuum cylinder. Another vacuum cylinder, operated by a governor switch, shifts the transmission from second to high whenever the car speed exceeds approximately 14 mph and the accelerator is released. However, as long as the accelerator is depressed, the car remains in second, regardless of how fast it is driven. The device shifts automatically from high to second when the car speed drops to about 12 mph when the throttle is closed.

The Drive-Master is supplied with or without overdrive. On 1951 models, when the device is used in conjunction with an overdrive, the mechanism is called "Hudson Super-Matic Drive".

Figs. 11 and 12 illustrate the components of the device on 1942-47 models, while Fig. 13 shows how the mechanism is located on the side of the engine on 1948-51 models.

DRIVE-MASTER OPERATION

On 1942-47 models the Drive-Master is controlled by three buttons on the instrument panel which are labeled "OFF", "VAC" and "HDM". When the OFF button is pushed in, both the clutch and gear shift must be operated manually because the vacuum power units are off. Pushing the VAC button in puts the automatic clutch control into use but the gears must be shifted by hand. Depressing the HDM button gives automatic shifting between second and high as well as automatic clutch operation. When any one button is depressed, it returns the previously pushed button to neutral.

On 1948-49 models, the Drive-Master is controlled by a single switch control knob on the instrument panel. Turning the knob to the left provides automatic clutch operation with manual gear shifting. Turning the knob to the right provides both automatic clutch and gear shifting operation. With the knob in the center or OFF position, clutch operation and gear shifting is done manually in the conventional manner.

On 1950-51 models, the Drive-Master is controlled by "OFF" and "HDM" buttons located on the instrument panel. When the OFF button is pushed, clutch actuation and gear shifting must be done manually. When the HDM button is pushed, these operations are performed automatically, provided the gear shift lever is in the high gear position.

To start the car forward in Drive-Master, start the engine and place the shift lever in high gear position. Depress the accelerator pedal and the car will move forward in second gear.

When the car has accelerated to the desired speed (above approximately 14

mph) momentarily release the accelerator pedal and the shift into high gear will be obtained automatically.

When slowing down the transmission will automatically shift to second gear at about 12 mph in preparation for acceleration or starting after a stop.

When rapid acceleration is desired when driving in high gear below 18 mph, move the shift lever to the second gear position, release the accelerator pedal momentarily and the transmission will shift into second gear. If driving at speeds above 20 mph in high gear, the clutch pedal must be depressed and the shift lever moved to the second gear position to obtain second gear operation.

When using second gear for greater engine braking effort when descending steep grades, the Drive-Master must be rendered inoperative to prevent free wheeling.

CONTROL UNITS

CLUTCH POWER UNIT—This unit, Fig. 11, is mounted on top of the engine. A vacuum line connects to the engine intake manifold to provide the power for operation.

The power is transmitted from the vacuum cylinder piston through a rod direct to the clutch throwout yoke shaft. The engaging and disengaging control is obtained through the accelerator switch and linkage connected to the accelerator pedal.

The unit is fitted with a throttle locking device which holds the throttle and accelerator switch closed to prevent gear clash while the transmission shift is being made.

The throttle lock consists of a vacuum-operated diaphragm connected to the accelerator linkage through a cable. Vacuum in the cylinder pulls up on the cable, closing the throttle and holding the accelerator switch against the stop even if the accelerator pedal itself is pushed to the wide open position. A solenoid mounted beside the clutch control solenoid controls the vacuum to the throttle lock.

ACCELERATOR SWITCH—This switch, Figs. 11 and 13, used in conjunction with the clutch power unit, makes starting possible with wide open throttle for rapid acceleration.

When the foot is removed from the accelerator and the throttle is closed, the accelerator switch closes the electrical circuit through the clutch control solenoid, opening the vacuum valve and the clutch is disengaged.

TRANSMISSION CONTROL SWITCH

The transmission control switch box contains the mechanically-operated switches indicated in Fig. 15.

TRANSFER SWITCH—This switch is operated by a non-adjustable link connected to the transmission cross shift selector lever.

When the gear shift lever on the steering column is moved through the neutral or cross over to the second-high side, the transfer switch lever is moved forward, closing the switch points. This completes a circuit to the solenoid of the power unit, which controls the transfer diaphragm, drawing the diaphragm back and connecting the power shift lever to

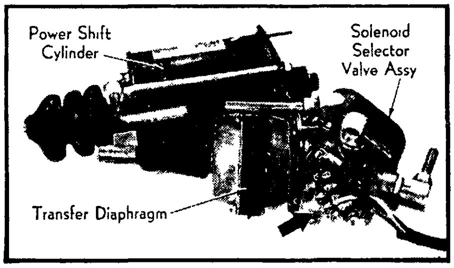


Fig. 14 Transmission power unit, 1942-47

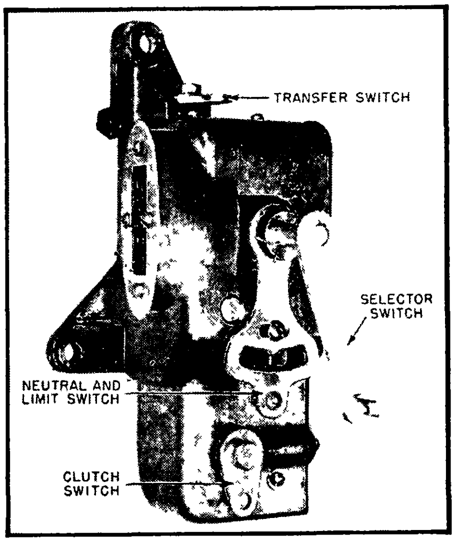


Fig. 15 Transmission control switch assembly, 1942-47. Except that the selector switch lever is positioned up and not down as shown, the 1948-51 unit is the same

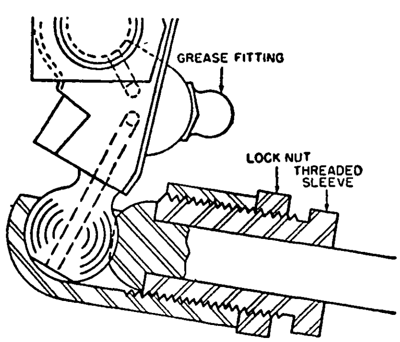


Fig. 16 Ball and socket joint at transfer key, 1942-51

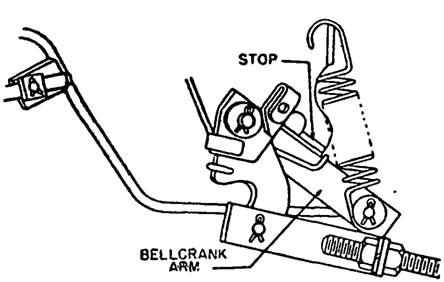


Fig. 17 Thr ttle b ll crank, 1948-51

the transmission shift lever through the transfer key.

When the gear shift lever is again moved to the low-reverse side, the transfer switch lever moves backward, opening the switch. The diaphragm spring moves the transfer key and linkage to disconnect the power shift lever and reconnect the manual shift, thus preparing it for shifting into low or reverse.

CLUTCH SWITCH—This switch is operated by a non-adjustable link connected to the clutch throwout shaft lever. When the clutch is disengaged, the clutch switch lever is moved backward.

One set of points close to complete the circuit to the starter button. A second set of points is closed, completing the circuit to the selector neutral and limit switches.

The clutch switch is open when the clutch is engaged. Therefore, no current is used when the car is being driven in any gear speed.

SELECTOR SWITCH — The selector switch lever is connected to the transmission manual shift lever by a non-adjustable rod. When the gear shift lever is moved to the second gear position, the selector switch lever closes the circuit to the power unit, causing the power unit piston to move into second gear position.

When the gear shift lever is moved to the high gear position, the selector switch lever closes the circuit to the governor, which automatically selects second or high gear.

When the gear shift lever is placed in the neutral position, the selector switch closes a circuit to the neutral switch.

NEUTRAL & LIMIT SWITCH — Both these switches are operated by the same lever which is connected to the transmission power shifting lever by an adjustable rod.

The neutral switch has two sets of points, both of which are open when the transmission is in neutral. When the transmission gears are in second or high, one set of points are closed and the other open.

If neutral is selected on the gear shift lever and the transmission gears are in high, the circuit then is from the neutral point on the selector switch to the closed points of the neutral switch and from there to the power unit solenoid which controls the shift to the second gear position. The piston then moves rearward, shifting the transmission out of high toward neutral. When the shift reaches the neutral position, the neutral switch points are open and the shift stops.

If the transmission gears are in second when neutral is selected, the other set of points in the neutral switch are closed and complete the circuits to the power unit solenoid which controls forward movement of the power cylinder. As before, when the transmission reaches neutral, the neutral switch points are opened and the shift stops.

The limit switch also has two sets of points but both are closed when the transmission is in neutral. One set of points are opened when the shift to high gear is completed and the other set open only when the shift to second is completed.

The limit switch also completes the

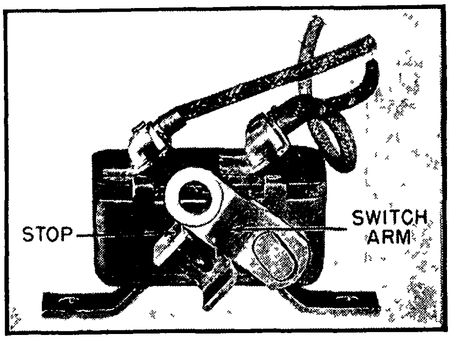


Fig. 18 Accelerator switch, 1942-51

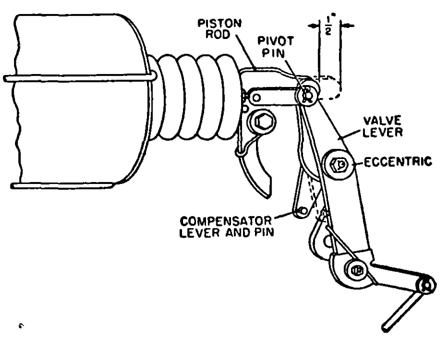


Fig. 19 Clutch vacuum cylin- d r pist n travel, 1948-51

circuit to the throttle lock solenoid on the clutch control, thus preventing the throttle being opened until each shift is entirely completed.

GOVERNOR SWITCH—This switch is located on the rear of the transmission and is operated by the speedometer drive gear. The governor controls circuits in the clutch control unit and in the transmission power unit.

The switch is fitted with two sets of points and automatically controls the speed at which the Drive-Master shifts from second to high and from high to second as well as the operation of the clutch control unit.

The switch also regulates the operation of the overdrive unit when one is fitted. For the latter function, a separate terminal marked "R" is provided which is only used with overdrive.

DRIVE-MASTER SERVICE

In servicing the Drive-Master, any of the following units which tests prove to be faulty must be replaced in their entirety rather than attempt internal repairs. These units include solenoids, transmission switch, governor switch, accelerator switch and instrument panel switch.

As power for operating the clutch control unit and the power unit of the Drive-Master is obtained from engine vacuum, it is very important that engine performance be checked first when servicing the Drive-Master. A vacuum gauge should read 17 or better to insure proper engine performance as well as correct Drive-Master operation.

VACUUM LEAKS—Leaks in the vacuum lines will cause sluggish operation or failure of the Drive-Master. All vacuum line fittings should be checked and hose connections given particular attention. These are as follows:

1. Between clutch power unit and intake manifold.
2. Between clutch power unit solenoids.
3. Between throttle lock solenoids and diaphragm.
4. Between transmission power unit and air cleaner.
5. Between transmission and clutch power unit.
6. Between front of power cylinder and solenoid housing.
7. Between rear of power cylinder and solenoid housing.

ELECTRICAL CONNECTIONS — The battery should be in good condition with a specific gravity of not less than 1.225. All terminal connections should be clean and in solid contact. The important points to be checked are as follows:

1. Connector plugs on clutch power unit.
2. Connections at accelerator switch.
3. Power unit plug.
4. Transmission control switch plug.
5. Shift rail switch plug.
6. Governor switch plug.

TRANSMISSION SWITCH PLUG—This plug is held in place by clips. When replacing, be sure clips enter and engage behind the plug cover plate. The plug is released by pressing the clips together.

Be sure the boot plug is in place to keep water from entering the switch housing.

INSTRUMENT PANEL SWITCH — Check to see that the switch is on. Also check the fuse and fuse holder.

LINKAGE—While checking power unit wires and plugs, make sure all rods and linkage are in place and properly connected and locked by their clips.

Check the ball and socket joint at the transfer key, Fig. 16. This is a specially designed joint to permit adjustment without affecting clearance of the ball in the socket. Adjustment is made by loosening the lock nut and turning the threaded sleeve inward so that it has no appreciable looseness and yet works free.

Lubricate this joint and the transfer key pivot with viscous chassis lubricant through the fitting on the transfer key.

The accelerator linkage and bell crank with the torsional spring assembly must work freely and should be well lubricated.

The accelerator switch lever must return solidly against the stop when the accelerator is released, otherwise, the clutch will not release and the Drive-Master cannot work.

CLUTCH SWITCH — In checking the operation of the clutch switch, Fig. 15, see that the clutch pedal free play is 1½". With the engine not running, ignition switch turned on and starter button depressed, slowly push the clutch pedal down. The starter should operate before the pedal is within two inches from the toeboard.

TRANSFER SWITCH—When the gear shift lever is in neutral, the transfer switch lever, Fig. 15, must return to the second-high side when released from any position in the cross over by means of its own return spring. If it sticks it will cause incomplete shifting, throttle locking, engine racing, etc.

Fig. 20 Throttle adjustment, 1948-51

The hand gear shift lever must be on the second and high side at all times to energize the transfer cylinder and hold the transfer key engaged in the power shift lever.

Check the operation by moving the gear shift lever through the neutral cross over. The key should engage in the manual lever during the upper part of the movement, and engage the power shift lever during the lower half of the movement.

DRIVE-MASTER ADJUSTMENTS

1948-51

Do not attempt any adjustments of the Drive-Master until the engine has reached normal operating temperature. The engine must be in proper tune and should idle smoothly at 580-600 rpm when the Drive-Master instrument panel switch is on. Be sure the clutch pedal has 1½" free play.

ACCELERATOR PEDAL ADJUSTMENT—Models equipped with overdrive and Drive-Master have a kickdown switch mounted on the floor panel under the accelerator pedal. Some models with Drive-Master but without overdrive have an accelerator pedal stop in the kickdown switch location.

The accelerator pedal rod should be so adjusted that the carburetor throttle is in the wide open position just before the accelerator pedal touches either the pedal stop or the moveable stem of the kickdown switch.

On other models without overdrive and without the accelerator stop in the kickdown switch location, the accelerator pedal rod should be so adjusted that wide

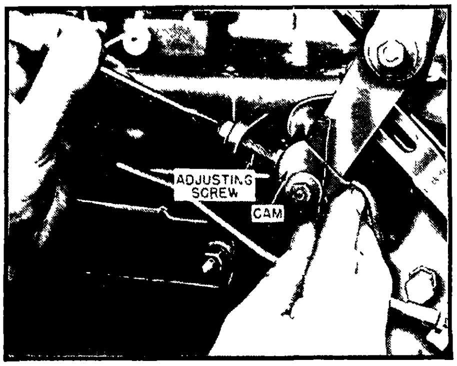


Fig. 21 Clutch control cushion p int adjustment, 1948-51

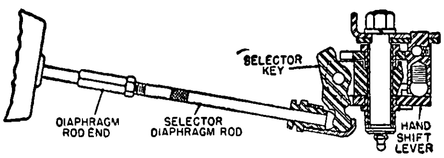


Fig. 22 Transfer rod and k y d tails, 1948-51

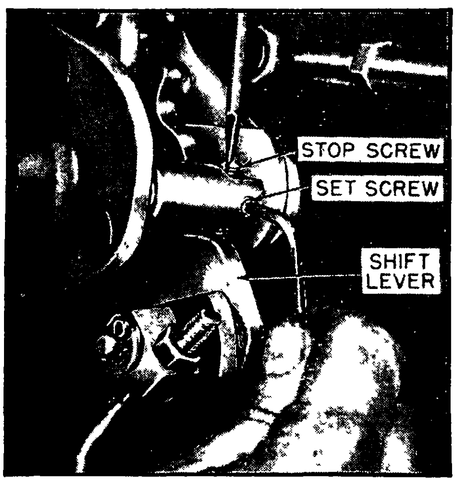


Fig. 23 Power shift l ver adjustment, 1948-51

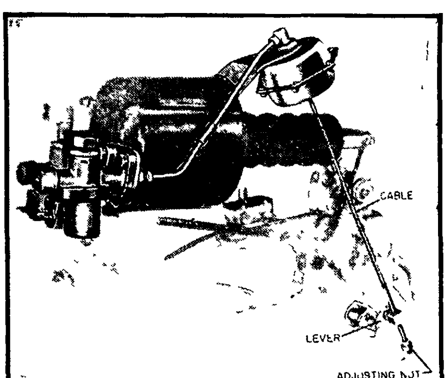


Fig. 24 Thr ttle l ck cable adjustment, 1948-51

open throttle is obtained just before the tip of the accelerator pedal strikes the floor mat.

ACCELERATOR SWITCH ADJUSTMENT—With the throttle bell crank, Fig. 17, against its stop, loosen the accelerator switch mounting screws and slide the switch forward until the switch arm bottoms against the stop on the switch, Fig. 18.

Recheck the adjustment by depressing the accelerator pedal and releasing it slowly. Both the accelerator switch lever and the bell crank lever should solidly contact their stops.

THREADED SLEEVE ROD ADJUSTMENT—Adjust the threaded sleeve, Fig. 13, until the clutch vacuum cylinder piston is ½" from its extreme forward position, Fig. 19. Check the adjustment by pushing on the valve lever and then releasing. This adjustment should be made with the compensator lever in the starting position with the compensator pin forward.

COMPENSATOR PIN, CHECK—Check the compensator by pushing the compensator lever and pin, Fig. 19, down to its normal running position. The piston rod should move forward. If it moves backward, the eccentric is assembled upside down.

PISTON VALVE ROD, CHECK—If the piston valve rod setting is correct, the center line of the pivot pin, Fig. 19, will be exactly in line with the center line of the pivot bolt.

The valve rod can be adjusted by loosening the lock nut and turning the valve rod in or out of the threaded trunnion.

CLUTCH PULL ROD ADJUSTMENT—Stop the engine. Pull the piston rod out to its full travel (to rear of car). Pull clutch rod up and forward to check for ⅛" backlash. If the lash is correct, the front end of the slotted clevis, Fig. 13, will just touch the pin.

THROTTLE ADJUSTMENT—Back out the cam adjusting screw, Fig. 20, until there is approximately ½" gap between cam and screw. Depress clutch pedal and start engine. Hold clutch pedal down until clutch control unit cylinder takes up the load. Do not race the engine. Put transmission in second gear and release the brakes. Slowly rotate the throttle bell crank until the clutch drags. Then turn the throttle adjusting screw until there is a slight increase in engine speed to 625-750 rpm when the car begins to move forward.

The above adjustment should be made with the compensator in the starting position (pin forward).

CUSHION POINT ADJUSTMENT—Stop the engine, depress the clutch pedal and restart the engine, but do not race it. Set the hand brake and place the transmission in second gear. Screw the cam adjusting screw in fully towards the cam, Fig. 21. Push the cam against the screw and back out the screw until the engine stalls. This adjustment should be made with the compensator in the starting position (pin forward).

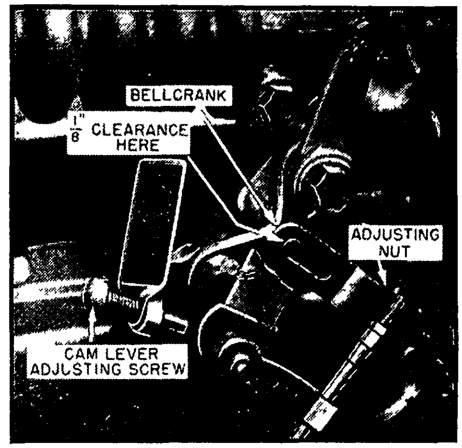


Fig. 25 Bell crank yoke adjustment, 1942-47

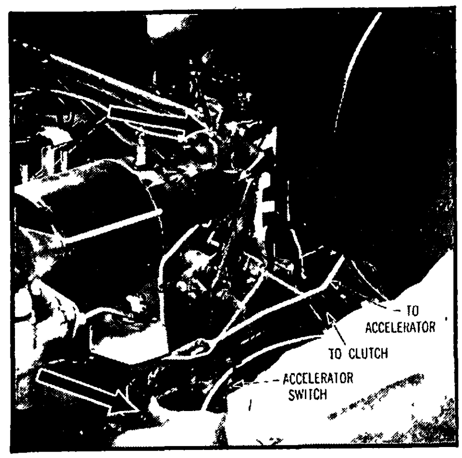


Fig. 26 Accelerat r cr ss shaft adjustment, 1942-47

ROAD TEST FOR CLUTCH OPERATION—To check a slow start, depress the accelerator pedal very slowly—engine should speed up slightly just before car starts to move. If necessary, adjust throttle adjusting screw to meet this requirement.

To check a fast start, depress accelerator pedal half way to floor—car should move forward smoothly without excessive slipping of clutch. If necessary, turn the cam adjusting screw in or out to meet this requirement, Fig. 21. Do not turn this screw in toward cam more than two turns from the throttle adjustment setting outlined previously.

Too frequent operation of the clutch will cause it to become overheated, making satisfactory adjustment impossible. Drive two city blocks between starts before adjusting.

TRANSFER KEY ADJUSTMENT — Check the adjustment of the transfer key ball joint, Fig. 16, for free rotation without perceptible end play. Adjust by loosening the lock nut and turning the threaded sleeve in or out as required.

TRANSFER ROD ADJUSTMENT — With engine shut off, shift transmission into high gear and adjust the length of the selector diaphragm rod, Fig. 22, until it is just long enough to allow the se-

lector key to bottom solidly in the slot in the hand shift lever.

Check this adjustment by starting the engine and shifting the transmission into neutral. The selector key should bottom solidly in the slot in the power shift lever. If it does not, recheck the adjustment.

While making the adjustment, hold the diaphragm rod end with a wrench to prevent the rod from turning and damaging the diaphragm.

POWER SHIFT LEVER ADJUSTMENT—With the engine running and instrument panel control switch on, shift to second gear. Turn the top screw, Fig. 23, down until it contacts the shift lever and then turn it down ½ turn more. Lock the adjustment with the Allen set screw.

THROTTLE LOCK CABLE ADJUSTMENT—With the engine running, operate the throttle lock by running a jumper wire from the battery negative post to either one of the throttle lock solenoid pins. Adjust the nut on the diaphragm cable, Fig. 24, until the lever is held solidly against the stop when the accelerator pedal is depressed. When the lock nut is tightened, the cable should not be so short that the shaft is deflected when the throttle lock operates.

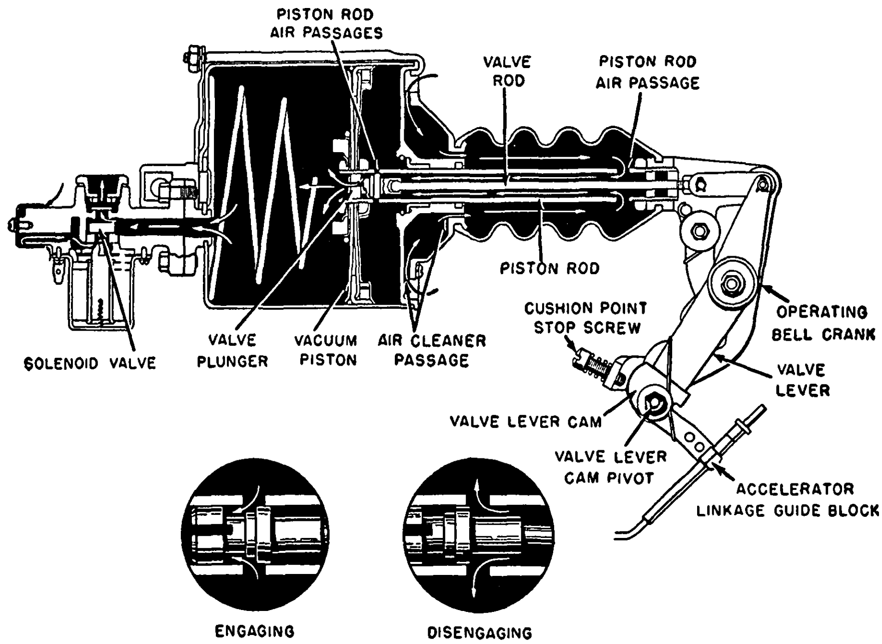


Fig. 29 Vacuum clutch control details, 1942-47

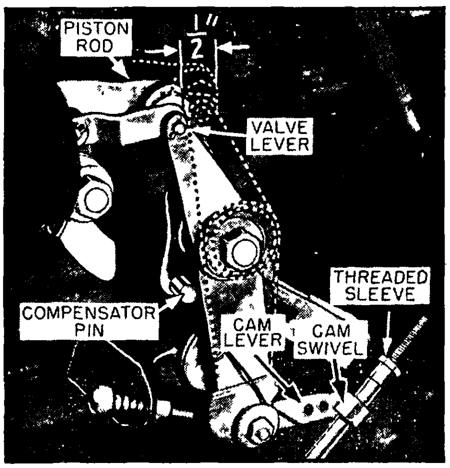


Fig. 27 Piston travel adjustment, 1942-47

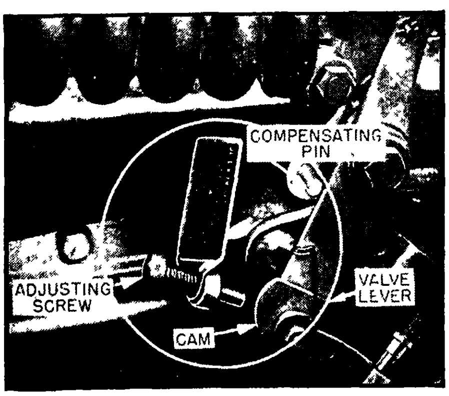


Fig. 28 Cushi n p int adjustm nt, 1942-47

DRIVE-MASTER ADJUSTMENTS 1942-47

Before proceeding with the transmission control units, first observe whether or not the clutch control portion of the system is functioning properly. This can be done by depressing the "VAC" button on the instrument panel switch and operating the car by manually shifting the gears. If the car does not function as is should the following adjustments should be made before proceeding with the transmission control units.

BELL CRANK YOKE ADJUSTMENT—With the engine shut off there should be ⅛" clearance between the clevis pin and end of slot in the link, Fig. 25. This can be checked by pulling the piston rod backward as far as possible. At this point the front end of the pull rod link should be flush with the front end of the bell crank. If adjustment is required, loosen the lock nut and turn the adjusting nut to increase or decrease the clearance. Tighten the lock nut and recheck the clearance.

Excessive lash at this point may cause the clutch to drag. This drag will prevent completion of the gear shift and the throttle will lock. When the throttle is locked because of this condition, the gear shift can be completed and the throttle unlocked by depressing the clutch pedal manually.

Excessive lash might also result in complete failure in the Drive-Master due to insufficient travel of the clutch switch.

No lash at this point will cause the clutch to slip.

ACCELERATOR CROSS SHAFT ADJUSTMENT—Depress the clutch pedal and start the engine. Back out the cam lever adjusting screw, Fig. 25, until there is approximately ½" clearance between the cam and screw end. Slowly rotate the bell crank until the clutch begins to take hold. Turn the throttle cross shaft adjusting screw (upper arrow, Fig. 26) until there is a slight increase in engine speed when the car begins to move. If the engine speed is too great, turn out the adjusting screw.

Excessive clearance at the throttle screw will cause the engine to stagger on clutch engagement. Insufficient clearance will give excessive engine speed before clutch engagement.

PISTON TRAVEL ADJUSTMENT — With the engine running and with the compensating pin, Fig. 27, away from its stop, check the movement of the piston rod. Make this check by pressing on the valve lever and releasing it. When the lever is released, the piston rod end should move back ½". If not, check to see that the cam swivel is set in the rear hole in the cam lever. Then adjust the threaded sleeve in or out until the piston rod end returns to proper position.

Insufficient travel of the clutch control piston will have the same effect as excessive lash at the bell crank yoke. Too much travel of the piston will cause it to stick in the end of the cylinder and make clutch engagement erratic.

CUSHION POINT ADJUSTMENT—This adjustment should be made immediately after starting the engine and with the compensating pin, Fig. 28, forward away from the stop. Set the brakes and shift the transmission into second gear. Hold the cam against the adjusting screw by pressing on the valve lever. Then turn the adjusting screw out until the engine stalls. Restart the engine and stall it a second time in the same manner.

Improper adjustment of the cushion point will affect the engagement of the clutch in the same way as improper clearance at the accelerator cross shaft adjusting screw. If this adjustment results in excessive slippage on a road test, check the bell crank yoke lash as outlined previously.

DRIVE-MASTER TROUBLE SHOOTING, 1942-47

CLUTCH CONTROL UNITS

ERRATIC OR SLOW ACTION—Common causes of slow or erratic action in the vacuum clutch control are:

1. Air leaks in the power cylinder or lines.
2. Sticky solenoid plunger due to a binding condition.
3. Friction in throttle or valve linkage.

Check for piston leaks by sliding the piston rod guard forward until the four circular ports, Fig. 29, are exposed. Start the engine and allow the clutch to remain automatically disengaged. Place the thumb and two fingers over the port holes. Any leaks in the piston seal can be felt as a suction action on the fingers at the port holes. If more than a slight suction is felt, lubricate the power cylinder with one ounce of shock absorber fluid as follows:

Remove the pipe plug from the rear of the cylinder and inject one ounce of shock absorber fluid. Disconnect the piston rod from the bell crank and work the piston in and out in a rotary motion to distribute the fluid over the entire piston and oil wick.

CHECKING UPPER CIRCUIT—Fig. 30. If the clutch does not disengage with fully closed throttle and the piston valve rod in its extreme forward position, see that the VAC button is pushed in. Also check the harness plug in the dash to see that both halves are together.

If disengagement still cannot be obtained, connect a test lamp to the BW terminal at the solenoid to ground—lamp should light. If the lamp does not light, the circuit is broken between the ignition switch and the solenoid terminal.

Next, ground the BW terminal connecting the solenoid to the accelerator switch. The solenoid should be heard to start to operate and the clutch release. If operation is not obtained, refer to *Solenoid Valve Test*.

CHECKING LOWER CIRCUIT—Fig. 31. With the accelerator switch operating arm held securely against its stop, remove the RW and Y wires from the accelerator switch. Ground the RW switch terminal. Clutch should release.

Touching the RW wire to its terminal should cause clutch to release. If not, refer to *Governor Switch Test*.

Touching the Y wire to its terminal should cause clutch to release. If not, refer to *Shift Rail Switch Test*.

ACCELERATOR SWITCH TEST—Remove the accelerator rod clip at the switch. With the RW and Y wires removed from the switch and the BW switch terminal grounded, move the switch arm five degrees, using the gauge designed for the purpose if one is available. Clutch should remain released. Moving the arm 10 degrees should cause the clutch to engage.

Connect the Y wire to its terminal and remove the ground from the BW terminal. Clutch should release. And when the accelerator switch arm is moved ½

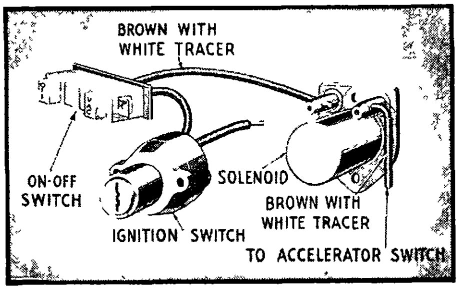


Fig. 30 Vacuum clutch control upper circuit, 1942-47

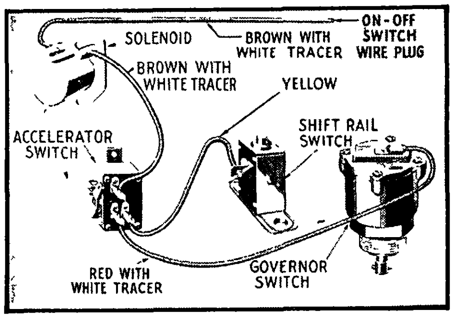


Fig. 31 Vacuum clutch control lower circuit, 1942-47

of its travel, the clutch should start to engage.

SHIFT RAIL SWITCH TEST — The vacuum clutch should operate in all gears except when in high gear above approximately 20 mph. The shift rail switch grounds the Y wire in all gear positions except high.

Remove the RW wire from the governor switch and with a test lamp connected between the Y wire and ground, lamp should light. If not, check for open circuit.

With the test lamp between the Y wire and the shift rail switch terminal, lamp should light in all gear positions except high. If lamp does not go out, check for sticking switch ball or replace switch.

GOVERNOR SWITCH—The contacts for the clutch control terminal on the governor switch are normally closed when the car is operating at less than approximately 19 mph.

A check of the governor switch can be made on the road. Be sure the RW wire is attached to the governor. Accelerate to a speed of 30 mph in high gear and release the accelerator pedal. Rest the foot lightly on the clutch pedal. As the speed drops to approximately 19 mph, the clutch should be felt to release. If the clutch does not disengage at this speed, or if the clutch disengages at all times in high gear, replace the governor switch.

SOLENOID VALVE TEST—To check the operation of the solenoid valve, remove both BW wires from their solenoid terminals and determine with a test lamp which is the live wire. Connect the test lamp between the live wire and one terminal of the solenoid and ground the other solenoid terminal. A bright light indicates a short circuit. No light indicates an open circuit and a faint glow indicates a normal circuit.

If the circuits test normal, remove the vacum line nut and check the valve. Insert a narrow scale in the opening and press lightly against the plunger disc. If the plunger does not move freely at least $\frac{5}{64}$", check for a swollen valve disc and for plunger interference. If the valve disc measures more than ⅝" in diameter, replace it.

DRIVE-MASTER UNITS

IMPROPERLY ADJUSTED OR FAULTY NEUTRAL SWITCH—A condition known as "hunting" may occur when the lever is in neutral. This is evidenced by a pulsating feeling in the accelerator pedal, preventing accelerating the engine while in neutral, or may be heard as a chugging noise.

Examination of the shifting cylinder rod will show that it is moving rapidly back and forth through a short range of travel. The most likely cause of this condition is an improper adjustment of the neutral switch. If a check indicates the adjustment is correct, and the condition continues, replace the transmission switch.

RUNNING CAR WITHOUT TRANSMISSION SWITCH—Should it be necessary to obtain starter operation by means other than depressing the clutch pedal, due to a faulty transmission switch, this may be accomplished by removing the chassis plug of the wire harness from the dash, Fig. 32, and placing a jumper between the terminals as shown.

If, in analyzing faulty operation of the Drive-Master, the transfer diaphragm is heard to operate when the instrument panel switch is turned off, the transmission switch is faulty.

GOVERNOR TERMINALS—All Drive-Master governors are provided with an extra terminal intended for Overdrive connection. This is the "R" terminal and should be *unused* if the car is not equipped with Overdrive.

ERRATIC TRANSFER DIAPHRAGM OPERATION — If, in selecting automatic, the transmission is shifted into high manually, it is an indication that the

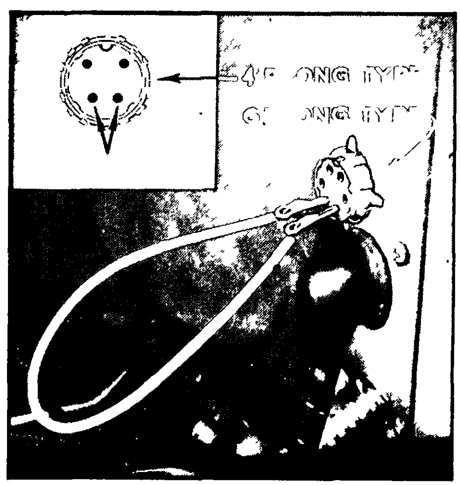


Fig. 32 Using jumper wir to b-tain start r operati n wh n transmissi n switch is faulty, 1942-47

transfer key is not working properly. Moving too rapidly from first or reverse to the automatic position may not allow the transfer key a sufficient interval of time to change into the power lever. The correction is a momentary pause in neutral. Or, it may result from the transfer diaphragm being torn, the solenoid valve being defective, or the circuit to this valve being broken.

LOCKED THROTTLE—If, in selecting automatic the throttle is locked, and further observation shows that the piston rod does not move, it indicates a bad power shift assembly, a faulty governor, or a circuit failure in the transmission switch.

A test lamp between the "BL" terminal on the shift cylinder and ground should light. The lamp should not light when placed between the "B" terminal and ground. If it lights in both positions, the governor may be faulty. This can be checked by removing the "YB" and "BL" wires from the governor. If these removals put out the light at the "B" terminal on the shifter cylinder, the governor is faulty. If the lamp lights on the "BL" and not on the "B" terminal, and the shift cylinder does not work, a solenoid failure is indicated

FAILURE TO GO INTO NEUTRAL—If unable to get back into neutral from second, and the throttle locks when neutral is selected, it is an indication that the "B" circuit is open, or the high gear solenoid is open. Check by placing a test lamp between "B" terminal and ground. If lamp lights but power cylinder remains in second, the trouble is in the solenoid. If it does not light, replace the transmission switch.

FAILURE TO SHIFT INTO LOW OR REVERSE—If the rubber on the transfer diaphragm solenoid valve is swollen, the action of the diaphragm rod will slow down, and the pause that the driver should normally give in neutral would not be enough to put the transfer key into the manual shift lever.

SLOW SHIFTING—One of the things that might cause slow shifting is a pinched, collapsed or out of line condition at the rubber connections or pipes. The ends of the pipes should not be more than ½" apart at the rubber connections.

FAILURE TO SHIFT AUTOMATICALLY—If the transfer switch rod was left disconnected, or if the switch failed, the entire system would be inoperative and all shifting would have to be done by hand. If it failed while it was in the "ON" position, manual shifting would be impossible except by pushing the "OFF" button.

THROTTLE LOCK FAILURE—This may be due to ruptured throttle lock diaphragm which is noticeable by a hiss in the diaphragm when the throttle lock valve is energized. The solenoid valve might be inoperative. There are two windings in this solenoid, one in the high gear circuit, and the other in the second gear circuit. Either one of these might fail.

The throttle lock solenoid circuits may be checked by connecting a light between each terminal and ground. If, while shifting, the light burns, the circuit is all right. If it does not burn, the transmission switch is faulty and should be replaced. This test should be made on the road and the leads should be long enough so that the bulbs can be put inside the car.

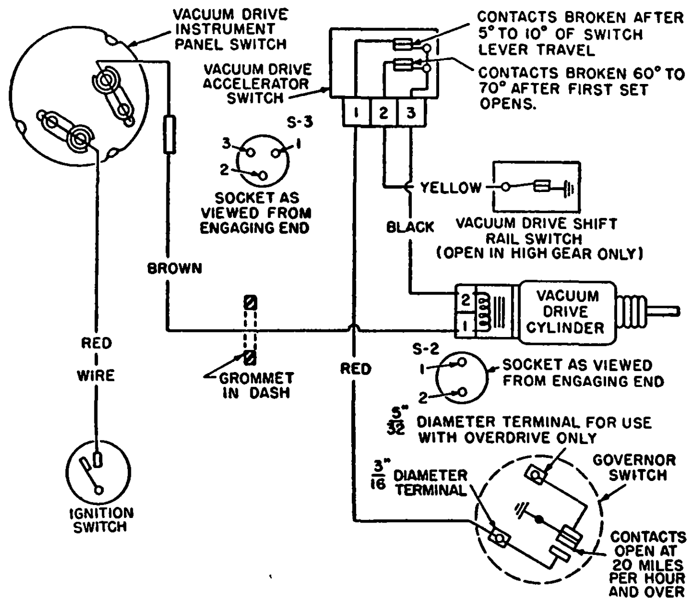


Fig. 33 Vacuum clutch control wiring diagram, 1948-51

DRIVE-MASTER TROUBLE SHOOTING, 1948-51

CLUTCH CONTROL UNITS

CLUTCH DOES NOT DISENGAGE—Fig. 33.

1. Check vacuum lines for leaks or collapsed hose.
2. Remove the plug at the solenoid and connect a test lamp between No. 1 socket of the plug and ground. With ignition and Vacuum Drive switches on, lamp should light. (Also check fuse at rear of instrument panel switch.)
3. If lamp does not light, check connector in wire from switch to unit located six inches from instrument panel switch and also feed wire from ignition switch to instrument panel switch.
4. Connect test lamp between No. 2 socket of solenoid plug and battery negative post—lamp should light. If lamp does not light, move test lamp to No. 2 socket of accelerator switch plug. Now if lamp does not light, shift rail switch or wire in the harness is defective. (This check should be made with gearshift lever in neutral.)
5. If lamp lights, check for defective accelerator switch plug. If plug is not defective, check accelerator switch.
6. If above checks show completed circuits, check for defective solenoid or connections.

CLUTCH DOES NOT DISENGAGE WHEN COMING TO A STOP—Fig. 21.

1. If clutch adjustments as outlined previously are all right, remove plug at accelerator switch and connect test lamp between No. 1 socket of plug and battery negative post—lamp should light.
2. If lamp does not light, check plug or connections at governor switch.
3. If plug and connections are all right, ground the wire at the governor switch. With test lamp still connected as indicated above, a light indicates a defective governor. No light indicates a defective harness.
4. If lamp lights (step 1) check plug at accelerator switch. If plug is all right, accelerator switch is defective.

ENGINE STALLS ON FAST STOP—Tune up engine and, if necessary, follow instructions under "clutch does not disengage when coming to a stop". Check to see that the car starts to free wheel at not less than 16 mph. If it doesn't, check the governor.

HARD SHIFTING AND GEAR CLASH—This is due to incomplete clutch disengagement.

PLUG CHECK—Insert a ⅛" diameter rod into each plug socket for a distance of ¼". Socket should grip tightly enough to make a good electrical contact. Use a $\frac{5}{32}$" rod in the No. 2 socket of the solenoid.

INSTRUMENT PANEL SWITCH—With ignition switch on and one lead of a test lamp grounded and the other connected to No. 1 terminal of the switch, the lamp should light.

ACCELERATOR SWITCH — Remove connector plug. Ground one lead of jumper wire and the other lead to No. 2 prong on accelerator switch. Connect one lead of a test lamp to the battery negative terminal and the other lead to

the No. 1 prong of the accelerator switch. With this hook-up, test lamp should light.

By moving the accelerator switch lever 10 degrees from the stop, the light should go out.

With test lamp moved to No. 3 prong, test lamp should light. Then when the lever is moved ⅔ the distance from the stop, the light should go out.

SHIFT RAIL SWITCH—With one lead of the test lamp to the negative terminal of battery and the other lead to No. 2 prong of accelerator switch, shift the hand control in all gears. If test lamp lights in all gears but high, replace connector socket.

VACUUM UNIT SOLENOID—Remove connector socket. Ground one lead of a jumper wire and the other lead to No. 2 prong of solenoid. With one lead of test lamp to negative terminal of battery and test prod to No. 1 prong of solenoid, solenoid valve should operate and test lamp should be dimly lit. If not, replace connector socket.

GOVERNOR SWITCH — The governor switch is tested in the same manner outlined for 1942-47 models.

DRIVE-MASTER UNITS

TRANSMISSION REMAINS IN NEUTRAL—

1. Lift gearshift lever through cross-over and return. If transfer diaphragm works, proceed with Step 10.
2. If transfer diaphragm does not work, start the engine and remove the power unit solenoid connector socket. Connect a jumper between negative battery terminal and No. 2 prong of power shift unit solenoid. Piston rod should move out. Moving jumper to No. 4 prong, piston rod should move in. Moving jumper to No. 1 prong, the transfer diaphragm should operate. If these events do not occur, replace power unit solenoid. If these events occur, proceed with Step 3.
3. With engine idling, attach a jumper wire from the negative battery terminal to the No. 1 power shift unit prong.
4. If transfer key does not operate, check for leaks in vacuum lines. If none are found, either the solenoid valve is defective or the diaphragm is ruptured. If engine speeds up when solenoid is energized, check for ruptured diaphragm by disassembling the unit. If solenoid valve seems dead and cannot be heard or felt to operate when energized, it should be replaced.
5. If the transfer key does operate, connect a test lamp between a ground and No. 1 socket of power unit plug.
6. If lamp lights in test 5, plug is at fault.
7. If lamp does not light, remove the ten (10) prong from the transmission control switch and connect a test lamp from No. 8 prong to a ground.
8. If lamp does not light, the wire between No. 8 prong and terminal "H" on the instrument panel control switch is open. Also check connector "4" from instrument panel switch.
9. If lamp does light in test 7, disconnect the transmission control switch plug. Connect a test lamp between the battery negative terminal and power unit plug socket No. 1 and ground the No. 1 prong of the ten-prong plug. If lamp lights, check transmission control switch. If switch is all right, white wire in harness is broken.
10. Move gearshift lever from neutral to second while watching the power unit. If transmission shifts to second gear, proceed to test 13.
11. Touch a jumper wire from the battery negative terminal to the No. 2 prong and No. 4 prong of the transmission' power shift unit alternately. Power cylinder piston rod should move out and in. If not, check for leaks in vacuum lines to each end of the cylinder and for defective second gear solenoid.
12. With engine running and gearshift lever in second gear, ground one lead of the test lamp with the other end to No. 2 socket of power shift unit harness plug. If lamp does not light, transmission control switch or wire harness is defective.
13. If transmission shifts to second gear as in test 10, connect Nos. 1 and 3 sockets at governor socket plug with a short jumper wire.
14. Place gearshift lever in high gear. If transmission shifts from neutral to second, the governor socket plug or the governor is defective.
15. If shift does not occur, either the wiring harness or the transmission control switch is faulty.

DOES NOT SHIFT INTO SECOND FROM HIGH AT SPEEDS BETWEEN 9 and 12 MPH—If transmission shifts from neutral to second but not from second to high, check for binding throttle linkage which may be restricting clutch disengagement.

If clutch disengages but transmission stays in high gear, check for defective governor switch or switch socket plug.

DOES NOT SHIFT OUT OF SECOND INTO NEUTRAL—With engine idling, attach a jumper wire from the battery negative terminal to the power shift unit No. 4 prong. Power cylinder piston rod should move in. If not, check for air leaks in lines to ends of cylinder if engine speeds up when solenoid is energized, and for defective high gear solenoid if valve seems dead and cannot be heard or felt to operate when energized.

Place gearshift lever in neutral. Connect a test lamp between a ground and the No. 4 socket of the power unit plug. If lamp lights, plug is at fault.

If lamp does not light, the transmission control switch or wire harness is defective.

DOES NOT SHIFT OUT OF SECOND INTO HIGH AT SPEEDS BETWEEN 9½ and 14 MPH—Check adjustment of power shift lever stop screw. If trouble still exists, set hand brake. Install a jumper wire between socket No. 1 (Y) and No. 4 (B) of governor switch plug or wires. (On 4A models with overdrive, disconnect RW, Y and B wires.) Start engine and shift to automatic (high) position while holding the clutch pedal down lightly with the foot. Shift to high gear will be indicated by an increase in pressure on the clutch pedal.

If shift to high gear does occur, either the governor socket plug or the governor is faulty. If the shift to high gear does not occur, check wire between governor socket No. 4 and power shift unit socket No. 4 for an open circuit. Also check both plugs.

SLOW RELEASE OF THROTTLE LOCK — Check transmission lubricant. In cold weather, too heavy a lubricant in the transmission will result in slow shifting, causing the throttle to remain locked for a longer period of time. Check for vacuum leaks in tubing.

TRANSMISSION

TRANSMISSION, REMOVE & REPLACE

1935-47—In general, transmissions are removed as follows:

1. Remove front seat cushion, unfasten accelerator pedal and remove transmission floor cover.
2. Remove transmission cover (1935-38) or on 1939-47, disconnect shift controls from side of transmission.
3. Uncouple speedometer cable and propeller shaft at front universal, and clutch linkage as necessary.
4. If equipped with overdrive, detach solenoid wire and overdrive control cable.
5. Raise car and remove flywheel pan.
6. Place jack under rear of engine and raise it ½".
7. Unfasten transmission from engine and move it straight back and out.

Replace in reverse order.

1948-52—To remove the transmission on these models, see *Clutch Removal*.

TRANSMISSION, OVERHAUL

1935-40—See Figs. 34 and 35 and disassemble as follows:

1. Remove link and shift rail lock rods.
2. Pull off universal flange and remove speedometer housing and drive gear.
3. Remove clutch housing and main drive gear bearing retainer.
4. Disassemble shifter mechanism.
5. To remove mainshaft, release snap ring from front of low and reverse gear and push mainshaft and rear bearing out through rear of case. Lift shift sleeve and low and reverse gear out through top.
6. Push main drive gear into case and lift out.
7. Remove screws and withdraw reverse gear cap and shaft. Take out stationary gear and shaft.
8. To remove countershaft, take off rear cap and related parts. Then separate the drive gear from the intermediate gear with a beveled drift inserted between them. After countershaft is forced back out of splines of drive gear, turn shaft so its splines butt against drive gear splines. Insert a gear drift through rear of case and drive the intermediate

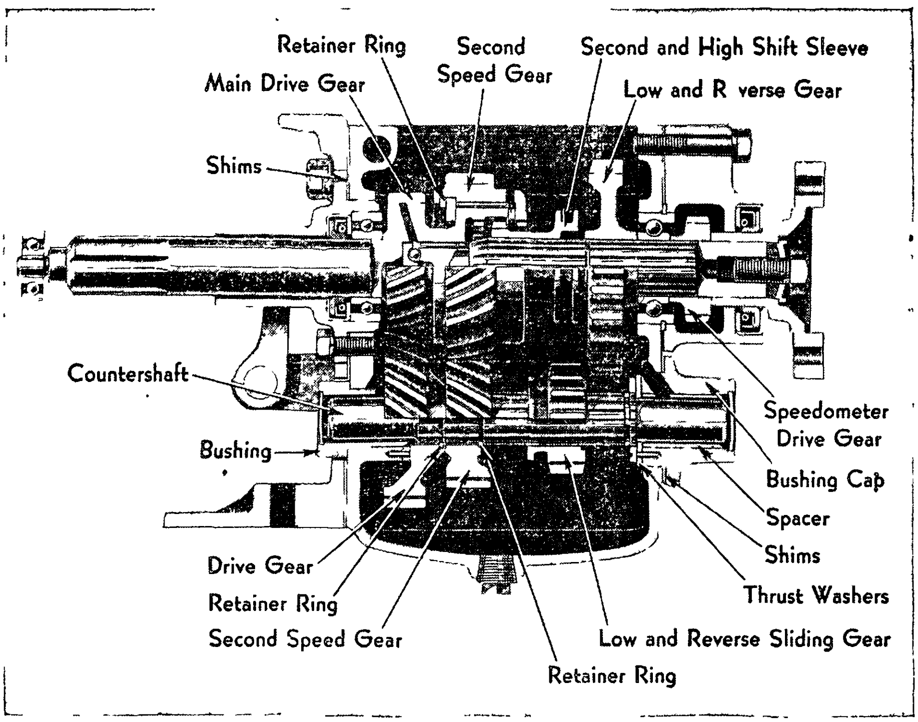


Fig. 34 Transmission, 1935-40

gear forward, but not entirely off the shaft. With the low and reverse shifter in reverse position, move countershaft to one side and move shifter to neutral position. Hold the three gears together and remove countershaft through the rear.

9. If the reversing mechanism has to be removed, see Fig. 35 (right view) and take out the parts, noting carefully their arrangement.

ASSEMBLY DETAILS — The second speed gear bushing should have a clearance not exceeding .0005". If more than this amount, the gear and bushing should be replaced as an assembly, because the bushing is machined to great accuracy at the factory to insure quiet operation. The end play should be .009".

The mainshaft end play is adjusted by shims at the front bearing cap and should be from .006" to .009". When installing the thrust balls and bearing rollers, use cup grease to hold them in position.

The countershaft end play is controlled by shims at the rear bearing cap and should be from .005" to .008". If necessary to replace the countershaft bushings, they should be line reamed to obtain .0005" clearance. When installing the countershaft intermediate gear, the front end of the gear should be flush with the edge of the countershaft splines.

If necessary to replace the reverse idler gear bushing, it should be reamed to obtain .003" clearance. On 1935 units, the reverse sliding gear on the rotating shaft should be installed so the shifting fork collar is to the rear. For 1936-40 units, the collar should be installed to the front. The reverse stationary and rotating shaft on 1936-40 units are pressed together and serviced only as an assembly.

The clearance between the shifter lock rod plungers and the lock rods should be .005". To obtain this adjustment, place shims between the lock rod guides and the transmission case.

TRANSMISSION, OVERHAUL

1941-52—See Fig. 36 and disassemble as follows:

1. Pull universal flange and remove speedometer drive gear and housing.
2. Remove shift rails and forks.
3. Pull mainshaft back, remove snap ring from its forward end and strip the shaft of its gears and synchronizer. The shaft may then be withdrawn.
4. Remove lock plate and drive countershaft out through rear. Then, after removing the main drive gear, lift out the cluster gear.
5. Drive out reverse idler shaft and lift out gear.
6. If the shift selector lever and shaft (which are splined) are to be removed, mark the relationship of these parts to assure correct assembly.

ASSEMBLY DETAILS—The main drive gear bearing retainer is a tight fit in the clutch housing and in addition, a locating pin is assembled in the retainer to hold it securely in position. If it is necessary to replace the main drive gear bearing retainer oil seal, the use of special tools is recommended to make the installation, as damage to the case may result.

If necessary to replace the counter gear bushings, make sure that the annular oil groove in each bushing is placed toward the front for the front bushing and toward the rear for the rear bushing. The annular groove in the

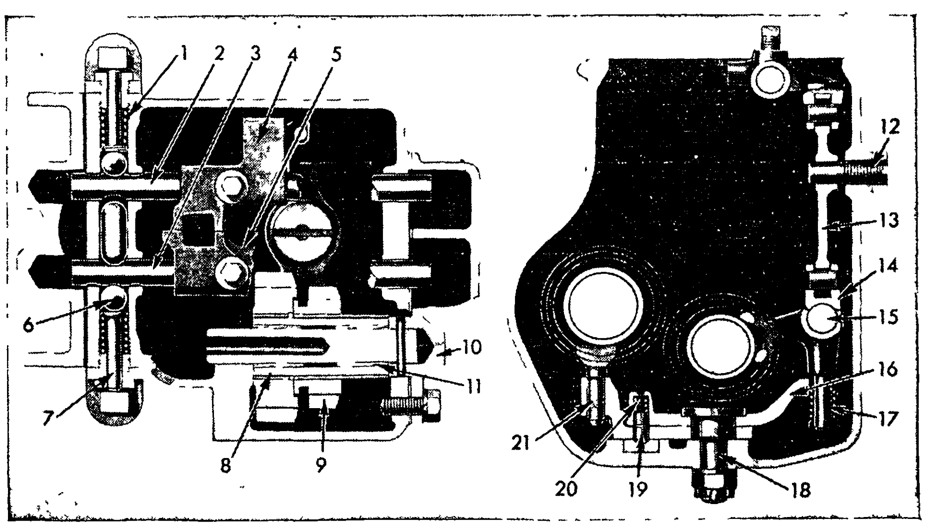


Fig. 35 Transmission shifter mechanism, 1935-40. Top view shown at left; rear view, right

1 — Lock ball spring
2 — Low and reverse shift rail
3 — Second and high shift rail
4 — Low and reverse shifter assembly
5 — S c nd and high shift fork
6 — L ck ball
7 — L ck ball spring cap
8 — Stati nary r v rse gear retainer
9 — Sliding revers g ar
10 — Revers gear shaft cap
11 — Reverse rotating shaft bushing
12 — Intermediate lever stud
13 — Intermediate lever
14 — Shift fork assembly
15 — Shift f rk shaft
16 — Shifter pick-up lev r
17 — Shift f rk spring
18 — Shift lever fulcrum
19 — Shift lever l cater pin
20 — Pick-up l v r plung r spring
21 — R vers g ar shift r

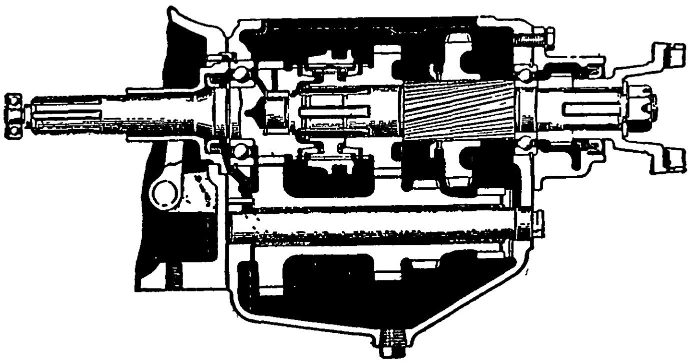


Fig. 36 Standard transmission, 1941-52

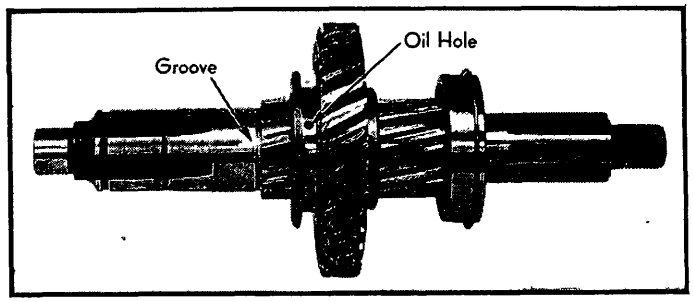


Fig. 37 Showing how oil holes in low and rev rse gear should line up with mainshaft grooves, 1941-52

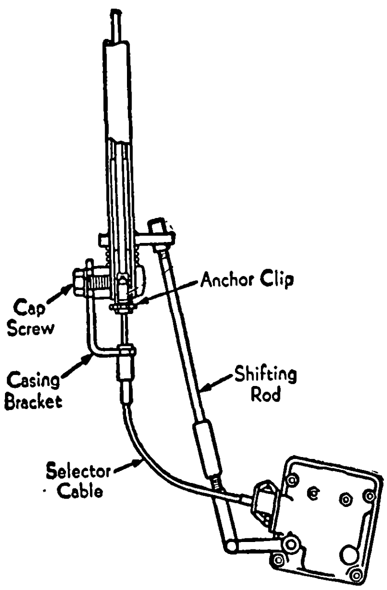


Fig. 38 Gearshift. Typical of 1939-47

reverse idler gear bushing, if it is to be replaced, should be toward the front end in the gear. When installing the countergear, place the steel thrust washer at the rear end of the cluster.

When installing the low and reverse gear on the mainshaft, Fig. 37, position the gear so that the four oil holes in the gear line up with the deep grooves in the mainshaft.

NOTE — The synchronizer shift sleeve hub and synchronizer rings are supplied with two different tooth designs. Parts designated as Design A have a 90 degree tooth chamfer, while parts designated as Design B have a 110 degree tooth chamfer. The parts with the 10 degree tooth chamfer are marked with a number 110, while the parts with the 90 degree tooth chamfer are not marked. Parts of different tooth design should never be installed together.

GEARSHIFT

OPERATING ROD, ADJUST

1939-52—Fig. 38. Raise the front end of the car and work from underneath. Remove the clevis pin and cotter pin in the yoke end of the operating rod at the transmission end. With the transmission cover lever and hand control lever in neutral, loosen the yoke lock nut and turn the yoke until the clevis pin will drop into the lever without moving either lever.

CROSS SHIFT, ADJUST

1939-52—This adjustment can be made from the top after raising the hood. Loosen the control wire anchor bracket bolt at the lower end of the steering column. Pull the casting bracket up until all slack is removed from the casing, and the shift shaft in the transmission is fully over to the low and reverse side. Tighten the anchor bracket bolt in place. Be sure there is some clearance at the top and bottom of the travel of the anchor clip.

HYDRA-MATIC DRIVE

1951-52—A detailed procedure on servicing this device is covered in a special *Hydra-Matic Drive* chapter. The following material covers the linkage adjustments as applied to Hudson cars.

THROTTLE CONTROL ADJUSTMENT

1951-52—1. Adjust engine idle speed at 490-510 rpm, with engine at normal operating temperature, transmission warm and control lever in neutral.

2. With the carburetor throttle screw, Fig. 39, against its stop and carburetor off fast idle, adjust the accelerator cross shaft operating rod trunnion nuts until the gauge pin, Fig. 40, enters freely into the accelerator pedal bellcrank lever and the hole in the boss of the cylinder block.

3. When the gauge pin enters both holes freely, remove the gauge pin and tighten the trunnion lock nuts securely. Recheck this adjustment by again entering the pin into the bellcrank lever and boss hole. Pin should again enter both holes freely. After rechecking, remove gauge pin.

4. Raise car and disconnect the transmission throttle rod at the transmission outer lever, Fig. 41. Tighten the outer lever clamp bolt if necessary.

5. Check position of outer throttle lever as follows: (A) Clean the machined surface at the back of the transmission case and place the throttle lever checking gauge, Fig. 41, flat against the back surface of the transmission case with the edge of the checking gauge against the transmission side cover. (B) With the transmission outer lever held against its stop (toward rear of transmission), the throttle outer lever hole should enter freely over the small diameter of the gauge pin, Fig. 41, and the inside face of the throttle control lever should just touch the larger diameter of the gauge rod. Do not force the outer lever against its stop and do not try to bend this lever unless you have the proper bending tool. This bending tool is shown in Fig. 42. (C) After making the proper alignment of the throttle outer lever to the throttle checking gauge, install the transmission throttle rod to the outer throttle lever and lower the car.

6. Disconnect the transmission throttle rod trunnion from the accelerator pedal link bellcrank lever, Fig. 43. The gauge pin should enter freely into the bellcrank lever and hole in engine boss.

7. Holding the transmission outer throttle lever against its stop by pushing the transmission throttle rod rearward lightly, adjust the throttle rod so the trunnion pin will slide freely into the accelerator pedal link bellcrank lever.

8. Install the trunnion pin and shorten

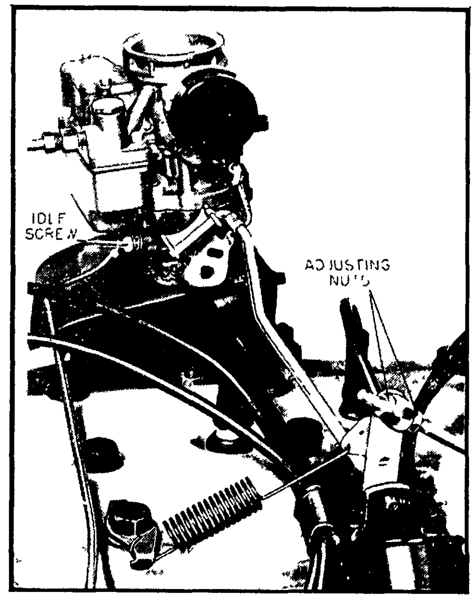


Fig. 39 Throttle linkage t carburet r. 1951-52 Hydra-Matic

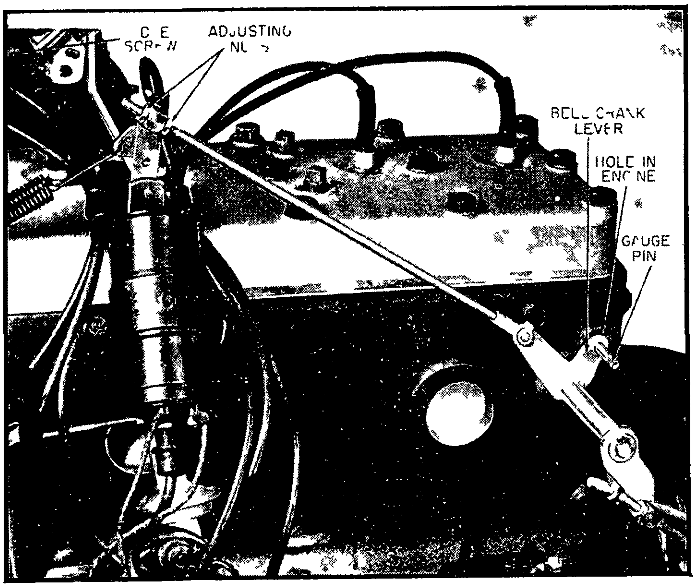


Fig. 40 Carburetor-to-bellcrank linkage. 1951-52 Hydra-Matic

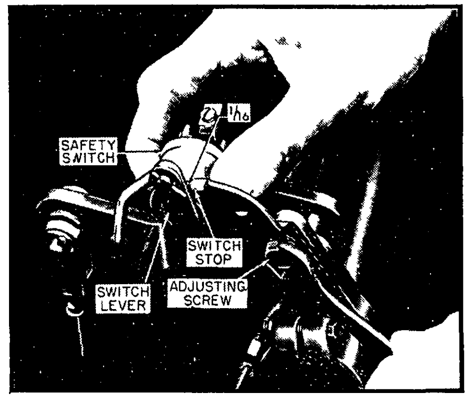


Fig. 46 Neutral safety switch adjustment. 1951-52 Hydra-Matic

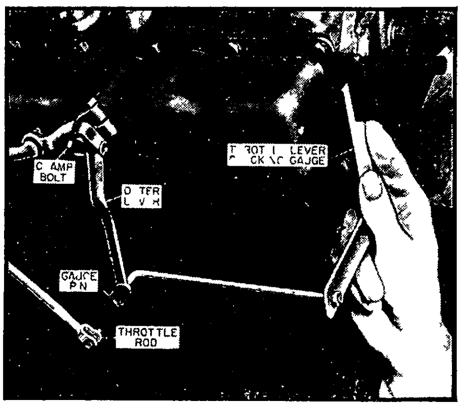


Fig. 41 Checking transmission throttle lever. 1951-52 Hydra-Matic

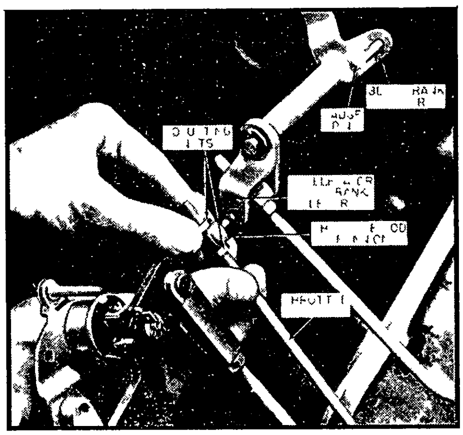


Fig. 43 Adjusting transmission throttle rod. 1951-52 Hydra-Matic

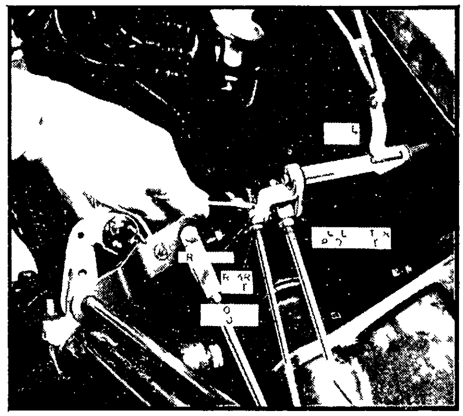


Fig. 44 After installing throttle rod trunnion, shorten throttle rod by backing off rear lock nut 1½ turns and tighten upper nut. 1951-52 Hydra-Matic

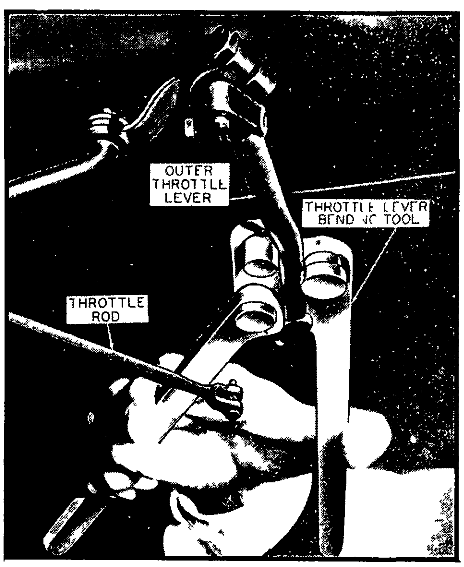


Fig. 42 Adjusting transmission throttle lever with bending tool. 1951-52 Hydra-Matic

Fig. 45 Manual control linkage. 1951-52 Hydra-Matic

the throttle rod by backing off the rear lock nut 1½ turns and tighten the upper lock nut securely, Fig. 44. Remove the gauge pin.

9. Adjust the accelerator pedal rod so that the accelerator pedal is 1/16 in. from its stop at the floor panel when the carburetor throttle is wide open.

MANUAL CONTROL ADJUSTMENT

1951-52—1. Disconnect the transmission shift rod at the manual control lower lever, Fig. 45.

2. Place transmission shift lever in the reverse position by pushing the shift rod rearward as far as it will go. Then pull shift lever rod forward one detent, placing the shift lever in "LO" position.

3. Place control lever at steering wheel in "LO" position and pull the manual control lever as far as it will go toward reverse without lifting the manual lever.

4. Adjust the length of the transmission shift rod until the clevis pin holes align. After determining the clevis pin enters freely, increase the length of the shift rod by turning the clevis one full turn. Install the clevis pin and tighten the clevis lock nut.

NEUTRAL SAFETY SWITCH ADJUSTMENT

1951-52—1. Place manual control lever in "N" position.

2. Loosen safety switch adjusting screw Fig. 46, and rotate the switch and bracket until there is 1/16 in. clearance between the stop and switch lever.

3. With the manual control lever in neutral the starter should operate when the ignititon switch is on and starter button on the instrument panel is pressed.

4. With manual control lever in the "DR" position, the starter should not operate when the starter button is pressed and ignition switch on.

REAR AXLE

REAR AXLE, OVERHAUL

1935-52—Fig. 47. The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

The drive pinion is held in position by the shoulders in the differential carrier, upon which the pinion bearing cups seat. The pinion position is maintained by shims located between the pinion head and the rear bearing cone. Shims between the bearing spacer and front bearing cone are used to adjust pinion bearings.

Pinion & Bearings, Replace—The differential unit must be removed before the drive pinion can be taken out, but it is not necessary to remove the drive pinion or differential unit if only the drive pinion bearing oil seal is to be replaced.

To remove the oil seal, take off the pinion flange retaining nut and pull off the flange. The oil seal may then be pulled out of the carrier.

Pull the drive pinion through the gear end of the differential carrier. The bearing spacer, front bearing and shims may then be taken out. Using a bearing puller, remove the rear bearing cone from the pinion shaft and, unless the ring gear and pinion are to be replaced with new parts, use care not to allow the front and rear shim packs to become mixed.

If the differential unit was satisfactory from the standpoint of noise before the unit was mismantled, the drive pinion may be assembled with the original shims behind the rear bearing. If new parts are used or if an adjustment was necessary, change the shims until the correct combination is obtained to locate the pinion properly.

To assemble, place the front bearing in position in its cup and install the pinion shaft oil seal. Place the shims on the pinion shaft against the pinion head and press on the rear bearing. Slip the bearing spacer against the rear bearing, then place the front bearing shims ahead of the spacer. Install the pinion and assembled parts in the carrier, passing the forward end of the pinion through the front bearing. Replace the pinion flange, slip on the washer, screw on the retaining nut and tighten securely.

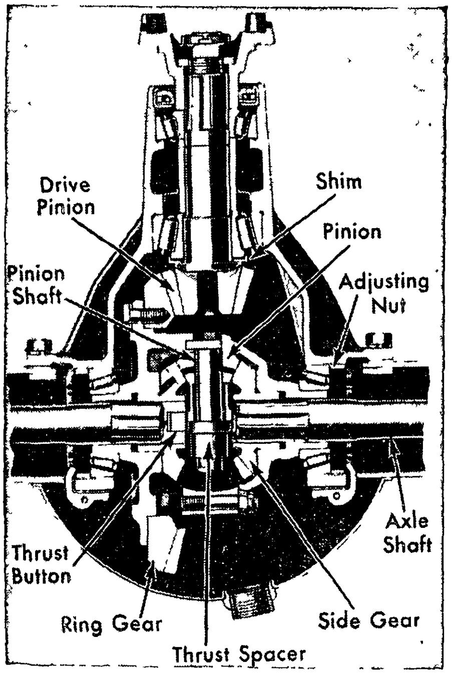


Fig. 47 Rear axle, 1935-52

Pinion Bearings, Adjust—The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and front bearing so that when the pinion retaining nut is tightened against the flange, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

Pinion, Adjust—After adjusting the pinion bearings, the position of the pinion should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle* chapter. If a correction is necessary, disassemble the parts and, if the pinion is to be moved toward the center of the axle, add shims between the pinion head and the rear bearing cone. If the pinion has to be moved away from the center of the axle, remove shims as required.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle* chapter. When the adjustment is correct, lock the flange nut with a new cotter pin.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-52—To remove an axle shaft, Fig. 48, raise the rear end of the car and take off the rear wheel assembly. Use a suitable puller to remove the hub and brake drum. A knock-off type puller should not be used, nor should the end of the shaft be struck with a hammer

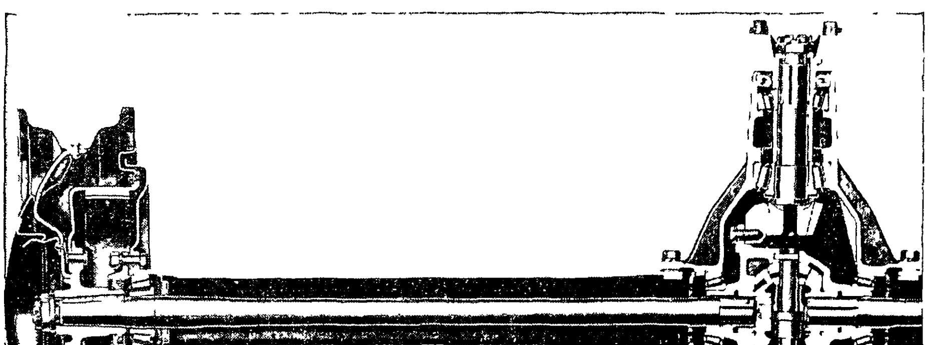


Fig. 48 Rear axl and rear wheel details, 1935-52

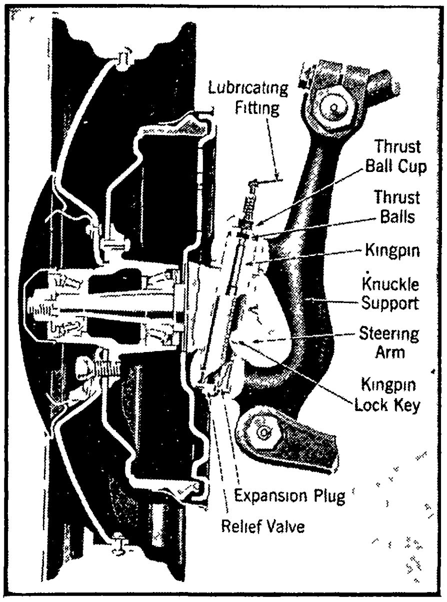


Fig. 49 Details of steering knuckl . 1940-52

in an attempt to loosen the hub because damage to the differential parts may be the result.

Remove the bearing adjusting cap and shims and pull out the axle shaft and bearings.

Reverse the procedure to install. The end play of the axle shaft should be maintained at from .004" to .010" for 1935 to 1938 cars, and from .002" to .004" for 1939-52 cars. By adding or removing shims between the axle housing and the bearing adjusting cap, the recommended clearance can be obtained.

AXLE SHAFT THRUST BUTTON

1935-52—Remove the axle shaft as described above. Grind off the button until it is flush with the end of the axle shaft. Drill an $\frac{11}{32}$" hole through the center of the button and tap a ⅜" thread in the hole. Screw a long ⅜" cap screw into the tapped hole. With the head of the cap screw locked in a vise, tap the end of the axle shaft with a soft hammer until the button is removed.

To install a new button, clean out the hole thoroughly, and drive in the button until it is firmly seated in the end of the shaft.

WHEEL ALIGNMENT

CASTER & CAMBER, ADJUST

HUDSON 1935, TERRAPLANE 1935-37—Caster up to about two degrees can be adjusted by inserting tapered caster plates between the spring seat and the spring. To increase caster, place the thick side of the plate toward the back of the car. To decrease caster, the thick side of the plate should face the front. When caster is out more than two degrees, the axle should be straightened to change the angle of the spring seat.

The only way camber can be adjusted is by bending the axle.

1936-39—To adjust caster, loosen the upper and remove the lower torque arm-to-axle bolts and add or remove shims between the torque arm and the axle. The shims are .020" thick and removing or adding one shim changes the caster ½-degree. To reduce caster, increase the thickness of the shims at the top of the torque arm and reduce the thickness of the shims at the bottom.

To increase caster, decrease the thickness of the shims at the top of the torque arm and increase the shim thickness at the bottom. When caster is correct, replace and tighten the bolts.

NOTE—Camber adjustment is the same as described for 1935 models.

1940-52—Caster is adjusted by turning the eccentric bushing in the upper end of the control arm. To make the adjustment, loosen the bushing lock nut in the control arm. Turning the eccentric bushing clockwise increases the caster, and counter-clockwise decreases the angle. One complete turn of the bushing changes the caster ½ degree. Always turn the bushing in multiples of one turn so that the camber angle will not be disturbed.

Note—On 1942-52 models with pressed steel upper support arms, the eccentric bushing is placed between the forks. On these models, the hexagon head for turning the eccentric is between the forks rather than at the end as it was on previous models.

To change the camber angle, it should be borne in mind that its complete range of adjustment is in a half-turn of the eccentric bushing. Turning the bushing a half revolution changes the camber ½ degree. When the adjustment is completed, tighten the eccentric bushing lock nut.

TOE-IN, ADJUST

1935-39—Toe-in is adjusted by loosening the clamps at either end of the tie rod and turning the rod in the desired direction to obtain the results according to the specifications given in the Front End table. The drag link should be adjusted so that the steering wheel is in its central position when the wheels are in their straight-ahead position.

1940-52—To adjust toe-in, loosen the clamp on both tie rods. Then rotate one tie rod at a time for half the required amount. Rotating the tie rods in the direction of forward wheel rotation increases toe-in, and turning them in the opposite direction decreases the toe-in.

FRONT END SERVICE

Front Wheel Bearings, Adjust, 1935-52—Jack up wheel and remove outer and inner hub caps. Remove the cotter pin and turn the spindle nut to the right to be sure bearings are properly seated and then back off the nut until a slight drag is felt when turning the wheel by hand. Then loosen the nut just enough to allow the wheel to turn freely, and lock the adjustment with a cotter pin.

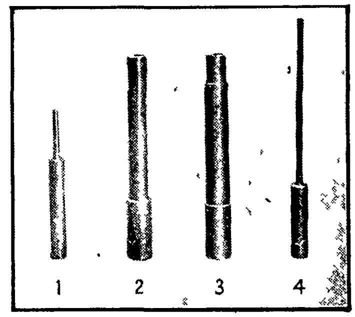


Fig. 50 Kingpin service t ols. 1935-52

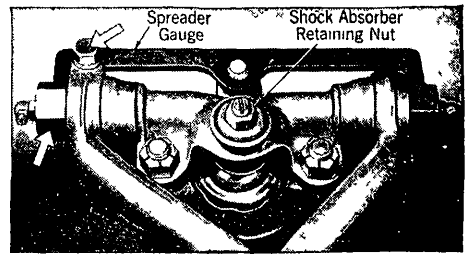


Fig. 51 Locating upper contr l arm bushing (drop forged type arm), 1940-42

Kingpins & Bushings, 1935-52—Due to the design of the steering knuckle mounting, Fig. 49, the special tools shown in Fig. 50 should be used to service the kingpins, the chief reason being that the kingpins are hollow.

To renew kingpins and bushings on cars with an axle (1935-39) it is not necessary to remove the axle from the chassis. On knee action cars (1940 and later) it is recommended that the steering knuckle support be taken off.

After the front end has been jacked up and wheels removed, proceed as follows, bearing in mind that unless otherwise stated, the following material covers all models, regardless of which type of suspension is employed.

On cars with an axle, disconnect the tie rod from the steering arms. Remove the nut and drive the steering arms out of the knuckles; the kingpin lock keys will come out at the same time. Unfasten the brake support plates from the knuckles and lift them off, avoiding any strain on the brake hose.

On knee action cars, disconnect the stabilizer from the brake support plates and push the connectors out of the way. Unfasten the brake support plates from the knuckles and lift off, using the same precautions regarding any strain on the brake hose. Remove the nut and drive the steering arm out of the knuckle. Unfasten the steering knuckle support from the upper and lower control arms. Then remove the support together with the knuckle. The knuckle and support may be disassembled on the bench.

On all models, knee action or otherwise, the knuckle is disassembled as follows. The tool numbers referred to are shown in Fig. 50.

Unscrew the grease fitting from the top of the kingpin thrust ball cup (upper bushing) and use the short driver (1) to loosen the kingpin and to drive out the expansion plug at the bottom. With the

long driver (4) drive the kingpin all the way down, being careful not to lose any of the thrust balls as the kingpin is freed from the upper yoke. Drive the thrust ball cup out of the support with a soft head hammer. With the two-step driver (3) drive the lower bushing out of the yoke.

Install the thrust ball cup with the two-step driver (3). Use driver No. 2 to install the lower bushing. (The thrust ball cup and lower bushing are hardened and ground so that no reaming is required after being installed.)

Drive the kingpin through the lower yoke until it is just about ready to enter the upper yoke. Position the thrust balls around the bearing race and drive the kingpin all the way up, being sure the key slot in the side of the kingpin is located so that when the steering arm is replaced, the key can be inserted. Install a new expansion plug in the lower end of the yoke, and the grease fitting in the top of the thrust ball cup.

On knee actions cars, connect the steering knuckle support to the upper and lower control arms. Complete the assembly by installing the brake mechanism and wheels.

Upper Control Arm, Replace. 1940-41—Jack up car and remove wheel. Unscrew the upper shock absorber retaining nut and the three bolts which fasten the control arm to the frame. Remove the outer pivot clamp bolt and unscrew the eccentric bushing from the control arm.

When installing, the tool shown in Fig. 51 should be used to maintain the central position of the control arm. The tool should be placed on the outer stud of the pivot bar and the eccentric bushing located so that the pivot bar is centralized with the tool.

When the assembly is completed and car resting on the floor, check and adjust wheel alignment.

Upper Control Arm, Replace, 1942-52—Used in late 1942 production and all models thereafter, this type control arm is serviced as follows:

Jack up car under lower control arm spring seat and remove wheel. Disconnect shock absorber at its upper end and unfasten the arm at its outer pivot and from frame.

When assembling the inner pivot bar and bushings to the control arm use the spreader tool shown in Fig. 52 together with a gauge to maintain the proper spread of the arm during assembly. Install the gauge on the outer stud of the pivot. Then install the control arm so that it is central with the gauge. Install the spreader tool so that its two ends rest against the inner faces of the control arm and the flange of the arm fits in the slots machined in the ends of the spreader tools.

Turn the hex portion of the spreader tool until the gauge rests against the outer surface of the arms which will spread the arms $\frac{1}{16}$ in.

Start the bushings on both ends of the pivot bar, lubricating them with tapping compound, which will aid the bushings

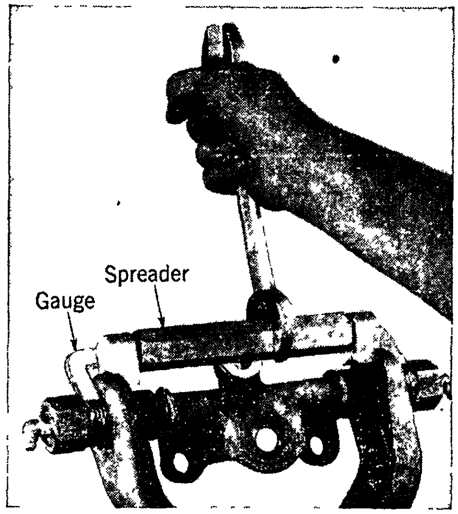


Fig. 52 Assembling upper control arm (pressed steel type), 1942-52

in cutting their own threads in the control arm. Thread the bushings into the arm until their shoulders bottom against the control arm and tighten them to 110 lbs. ft. torque. Remove both tools and check the operation of the pivot bar for free movement. When the work is completed and car resting on floor, check and adjust wheel alignment.

Front Spring & Shock Absorber, 1940-52—Raise the car and place stand jacks under the frame side rails. Place an adjustable jack under the lower control arm but not under the spring seat. Remove the wheel. Remove the nuts which attach the upper and lower ends of the shock absorber. Turn the shock absorber ¼ turn and take it out through the opening in the lower control arm. Unfasten the lower control arm pivot bar from the frame. Lower the jack under the control arm until the spring is loose and can be taken out. Reverse the procedure to install the spring and shock absorber, being sure the flat end of the spring is to the top.

Lower Control Arm Service, 1940-52—To remove the arm, remove the spring and shock absorber as outlined previously. Then unfasten the outer pivot from the knuckle support.

When assembling the control arm inner bushings, insert the pivot bar on the control arm and place a suitable spreader tool between the legs of the arm to maintain the correct spread.

Start the bushings in both ends of the pivot bar, using a suitable tapping compound so the bushings can cut their own threads in the control arm. Thread the bushings into the control arm and onto the pivot bar until the bushing heads contact the arms and tighten securely. Remove the spreader tool and check the operation of bar for free movement.

Assemble the control arm to the car, being sure to centralize the outer pivot pin in the knuckle support. When the work is completed and car resting on the floor, check and adjust wheel alignment.

STEERING GEAR

STEERING GEAR, REMOVE & REPLACE

1935-37—Disconnect the negative terminal at the battery and the wires at the starting motor terminal and the solenoid switch. (Not necessary on 1937.) On 1935-36 models, remove the starter. If equipped with electric hand, disconnect the electric hand jack at the bottom of the jacket tube.

On all models, remove the two cap screws holding the jacket tube bracket to the instrument panel bracket. Loosen the steering column clamp at the bottom of the jacket tube and remove the tube. Using a suitable puller, remove the pitman arm.

On 1935-36 models, remove the spring seal retainer and seal from the steering gear cross shaft.

On all models, remove the steering gear mounting stud nuts and washers from the outside of the frame side member, and remove the steering gear. On 1937 models, it is necessary to remove the engine side pan.

1938-52 — Disconnect the battery cable at the negative terminal and remove the cable clip bolt and nut at the battery tray. On the 89 and 90 models, remove the bolts attaching the starter motor switch to the lower end of the steering gear.

On all models, disconnect the horn wire at the lower end. Remove the jacket tube clamp bolt and nut. Disconnect the column shift control wire (if so equipped) by removing the anchor clip and wire casting anchor bracket bolt. Disconnect the column shift control tube rod at the tube lever. Remove the control tube lower bracket clamp bolt. Disconnect the drag link at the pitman arm. Using a suitable puller, remove the pitman arm. Remove the horn button and wire, steering wheel nut and steering wheel as already described. Remove the jacket tube bracket cap and bolts. Remove the shift control tube upper bracket and ring.

Slide the jacket tube from the main tube, and out of the jacket tube clamp and the control tube lower bracket. Remove the shift control tube by working the lower lever up through the hole in the toe board, leaving the rubber hole cover on the control tube. Remove the steering gear mounting nuts and washers.

On 1940-47 cars, disconnect the radiator stay rods at the dash and move them out of the way. On 1940 models, disconnect the hood hinge at the right hand side of the hood.

Remove the steering gear by raising the lower end up over the engine, and out over the right hood side panel, by turning the lower end for clearance, as required.

Installation may be made in the reverse order.

KAISER & FRAZER

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake Developed H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1947	Kaiser Special 6	K-100	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	6.86	100 @ 3600	180 @ 1400	35 @ 35
	Kaiser Custom 6	K-101	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	6.86	100 @ 3600	180 @ 1400	35 @ 35
	Frazer 6	F-47	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	6.86	100 @ 3600	180 @ 1400	35 @ 35
	Frazer Manhattan 6	F-47C	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	6.86	100 @ 3600	180 @ 1400	35 @ 35
1948	Kaiser Special 6	K-481	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
	Kaiser Custom 6	K-482	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
	Frazer 6	F-485	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
	Frazer Manhattan 6	F-486	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
1949	Kaiser Special 6	K-491	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
	Kaiser De Luxe 6	K-492	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
	Frazer 6	F-495	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
	Frazer Manhattan 6	F-496	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
1950	Kaiser Special 6	K-501	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	100 @ 3600	180 @ 1400	35 @ 35
	Kaiser De Luxe 6	K-502	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
	Frazer 6	F-505	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
	Frazer-Manhattan 6	F-506	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	112 @ 3600	180 @ 1400	35 @ 35
1951	Kaiser Special 6	K-511	$118\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35
	Kaiser De Luxe 6	K-512	$118\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35
	Frazer 6	F-515	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35
	Frazer Manhattan 6	F-516	$123\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35
1952	Kaiser Virginian 6	K-521	$118\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35
	Kaiser Manhattan 6	K-522	$118\frac{1}{2}$	In Block	$3\frac{5}{16} \times 4\frac{3}{8}$	226	7.3	115 @ 3650	190 @ 1800	40 @ 35

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note H	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Transmission	Automatic Transmission	
1947	All	A	.032	.020	35–38	153624	B	Positive	500		30–35
1948	All	A	.032	.020	35–38	153624	C	Positive	500		30–35
1949	All	D	.032	.020	35–38	153624	E	Positive	500		30–35
1950	All	F	F	.020	35–38	153624	E	Positive	500	425–450	30–35
1951–52	All	G	.032	.020	35–38	153624	E	Positive	500	425–450	30–35

A—Auto-Lite A5 or Champion J9.
B—TDC mark on flywheel to engine number 17,160; "O" mark on vibration damper thereafter
C—"O" mark on vibration damper.
D—Auto-Lite A5 or Champion J7.
E—Fourth line before the "O" on vibration damper.
F—Auto-Lite A5 (.032" gap) or Auto-Lite AR5 (.040" gap).
G—Auto-Lite A5 or AN5.
H—Plus or minus .002".

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1947-50	All	.002	.002–.004	2.0619–2.0627	.0005–.0023	.006–.010	40–45	2.3744–2.3752	.0015–.002	.004–.006	85–95
1951-52	All	.002	.002–.004	2.0619–2.0627	.0005–.0018	.006–.010	40–45	2.3744–2.3752	.0007–.002	.002–.006	85–95

A—Thrust taken by rear bearing.

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1947	All	B	.014C	B	C	10	10	45@1 21/32	.001-.0025	.0035-.005	.3410	.3410
1948-52	All	.014C	.014C	.014	C	10	10	45@1 21/32	.001-.0025	.0035-.005	.3410	.3410

A—BTDC means before top dead center; ATDC means after top dead center.
B—Up to engine No. 10769, .010"; after 10769; .014".
C—Intake 30, exhaust 45.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Shim Thickness To Use	Pounds Pull on Scale	Ring Gap, Minimum (Note A): Compression	Ring Gap: Oil	Clearance in Groove: Compression	Clearance in Groove: Oil	Pins: Type	Pins: Fit
1947-52	All	Above	.0015	5 to 10	.008	.008	B	.001-.0025	C	D

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Top ring .0025-.004", second ring .0015-.0035".
C—Floating type. Pin retained by snap rings in piston bosses.
D—Thumb push fit in piston and rod but with piston heated.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	Engine: Crankcase Refill Capacity, Quarts	Engine Grade of Oil: Above +32°F.	Above +10°F.	Above −10°F.	Transmission: Capacity, Pounds or Pints	Transmission Grade of Oil: Summer	Winter	Differential: Capacity, Pounds or Pints	Differential Grade of Oil: Summer	Winter
1947-48	All	15	21	5	20	20W	10W	A	90	80	3	90H	80H
1949-50	All	13½	21	5	20	20W	10W	A	90	80	3	90H	80H
1951-52	Kaiser	13½	17	5	20	20W	10W	A	90(B)	80(B)	3	90H	90H
	Frazer	13	21	5	20	20W	10W	A	90(B)	80(B)	3	90H	90H

A—Less overdrive 2½; with overdrive 4; with Hydra-Matic 11 quarts.
B—Cars with Hydra-Matic use Hydra-Matic fluid only.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1947-50	All	Zero	+ 3/8	1/16	5¼
1951-52	All	Zero	+ ½	1/8	5½

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1947-52	All	.003-.006	Shims	Shims	.001-.006

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1947-50	All	Molded	22 5/32	2	3/16	7/8
1951-52	All	Molded	22	2	13/64	7/8

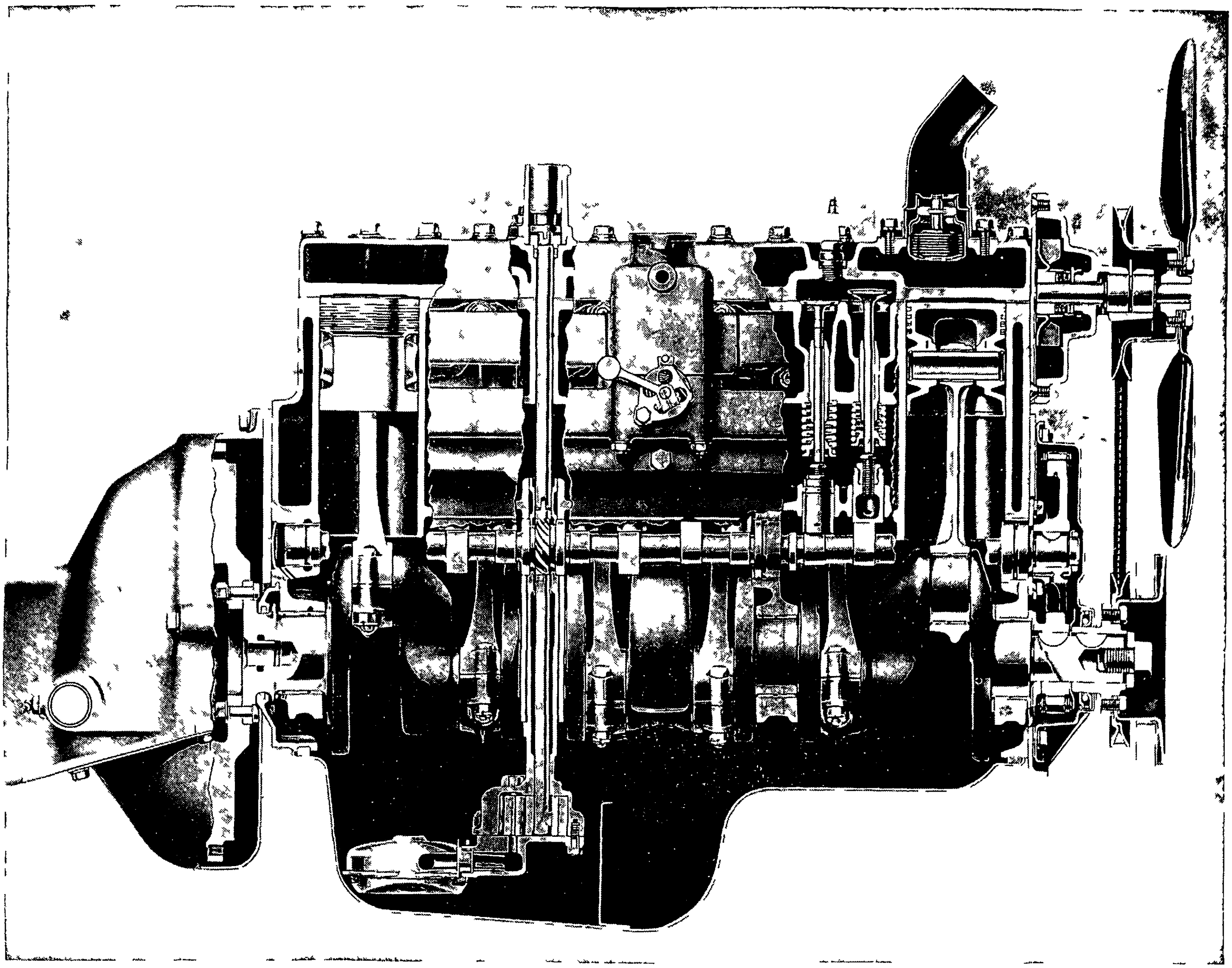


Fig. 1 Sectional view of engine, 1947-52

ENGINE

ENGINE REMOVAL, 1947-52

1. Remove radiator and battery
2 Disconnect fuel lines and linkage.
3 Disconnect exhaust pipe.
4 Disconnect starter solenoid cable (1949-52).
5 Disconnect oil pressure gauge tube on Frazer models On Kaiser models, disconnect electrical wiring at engine oil gauge engine unit terminal
6 Disconnect wire from ignition coil minus terminal
7 Disconnect generator wiring
8 Remove transmission and overdrive
9 Remove clutch linkage
10 Attach suitable engine lifting bracket to cylinder head, preferably to No 7 and 28 bolt holes, Fig 3
11 Attach hoist and raise engine slightly
12 Detach front engine mountings
13 Raise hoist and turn engine at a slight angle to clear shroud and lift out.

CYLINDER HEAD

1947-52—The general procedure for removing the cylinder head is as follows
1. Drain cooling system
2 Disconnect fuel line from carburetor.
3 Remove air cleaner and carburetor
4. If valve work is to be done, disconnect exhaust pipe from manifold and remove manifolds from engine
5 Remove upper radiator hose, spark plugs, temperature gauge bulb or wire
6 Remove cylinder head bolts and lift off head

Installation Notes—Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block

If possible, use a torque wrench when tightening cylinder head bolts Uneven or excessive tightening may distort cylinder bores, causing compression loss and excessive oil consumption

Tighten cylinder head bolts in the order shown in Fig 2, tightening them a little at a time in the proper sequence about three times around before final

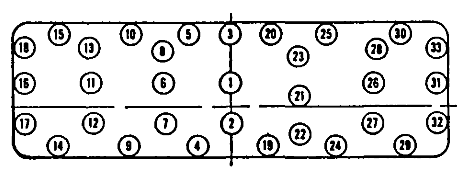


Fig. 2 Cylinder h ad bolt tightening sequence. 1947-52

tightening to the torque values given in the *Tune Up Chart* After the engine has warmed up to operating temperature, recheck the bolts and adjust torque as required

VALVE SERVICE, 1947-52

Valve Adjustment—The valves should be adjusted while the engine is at normal room temperature The procedure is as follows
1 Raise right front end of car and support it with a stand
2 Remove right front wheel and splash shield access cover
3 Remove valve chamber covers
4 Crank engine over until valve to be adjusted is fully closed
5 Hold the valve lifter body, Figs 3 and 4 to prevent it from turning. Then

FIRST SERIAL NUMBER

LOCATION — On left front door hinge pillar post.

Year	Model	
1947	K-100	K100-001001
	K-101	K101-2000001
	F-47	F47-001001
	F-47C	F47C-1000001
1948	K-481	K481-001001
	K-482	K482-001001
	F-485	F485-001001
	F-486	F486-001001
1949	K-491	K491-1001
	K-492	K492-1001
	F-495	F495-1001
	F-496	F496-1001
1950	K-501	K501-1001
	K-502	K502-1001
	F-505	F505-1001
	F-506	F506-1001
1951	K-511	K511-001001(A)
	K-512	K512-001001(A)
	F-515	F515-001001(A)
	F-516	F516-001001(A)

A—Additional letter in serial number denotes plant of assembly.

FIRST ENGINE NUMBER

LOCATION—On left side of engine at upper front and also on plate attached to left side of crankcase.

Year	Model	
1947	K-100	K-10001
	K-101	K-10001
	F-47	GP-10001
	F-47C	F-10001
1948	K-481	Note A
	K-482	Note A
	F-485	Note A
	F-486	Note A
1949	Kaiser (early)	403001(B)
	All	M-5001(B)
	All	800001(C)
1950	All	Note A
1951	Kaiser	1100000
	Kaiser	2000000
	Frazer	1000001
	Frazer	2300000

A—Continued from previous year.
B—Detroit, Mich.
C—Muskegon, Mich.

turn the tappet adjusting screw until the proper clearance (measured with a feeler gauge Fig. 5) is established.

6. Adjust remaining tappets in the same manner.

NOTE—In addition to the conventional method of adjusting tappets by locating the distributor rotor and then adjusting the tappets by following the firing order of the engine, the following method may also be used:

Valves Fully Raised	Adjust Tappets
1 and 3	10 and 12
8 and 9	4 and 5
2 and 6	7 and 11
10 and 12	1 and 3
4 and 5	8 and 9
7 and 11	2 and 6

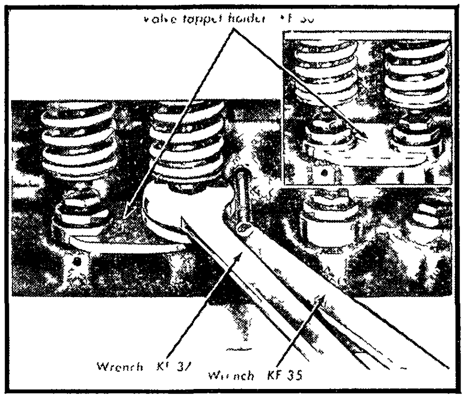


Fig. 3 Three piece tappet adjustment. 1947-50

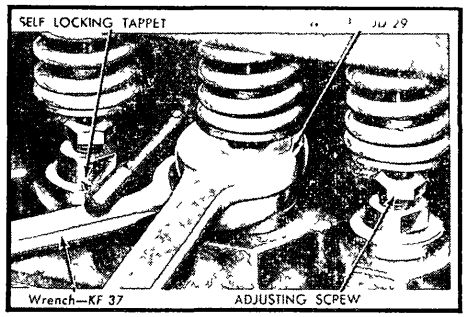


Fig. 4 Self-locking tappet adjustment. 1949-52

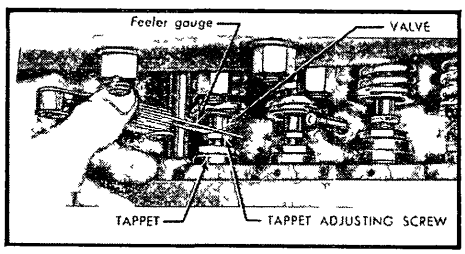


Fig. 5 Checking valve clearance. 1947-52

Valves, Remove—After taking off the cylinder head as outlined previously, take off the valve chamber covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the valve locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so that they can be identified as to the valve port from which they were removed.

Valve Springs—After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring pressure on a spring testing fixture if one is available. If not, at least check the free length of

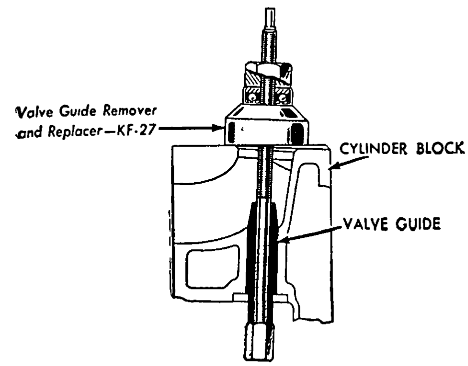


Fig. 6 Removing valv guide. 1947-52

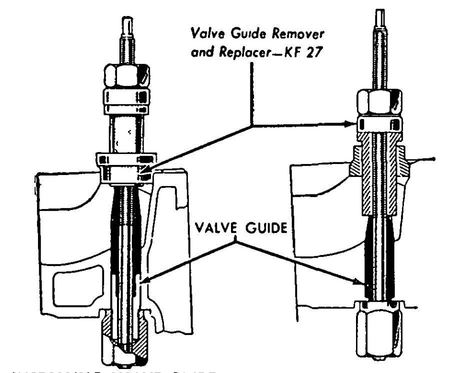


Fig. 7 Installing valve guide. 1947-52

each spring by standing it alongside a new one. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced. Likewise, any spring that stands up shorter then the new spring used for comparison should be discarded.

Valve Guides — Clean the valve guides with a wire guide brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the clearance between the valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between valve stems and guides will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

Valve stem-to-guide clearance may be checked with special "GO" and "NO-GO" gauges. Lacking these, an alternate method is to take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the guides that are worn as indicated by this test. If the clearance is not excessive when checking with a new valve but is exces-

sive when checked with the old valve, it is an indication that the old valve stem is worn and a new valve must be installed.

The guides may easily be removed with the special equipment shown in Fig. 6. When they are replaced, use the tool as shown in Fig. 7. When installed, the top end of the valve guides should be $1\frac{7}{32}$ in. below the top face of the cylinder block for maximum engine performance.

After removing the old guides, check the valve guide bore in the block as well as the outside diameter of the new guide for size to obtain .0005-.0025 in. press fit. Valve guides are available in oversizes of .0005 and .0055 in.

When the new guides are installed, they must be reamed to provide the operating clearance given in the *Valve Data* chart, Fig. 8.

Valves, Reface—In refacing valves, take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

Inspect the valve seats in the block for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valves guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

The valve seat width after refacing should not meausre more than $\frac{5}{64}$ in. The width may be checked by placing a scale across the face of the valve seat.

A simple check can be made to prove the fit of the valve in the valve seat by spreading a thin film of Prussian Blue on the valve face and then inserting the valve into the valve seat. With hand pressure, rotate the valve ¼ turn and then remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indiate an inaccurate valve and valve seat refacing operation.

Valve Lifters, 1947-50—Two types of valve lifters (tappets) have been used, Fig. 9, both being interchangeable. Oversizes are available in .0005, .001, .0015, .002, .005 and .008 in.

Proper fit of the tappets may be determined by rotating the tappet in the bore. If properly fitted, a slight drag will be evident. If the tappet is loose, selectively fit another standard or oversize tappet. Ream the tappet bores, if necessary, to obtain a proper fit. If the tappet bores are out-of-round or scored, reaming will be necessary to correct the condition.

If the tappet bores are to be reamed with the engine installed in the car the valve tappet bore must be accessible by the removal of the cylinder head, valve and spring, and the tappet. The oil pan must be removed to prevent chips falling into the oil and to facilitate thorough cleaning. As a precautionary measure, to avoid leaving any chips in the engine, apply a light grease to the cutting flutes of the reamer to pick up chips and also place an oily cloth directly below the tappet bore being reamed. When the reaming operation is completed, carefully wipe all surfaces with a clean cloth.

Valve Lifters, 1951-52 — These valve lifters or tappets are of the mushroom type, which means that the camshaft will have to be removed from the engine if valve lifters require replacement. They must be removed from the bottom of the cylinder block rather than from the valve chambers as is the case with the barrel-type lifters used formerly.

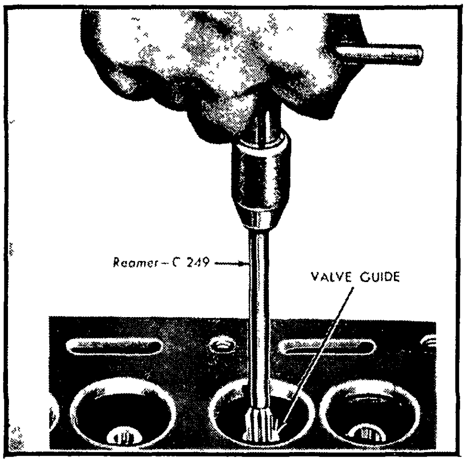


Fig. 8 Reaming valve guide. 1947-52

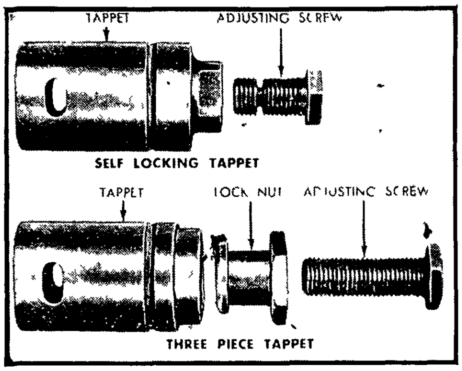


Fig. 9 Two types of tappets. 1947-52

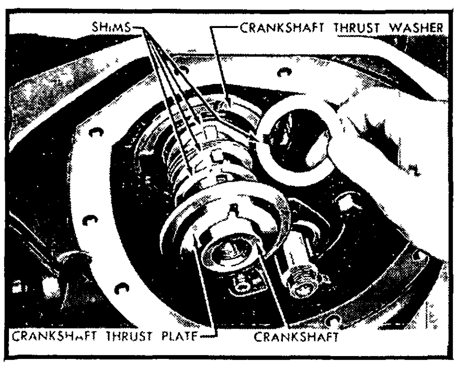


Fig. 10 Installing crankshaft thrust washer, shims and thrust plate. 1947-50

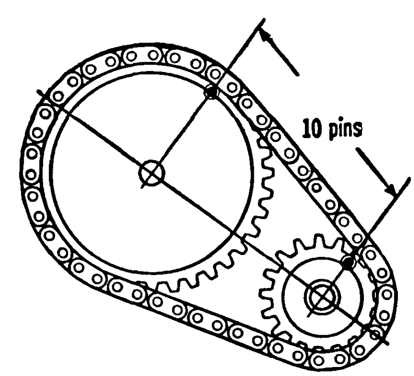


Fig. 11 Valv timing. 1947-52

CAMSHAFT & BEARINGS

1947-52—The camshaft is supported on four bearings (bushings) pressed into the cylinder block. Because the expansion plug at the rear of the cylinder block must be removed for accessibility, the bearings may only be replaced with the engine out of the vehicle.

Camshaft, Remove—Engine in vehicle.

1. Drain cooling system and remove radiator, vibration damper, timing case cover, chain and sprockets.
2. Remove fuel pump, cylinder head, oil pan and oil pump.
3. Raise vehicle and remove right front wheel.
4. Remove splash shield access hole cover under right front fender.
5. Remove valve covers, valves and springs.
6. Lift tappets out through valve compartments on 1947-50 models.
7. On 1951-52 models, tie valve lifters up at their highest point of travel with string wrapped around the adjusting screws and attach to manifold studs.
8. Unfasten the camshaft thrust plate from the front of the engine and withdraw the camshaft from the engine. On 1951 models, the valve lifters may be taken out from below at this time if necessary.

TIMING CHAIN & GEARS

1947-52—The timing chain and gears are accessible after removing the radiator, vibration damper and timing case cover.

It is recommended that the crankshaft oil seal in the cover be replaced while the cover is removed to assure a good seal around the crankshaft. Install the seal so that the lip faces toward the rear of the cover.

When it becomes necessary to replace the timing gears (sprockets) due attention must be given to the end play of both shafts.

On 1947-50 models, end play of the crankshaft is controlled by the running clearance between the crankshaft sprocket and thrust plate. The end play is adjusted by shims placed between the thrust plate and thrust washer, Fig. 10. Shims .002 and .008 in. thick are available for this adjustment. When checking crankshaft end play, the two thrust washers must be in place on the crankshaft, one at the rear side of the front main bearing and the other at the front of the bearing.

On 1951-52 models, crankshaft end play is controlled by flanges that are integral with the rear main bearing halves.

End play of the camshaft is controlled by the thrust plate which is bolted to the block behind the camshaft sprocket.

Installing Chain & Gears—Set the gears into the chain so that the timing marks on the two gears are as shown in Fig. 11. Place the gears on their respective

Fig. 12 Details of piston and c nn cting rod. 1947-52

shafts after installing the Woodruff keys in place.

The gears should slip onto the shafts with finger pressure after the shafts are rotated to properly align the keyways. If the camshaft gear must be tapped onto the shaft, hold the camshaft forward to prevent breaking the valve lifters.

PISTONS & RODS, REMOVE

1947-52—After removing the cylinder head as outlined previously, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove the connecting rod caps and push pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so they can be reinstalled in the original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1947-52—Pistons should be assembled to the connecting rod so that the oil spray hole in the rod faces the camshaft side of the engine with the vertical slot in the piston facing away from the camshaft side.

PISTONS

1947-52—Standard size service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages. Service pistons are also furnished in .002, .005, .010, .020 and .030 in. oversizes.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin (thrust side of piston). Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is very important that refinished cylinder bores are trued up to have not more than .0005 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for it, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fibre brush.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore; therefore, the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees F. between parts is sufficient to produce a variation of .0005 in.

To check the fit of pistons, use a feeler ribbon gauge ½ in. wide and the thickness listed in the *Piston Ring & Data* chart. Insert the piston upside down in the cylinder bore with rings removed, Fig. 13. Locate the feeler 90 degrees from the piston pin hole, between the thrust face of the piston and cylinder wall. Hook the feeler to a spring scale, and if the force required to pull the feeler out of the cylinder with the scale is as specified in the chart, the piston fit is correct. If too tight, the cylinder must be honed out until the proper clearance is obtained.

PISTON RINGS

1947-52—When new piston rings are to be installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter. This is done with a "Glazebuster" or a hone equipped with the finest grade of stones.

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance may result.

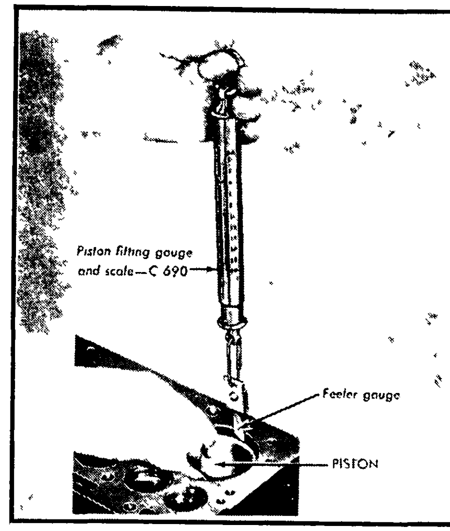


Fig. 13 Fitting pist n in cylinder. 1947-52

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston Ring & Data* chart for groove clearances and end gap clearances.

To check the end gap of rings, place the ring in the cylinder in which it is to be used. Square it in the bore by tapping with either end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends of rings carefully with a smooth file.

PISTON PINS

1947-52—Piston pins are the "floating type," being locked in place with snap rings which fit in grooves in the piston bosses. Pins are available in standard size and .003 and .005 in. oversizes.

Pins must be a push fit in the piston after the piston has been heated in boiling water. Oversize pistons are used when it becomes necessary to ream the piston to obtain a push fit when installing the pin. Pins that are worn more than .0005 in. must be replaced.

CONNECTING RODS

1947-52—Connecting rod bearings consist of two half shells, the upper shell having an oil spray hole which communicates with the oil hole in the rod.

When the bearing shells are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the shells must*

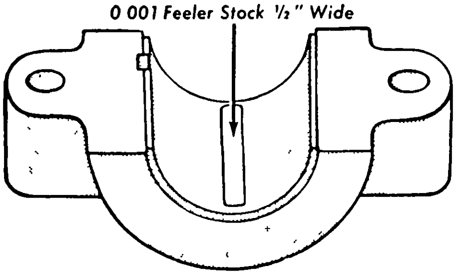


Fig. 14 Test shim in position on main bearing. 1947-52

never be filed flush with the parting surface of the rod and cap.

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the rod or cap be filed to adjust bearing clearance.

Service bearings are furnished in standard size and .001, .002, .010 and .012 in. undersizes.

The clearance of connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber and full instructions for its use are furnished with the envelope in which it is contained.

Lacking Plastigage, however, clearance may be checked with a .001 in. test shim, ½ in. wide, Fig. 14. Place the shim between the bearing and shaft journal, tightening the nuts to the proper torque. A locked bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed. Do not overlook removing the shim.

On some models, the connecting rod nuts are locked with stamped nuts which should not be reused when once removed. Install these nuts with the flat face toward the rod nut. Turn the locking nut finger tight and tighten it only a half-turn more.

CRANKSHAFT & MAIN BEARINGS

1947-52—Main bearings are the replaceable shell type which, when correctly installed, provide proper clearance without filing, boring, scraping or shimming. Upper and lower bearing halves are retained in position with locks notched on the bearing to fit into corresponding notches in the cylinder block and bearing cap. Upper and lower bearing halves of each bearing are the same.

Main bearings are available in sets of standard size and .001, .002, .010 and .012 in. undersize.

Main bearings may be replaced without removing the crankshaft from the engine. When it is necessary to install new bearings it is advisable to measure the shaft journals with a micrometer for being out-of-round. If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or connecting rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft.

After installing the bearings, check the running clearance to be sure it is standard (*see Engine Bearing Data chart*). Use Plastigage or a .001 in. test shim, Fig. 14. Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque. The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct. Do not overlook removing the test shim.

CRANKSHAFT END PLAY

1947-50—End play of the chankshaft is adjusted by shims placed between the crankshaft thrust plate and thrust washer, Fig. 10. The end play is adjusted as outlined under *Timing Chain & Gears.*

1951-52—Crankshaft on these models is controlled by integral flanges on the rear main bearing.

ENGINE OILING

OIL PAN

1947-50 — To remove the oil pan, raise the car and place stand jacks under the frame side rails. After draining the engine oil, loosen the steering drag link at the idler lever and turn the wheels to the right to work the drag link clear of the oil pan. Unfasten the pan from the crankcase and slide the pan toward the rear of the engine for removal.

In order to install a new oil pan gasket, the front and rear lower oil seal plates must be removed. When this is done, also replace the seal plate gaskets.

1951-52—The oil pan can be removed without disconnecting the steering linkage when the engine front supports are loosened and the engine raised slightly.

OIL PUMP

1947-52—The oil pump is of the positive gear type, located at the bottom of the vertical shaft which also drives the distributor.

To disassemble the oil pump, take off the screen float. Drive out the pin which secures the drive gear to the shaft and take off the gear. Remove pump cover and gasket. Position the pump with the drive shaft end up and allow the gears to drop from the pump body. Do not remove the idler gear shaft unless worn or damaged.

Assemble the pump with new parts, using a new gasket. When replacing the upper drive gear, position it on the shaft and use a feeler gauge to measure clearance between gear and end of pump body, allowing a clearance of .002 to .004". When proper clearance has been obtained, drill a $\frac{1}{16}$" pin hole through the drive shaft, install the pin and peen it securely.

OIL PRESSURE REGULATOR

1947-52 — Normal oil pressure is 35 pounds at about 30 mph. If the pressure gauge shows a low (or high) reading, disconnect the oil pressure gauge at the cylinder block and connect a test gauge. Start the engine and check the pressure. If the test gauge shows the proper reading, the gauge on the instrument panel is faulty, in which case it should be replaced.

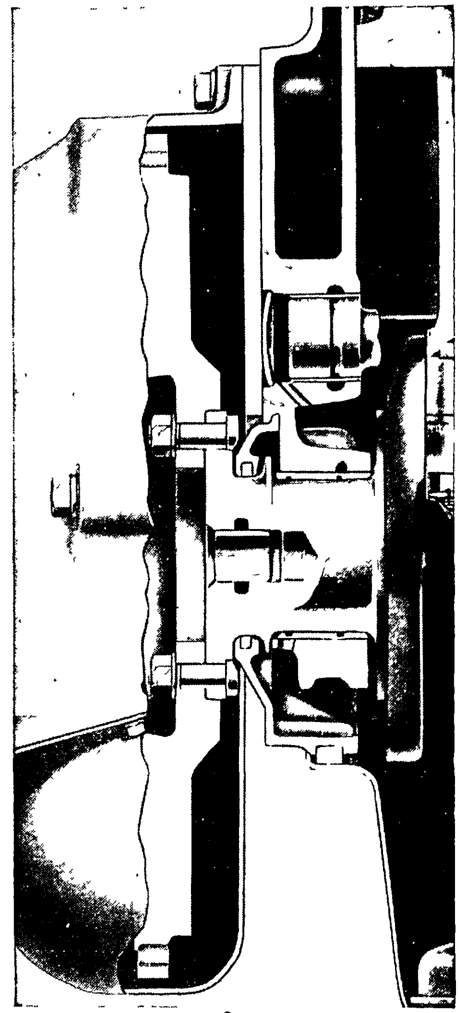


Fig. 15 Details of camshaft and crankshaft at rear, 1947-50. 1951-52 c nstructi n is similar except that rear main bearing has flanges to control crankshaft end thrust

If the reading on both the instrument panel and test gauges indicates the same pressure, check the relief valve, which is located on the valve side of the block.

Remove the relief valve and disassemble. Inspect the valve for dirt or other foreign matter. If the control spring appears to be collapsed or otherwise weakened, replace the spring or install a shim between the spring and plug. Install the relief valve.

After performing the above operations, if the oil pressure reading on both gauge units is low, remove and examine the oil pump. Inspect crankshaft bearings and replace as required.

COOLING SYSTEM

RADIATOR REMOVAL

1947-48—While the cooling system is draining, detach the tie rods from the cowl and radiator. Disconnect upper and lower hose. Remove two mounting nuts at bottom of radiator and lift out the radiator.

1949-50—Drain cooling system and remove upper and lower hose. Remove the six screws attaching the radiator to the shroud and lift out the radiator.

1951-52—Drain cooling system and remove upper and lower hose. Remove sheet metal shroud in order to gain access to the front side of the radiator. Remove the six radiator mounting bolts and lift out the radiator.

WATER PUMP REMOVAL

1947-52—Drain the cooling system. Detach the hose at the right side of the water pump (also heater hose if installed). Remove the fan belt, unfasten the pump from the block and take off the pump.

WATER PUMP, OVERHAUL

1947-52—To disassemble, take off fan blade and pulley. Detach cover and gasket from body. Remove snap ring. If pump is equipped with brass type impeller, remove impeller and hub as follows: Drill two ¼" holes through impeller hub (close to shaft) and spread the hub with a punch. Then pull the hub from the shaft, using a clamp-jaw type puller. If this method fails, use a torch and heat the impeller until the blades can be separated from the hub, then use a puller to remove the hub. Remove seal assembly and washer and drive out the shaft, bearing and sleeve (see Fig. 16).

Inspect all parts for wear or damage and replace as required. If the thrust seal surface in the pump body has become rough due to wear, reface it with a suitable water pump refacing tool.

If shaft, bearing and sleeve requires replacement, install a new fan hub. Press the fan hub $\frac{3}{64}$" beyond the end of the shaft. Coat the shaft and sleeve with a small amount of cup grease, which will protect the sleeve from damage when the impeller is pressed on the shaft. Also coat the carbon washer and washer surface in the pump body, which will assist initial sealing of pump and provide lubrication until seal is "broken in."

Fit the shaft in the body and install the snap ring. Slide the washer and seal on the shaft sleeve and press a new cast iron impeller on the shaft. When the impeller is properly installed (flush with end of shaft) the rear surface is $\frac{1}{32}$" below pump cover with $\frac{1}{16}$" clearance between impeller and pump body. Fit a new gasket on the pump body and install the cover.

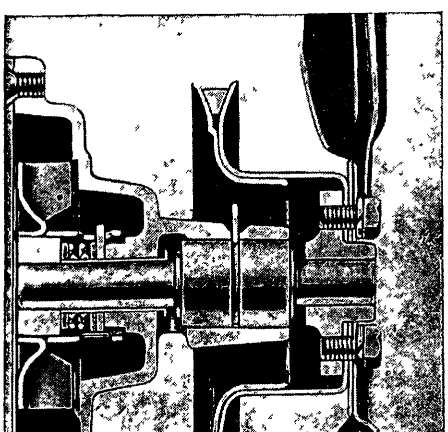


Fig. 16 Wat r pump, 1947-52

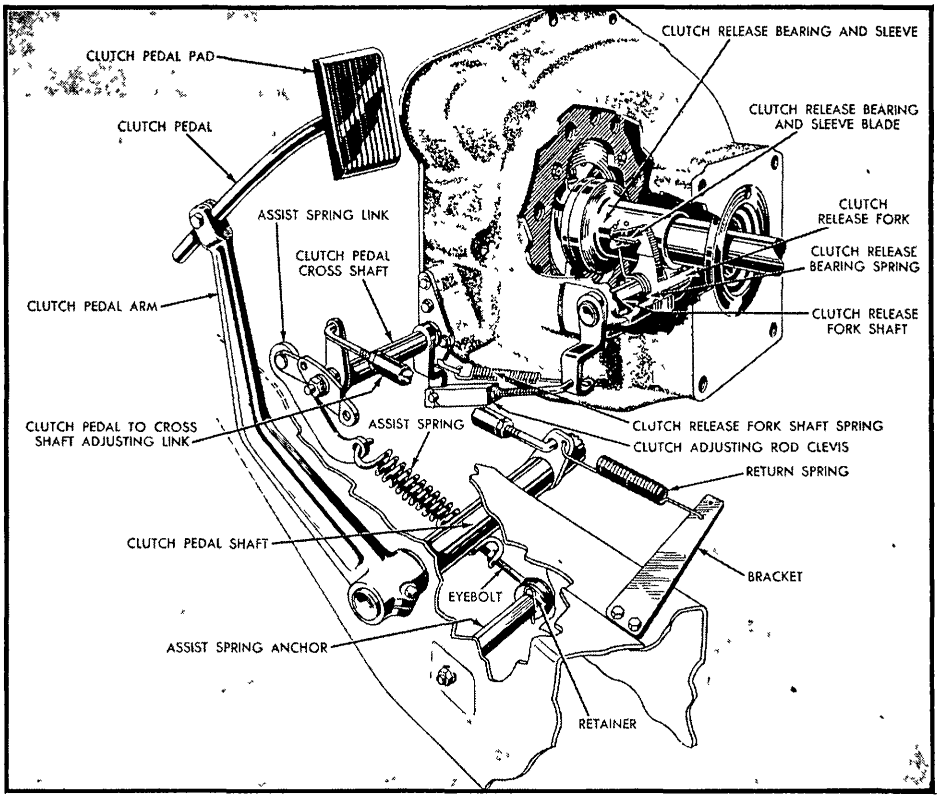


Fig. 17 Clutch release linkage, 1947-48

ELECTRIC SYSTEM

IGNITION TIMING

1947-52—With the breaker gap set to the clearance given in the *Tune Up Data* crank the engine to bring No. 1 piston up on its compression stroke and stop when the TDC mark on the vibration damper (flywheel on early jobs) is in line with the pointer. Tighten the distributor clamp bolt.

For best results, use a timing light to check the timing. Advance or retard as required to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" when driving the car at low speed with wide-open throttle.

CLUTCH

CLUTCH PEDAL, ADJUST

1947-48—Pedal free movement should be ¾ to 1 in. and may be obtained at the clutch adjusting rod which connects the clutch pedal cross shaft to the clutch release fork shaft. Remove the clevis pin and release the clevis end of the adjusting rod from the cross shaft bellcrank, Fig. 17.

Adjust the length of the rod by backing off the lock nut and turning the adjusting rod clevis. Lengthen the rod to decrease pedal free movement and shorten the rod to increase free pedal movement.

1949-50—Pedal free movement should be ⅝ to ¾ in. and is adjusted as follows: Remove the clutch pedal return spring. Remove the clevis pin and release the clevis end of the adjusting link from the clutch pedal shaft bellcrank, Fig. 18. Turn the clevis end in or out to obtain the correct amount of free pedal movement.

1951-52—To adjust the clutch pedal free travel, loosen the two lock nuts on the pedal adjusting link, Fig. 19. Turn the nuts forward to decrease pedal travel and backward to increase the travel. After free pedal travel of ¾ to 1 in. is established, tighten both lock nuts against the adjusting link guide, being careful not to change the adjustment while tightening the nuts.

CLUTCH REMOVAL

1947-52—Remove the transmission. Take off the clutch housing lower pan, and disconnect the clutch pedal cross shaft from the pedal linkage. Mount the clutch plate aligning arbor, Fig. 20, which aligns the clutch plate spline and pilot bushing and locks the pressure plate in place. Remove the clutch mounting bolts, meanwhile rotating the flywheel to bring each bolt around to a convenient position for removal. After the cover bolts are removed, take out the aligning arbor and slide out the clutch.

If an aligning arbor is not available,

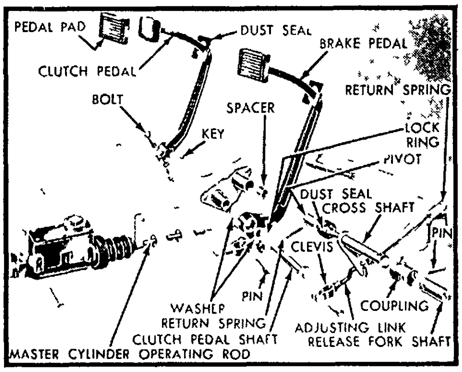


Fig. 18 Clutch release linkage, 1949-50

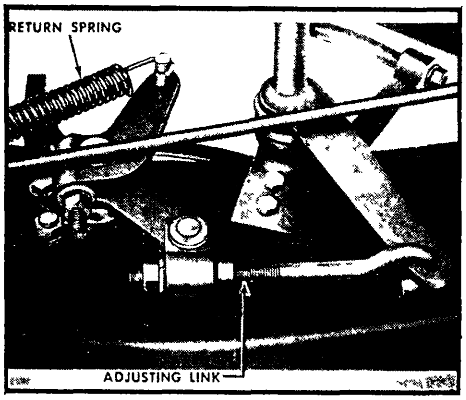


Fig. 19 Clutch pedal linkage adjustment, 1951-52

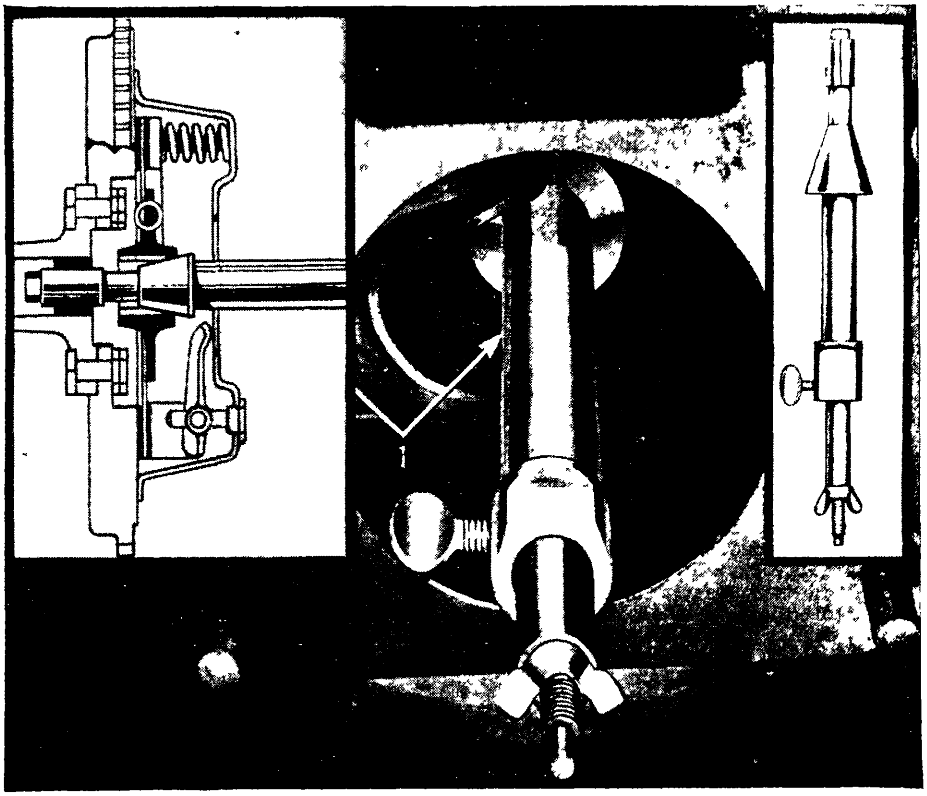


Fig. 20 Showing use of clutch plate aligning arbor (1) used when removing and installing clutch. 1947-52

release the clutch by placing wooden wedges between the cover and release lever. Then remove the cover bolts and take down the clutch.

Reverse the above procedure to install the clutch and check and adjust the free play of the clutch pedal.

TRANSMISSION

TRANSMISSION REMOVAL

1947-52—The following procedure is applicable to all models except as noted:

1. Disconnect gearshift rods from transmission shift levers. If overdrive is installed, disconnect overdrive shift lever at overdrive unit.
2. Disconnect propeller shaft at front companion flange and move it away from the rear of transmission.
3. Disconnect speedometer cable. If equipped with overdrive, disconnect wiring to overdrive unit.
4. On 1947-48 models, detach hand brake front cable at rear cable equalizer and at the crossmember so that it may be pulled through and removed from the rear engine support crossmember. The master cylinder operating rod must be disconnected at the brake pedal clevis and removed so that the crossmember is free for removal.
5. Support rear of engine with a jack under clutch housing.
6. On 1947-48 models remove four engine rear support insulator-to-crossmem-

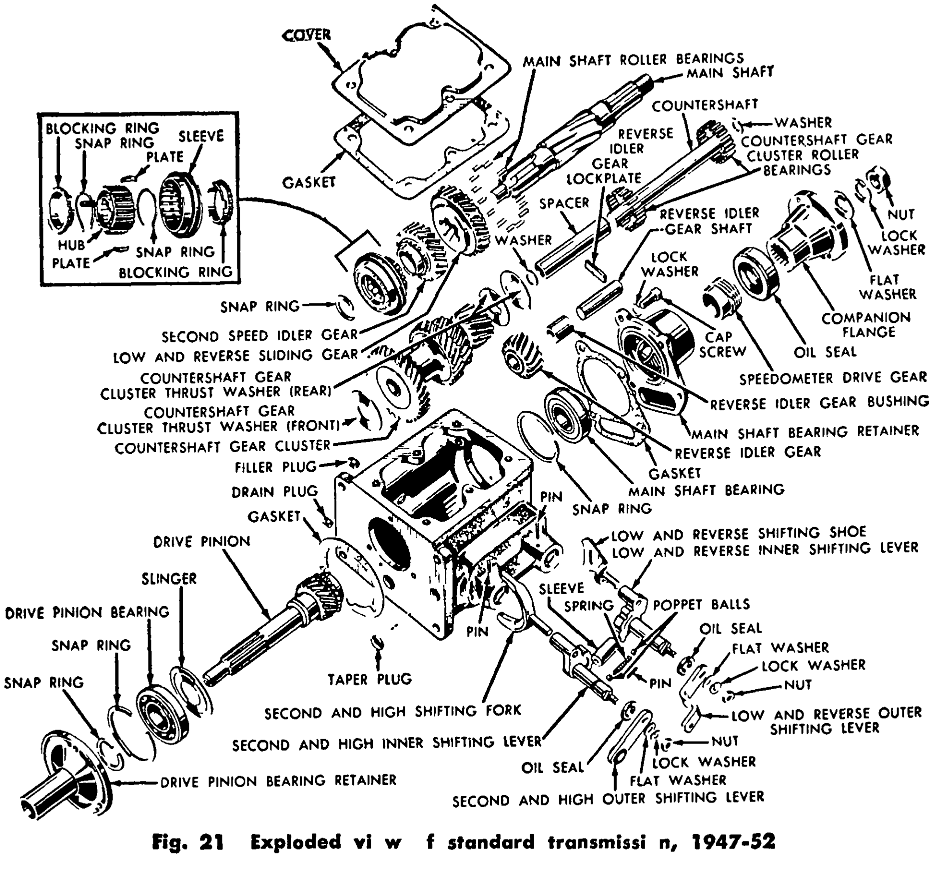


Fig. 21 Exploded vi w f standard transmissi n, 1947-52

Fig. 22 Checking transmission interlock sl eve clearance, 1947-52

ber bolts. On 1949-52 models, the engine rear support crossmember must be removed to facilitate removal of transmission.

7. Loosen four bolts attaching transmission to clutch housing. On 1947-48 models, remove the two bolts at the bottom of the case and raise the engine sufficiently to provide clearance between the crossmember and transmission for removal.

8. On 1947-48 models, remove attaching bolts at top of case and work transmission loose, sliding it back over the frame crossmember for removal. If equipped with overdrive, remove it together with the transmission.

9. On 1949-52 models, support transmission and remove four case-to-clutch housing bolts. The transmission may then be worked loose and removed. If overdrive is installed, remove it together with the transmission.

TRANSMISSION, OVERHAUL

1947-52—Fig. 21.

1. Remove cover and universal joint flange.

2. If rear oil seal shows evidence of leakage, use a puller to remove it.

3. Use a puller to remove the rear bearing retainer.

4. Take off the front bearing retainer.

5. Drive out the lock plate holding the countershaft and reverse idler shaft.

6. Use an old countershaft cut to the length of the cluster gear to drive out the countershaft, leaving the cut shaft in the cluster gear to hold the bearings and washers in place. Cluster gear will drop to bottom of case allowing clearance for removal of main drive gear.

7. Pull main drive gear out through front of case.

8. Cock mainshaft as far away from shift fork and shoe as possible and work the mainshaft out through the rear of the case.

9. Lift out the cluster gear, carefully noting the position of the washers.

10. Drive the reverse idler shaft out through the rear and lift out the gear.

11. Drive out the shift shaft locating pins and remove shift levers and shafts, oil seals and interlock.

ASSEMBLY NOTES — After installing new shift shaft oil seals and shift shafts and levers, shift the transmission into any gear and, with one end of the interlock sleeve against the shift shaft cam, measure the clearance between the other end of the sleeve and the cam on the other shaft, Fig. 22. This clearance should be from .001 to .005". If not within these limits, interlock sleeves of different lengths are available. After installing the correct sleeve, lock the shift levers in place with the shaft locating pins.

When assembling the synchronizer, the identical ends of the two snap rings should be hooked in the same shifting plates.

GEARSHIFT

1947-50—If shifting is difficult, check the transmission and engine mounting bolts for proper tightness. If a torque wrench is available, tighten the bolts to a torque of from 38 to 42 lbs. ft. If this is not the cause of the difficulty, check the steering column for misalignment. Finally, adjust the shift linkage as follows:

Disconnect the control rods from the shift levers at the transmission. Then, using a ¼" drill rod, align the bracket and two shifting levers at the bottom of the steering column by inserting the tool through the holes in the bracket and levers. Set the transmission shifting levers in neutral (forward) position. Adjust the clevises on both control rods so that the clevis pins may be freely inserted through the clevises and transmission shifting levers.

When adjustments have been completed, check to see whether or not the ends of the control rods interfere with the shifting levers when the shift mechanism is actuated. If they do, the rods will have to be shortened as this condition will cause incomplete shifting.

1951-52—1. Disconnect the gearshift rods from the levers mounted on the steering gear.

2. Remove the gearshift control housing cover and place the levers at the transmission in neutral position. Then hold the lower shift lever (mounted on steering gear) 15 degrees above the horizontal position.

3. Turn the two nuts on the front gearshift rod (second and high) to position the pivot on the rod so that it can be inserted through the gearshift lever on the steering gear without changing the position of the lever either on the transmission or steering gear. Install washers and clip.

4. Hold the other lever on the steering gear so the pin inside the control housing will slide from the lower lever into the upper lever without interference.

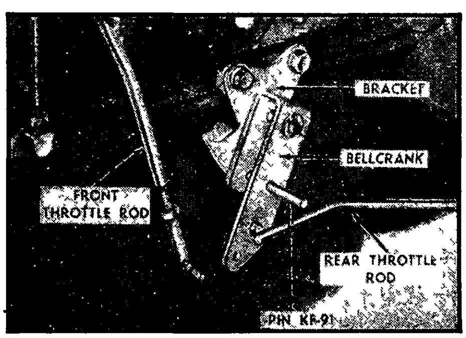


Fig. 24 Adjusting pin install d in l w r b llcrank. 1950-52 Hydra-Matic

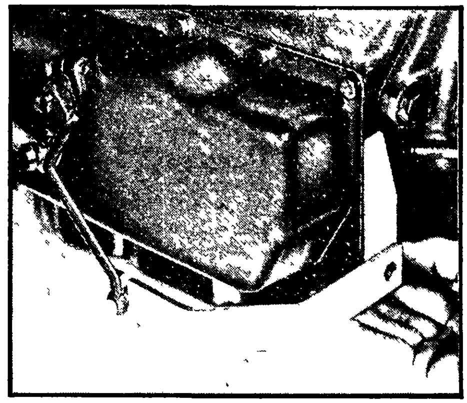


Fig. 25 Installing throttl lever ch cking gauge. 1950-52 Hydra-Matic

5. Turn the two nuts on the rear gearshift rod (first and reverse) to position the pivot so that it can be inserted through the lever on the steering gear without changing the position of the lever on either the transmission or steering gear. Install washers and clip.

6. Install gearshift control housing cover.

HYDRA-MATIC DRIVE

1950-52—For a step-by-step pictorial service procedure on this device, see the *Hydra-Matic Drive* chapter.

LINKAGE ADJUSTMENTS, 1950-52

Throttle Control Linkage—Linkage operation will not be satisfactory if binding or excessive wear exists.

1. Disconnect the transmission rear throttle rod at the throttle control lever (long lever) at the transmission.

2. Loosen the carburetor extension shaft lock bolt, Fig. 23.

3. Install linkage adjustment pin KF-91 through alignment holes in upper bellcrank and bracket, Fig. 23.

4. Adjust engine idle speed to 425-450 rpm consistent with best idle performance. Before making this adjustment, the engine temperature must be 150 to 160 degrees F., carburetor off fast idle, transmission warm and the selector lever in "N" or neutral position.

5. Tighten the carburetor extension shaft lock bolt. Do not remove adjustment pin.

6. Install another adjustment pin through the lower bellcrank and bracket, Fig. 24. If the holes for the pin do not align, disconnect the front throttle rod and adjust its length as required to align the holes and permit a free installation of the pin without binding. Do not remove the adjustment pins.

7. Tighten the clamp bolt at the throttle control lever at the transmission 12-15 lbs. ft. troque.

8. Check position of the lever as follows: Clean the machined surface on back of transmission case and place the throttle lever checking gauge flat against the surface with the edge of the gauge against the transmission side cover flange.

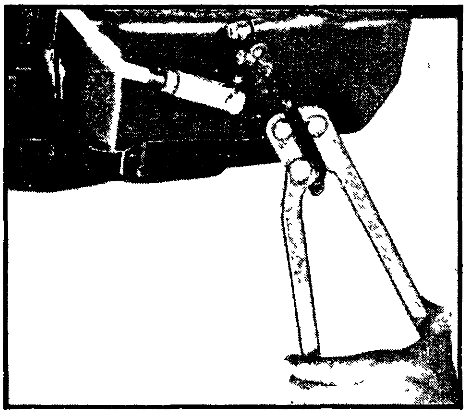


Fig. 26 Thr ttle lever bending tool. 1950-52 Hydra-Matic

9. With the lever held against its stop (toward rear of transmission) move gauge upward and align slot with clevis pin installed in the lever.

10. If the slot in the gauge does not align freely with the clevis pin in the lever, bend the lever as required with the bending tool shown in Fig. 26.

11. Connect the throttle rod to the lever at the transmission using anti-rattle spring between trunnion and lever. Secure with cotter pin.

12. Adjust transmission throttle rear rod trunnion toward the rear until the control lever seats lightly against the stop inside the transmission. Shorten the length of the rod by backing off the trunnion front lock nut two full turns. Tighten the rear lock lock nut securely.

13. Remove both adjusting pins.

14. Then with the carburetor throttle valve held in full open position, adjust the accelerator adjusting rod so that the accelerator clears the floor mat approximately ¼ in.

Selector Lever Linkage—1. If working on a Kaiser, tighten the gearshift control shaft upper bracket clamp screw while holding the selector lever firmly down in "Lo" position. No attention is required at this point on Frazer models.

2. Back off both gearshift control and rod trunnion lock nuts several turns.

3. Check tightness of clamp bolt in transmission outer shift lever; it should be tightened to 10-13 lbs. ft. torque.

4. Move the shift lever (short lever) at transmission to the rear as far as possible. Then move forward to the first detent position which is "Lo."

5. With the selector lever and control lever at transmission in "Lo" position, turn the inner lock nut finger tight against the tunnion. Lengthen the control rod by turning the inner lock nut one àdditional full turn. Tighten lock nuts securely, being careful not to change the adjustment.

Neutral Safety Switch—The following adjustment applies to Kaiser models only. The neutral safety switch on Frazer models is non-adjustable.

1. Place selector lever in "Dr" position. On 1952, place selector lever over four-speed range.

2. Loosen neutral safety switch bracket lock screw, Fig. 27.

3. Adjust bracket to a position where the starting motor will not operate when the starter button on instrumental panel is pushed in.

4. Place selector lever in "N" position.

5. Check clearance between neutral safety switch arm and stop on switch bracket. Clearance should be approximately 1/16 in., Fig. 27.

6. Tighten lock screw securely.

REAR AXLE

REAR AXLE SERVICE

1947-52—Fig. 28 pictures the rear axle design which is typical of those used on these cars. The drive pinion is held in position by the shouders in the differential carrier, upon which the pinion bearing cups seat. The pinion position is maintained by shims located between the rear bearing and the rear shoulder in the differential carrier. Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings.

The shimmed type of differential bearing adjustment is employed. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

The axle tubes are pressed into the differential carrier to form a one-piece housing. To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, unscrew the pinion flange retaining nut and pull off the flange. The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and press the rear bearing cone from the shaft. When replacing the cone, select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when pressed on the shaft.

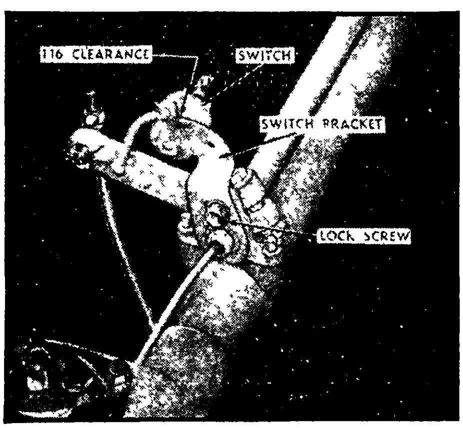


Fig. 27 N utral saf ty switch in n utral p siti n. 1950-52 Kais r

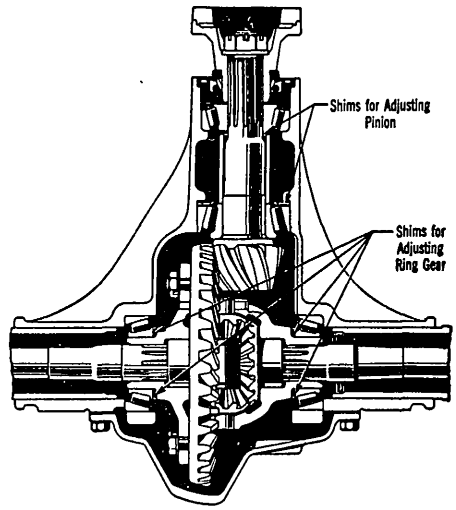


Fig. 28 Rear axl , 1947-52

Drive out the front bearing cup and oil seal toward the front. If the rear bearing cup is to be replaced, or if the pinion setting is to be changed, remove the rear bearing cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used (see *Rear Axle* chapter). After the required shims have been added or subtracted, the rear bearing cup may be replaced.

When making pinion adjustment, the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to retain the proper pinion bearing adjustment.

To install the pinion, support it under the head with a wooden block while the pinion flange is reinstalled. The pinion oil seal should not be replaced until after the pinion setting has been checked.

PINION BEARINGS, ADJUST — The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and the front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

PINION, ADJUST—After adjusting the pinion bearings, the pinion position should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the pinion, and, if the pinion is to be moved toward the center of the axle, add shims between the rear bearing and the rear shoulder in the carrier. If the pinion has to be moved away from the center of the axle, remove shims from this point.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring teeth as described in

the *Rear Axle Chapter.* After satisfactory tooth contact has been established, remove the pinion flange to install the oil seal. After pressing in the seal, install the flange, tighten the nut solidly in place and lock it with a new cotter pin.

AXLE SHAFTS, BEARINGS & OIL SEALS

1947-52 -- To remove an axle shaft, raise the rear of the car and take off the wheel. Pull off the hub and drum. Block the brake pedal so it cannot be depressed. Disconnect the brake line from the wheel cylinder. Remove the brake support, outer oil seal and shims and pull out the shaft. Use a suitable puller to remove the inner oil seal.

If both shafts are to be removed, keep the shims on each shaft separate and assembled to their respective ends of the axle housing so that the bearing adjustment will be correct when assembly is completed.

Replace in the reverse order and if new parts are used, check the axle shaft end play as follows:

The axle shaft end play can be checked after all parts have been replaced except the wheel and hub. To make this check, rap each shaft after the nuts are tight to be sure the bearing cups are seated. Then fasten a dial indicator so that its stem contacts the end of the shaft and note the amount of end play as the shaft is pushed in and out. If an adjustment is necessary, remove the oil seal and brake support and add or remove shims as required to obtain from .001 to .006 inch play. When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain the central position of the thrust block in the differential.

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1947-52—Caster is adjusted by turning the eccentric pivot pin in the outer end of the upper control arm. To make the adjustment, loosen the lock bolt and turn the pin clockwise to increase caster and vice versa. One complete turn of the pin changes caster ½ degree. Always turn the pin in multiples of one turn so the camber angle will not be disturbed.

To change the camber angle, bear in mind that its complete range of adjustment is within a half turn of the eccentric pin. Turning the pin a half revolution changes camber ½ degree. When adjustments are correct, tighten the lock bolt.

TOE-IN, ADJUST

1947-52 — To adjust toe-in, locate the steering gear in the center of its travel. Then increase or decrease the length of the right hand tie rod until the wheel is straight ahead.

Adjust the tie rods by turning each sleeve an equal amount until the desired toe-in is obtained. Be sure to tighten the clamp bolts when adjustments are completed.

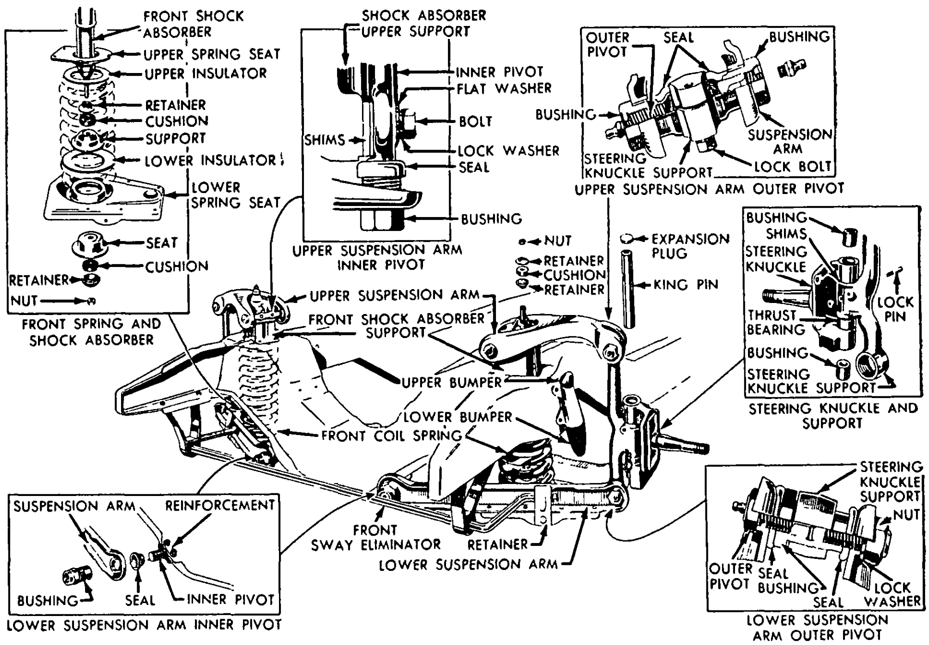


Fig. 29 Exploded view of front suspension. 1947-52

FRONT END SERVICE

1947-52

Front Wheel Bearing Adjustment—With front wheels jacked up and brakes released, check for end play of the wheel on the steering knuckle by grasping the tire at the top and pushing and pulling alternately. If the bearings are loose, there will be perceptible end play or side movement of the wheel.

If the bearings are not loose, rotate the wheel to check for tightness — the wheel should turn freely without drag. If the wheel drags make sure it is not the brakes dragging instead of tight wheel bearings. If bearings are too tight, overheating will result. If bearings are too loose, it will cause pounding. To adjust the bearings, proceed as follows:

1. Release brakes and jack up wheels.
2. Remove hub cap, grease cap, and cotter pin which locks the hub nut.
3. Turn hub nut up tight on steering knuckle spindle to seat the bearings. Then back off the nut until end play is evident and tighten again until there is no end play. Back off the nut only enough to permit installation of the cotter pin.
4. Install grease cap (without grease) and hub cap. Check the adjustment as described above and lower car to floor.

Kingpins & Bushings—Early type steering knuckles which were fitted with needle bearings and later with pressed-in bushings have been superceded by knuckles in which the bores are micro-finished for use of floating, split-type, steel-backed bushings. This latest type permits free rotation of the bushings in the knuckle and also around the kingpin, resulting in more even distribution of wear. See Fig. 29.

1. Remove wheel and hub assembly.
2. Block brake pedal so it cannot be depressed.
3. Unfasten brake support plate from knuckle.
4. Remove steering arm from knuckle.
5. Remove brake hose and connection and lift off brake support.
6. Remove kingpin lock pin.
7. Drive a punch into the upper steering knuckle dust plug and pry out plug.
8. Drive kingpin downward, forcing out lower dust plug. A soft brass drift should be used in driving against top of kingpin.
9. If needle bearings are used in the knuckle they should be removed with a suitable puller. A puller should be used when pressed-in bushings are used.
10. The floating bushings are a free fit and do not require driving, reaming or burnishing. Floating type bushings must be used only in steering knuckles in which the bores are micro-finished for these bushings. However, pressed-in bushings can be used in micro-finished knuckles and must be used in early type knuckles. Use of needle bearings is no longer recommended and when replacement of them in the original steering knuckle is necessary, pressed-in bushings should be used. Pressed-in bushings must be burnished and line-reamed after installation.
11. Remove the thrust bearing and shims and remove the bushings from the knuckle.
12. If pressed-in bushings are to be used, press them in place so that each bushing is flush with the face of the knuckle which is toward the knuckle support, and the oil hole in the bushing must align with the hole in the knuckle.
13. If floating bushings are to be installed, press them in place by hand after wiping the outside of the bushing with lubricant. In these bushings the oil groove runs out at one end. Install the bushing with this end toward the knuckle support. In this position the closed end of the oil groove in each bushing will be

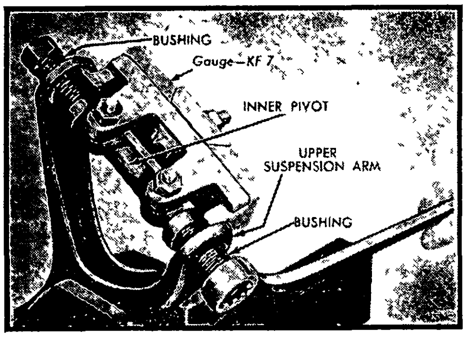


Fig. 30 Installing upper control arm inn r pivot. 1947-52

next to the dust plugs in the knuckle.

14. To install the knuckle, place it on the knuckle support. Insert the thrust bearing, open side down, between the lower face of the support and steering knuckle. Fit shims between the top face of the support and knuckle as required to provide 0 to 5 lbs. pull measured with a spring scale attached to the cotter pin hole at the outer end of the spindle. These shims are available in thicknesses of .003, .010 and .030 in. The kingpin must be installed before making this check.

15. Complete the assembly in the reverse order of disassembly.

Upper Control Arm, Remove—

1. Raise car with jack under frame side rail and remove wheel.
2. Place another jack under lower control arm to hold arm and coil spring in position while upper arm is removed.
3. Unfasten upper control arm inner pivot from shock absorber support. If shims are present between pivot and support, set them aside and be sure they are used when installing the control arm.
4. Remove clamp bolt from knuckle support outer pivot pin.
5. Unscrew two threaded bushings from outer end of control arm.
6. Turn pivot pin out of knuckle support, remove seals and lift off control arm.

Upper Control Arm, Repair—Be sure the control arm is not bent or distorted or cracked and that new bushings will fit tight in holes in arm. When bushings are installed in new arm they cut threads in the arm and fit tight. New bushings used in an old arm already threaded must also fit tight. Discard bushings and seals if worn, replacing with new parts.

1. Turn the two bushings out of the inner end of the control arm.
2. Move pivot seals away from arm to permit moving pivot endwise enough to clear arm at one end. When one end is free, pull other end out of arm.
3. To install inner pivot, place new rubber seals on pivot, one on each end with cupped side out. Fit pivot into control arm and mount arm in a vise.
4. Start threads of two bushings into control arm. Use a large wrench and turn bushings slowly. Do not use cutting lubricant.
5. A special control arm spreader gauge should be used to establish the proper spacing between the sides of the arm, Fig. 30. The arms should be spread apart $\frac{1}{16}$ in. from the normal position.
6. Turn both bushings into the control arm and onto the pivot until the hex head bottoms against the control arm.
7. Check the pivot to be sure it will move freely in the bushings. If the fit is correct it will resist slightly any effort to turn the pivot by hand. Do not rotate the pivot as this will change the centered position of the pivot in relation to the control arm.
8. Move the two rubber seals on the pivot until each seats against the flange at the bushing hole in the arm. Install the grease fitting in the end of each bushing.

Upper Control Arm, Install—

1. Fasten upper control arm pivot to shock absorber support, being sure to reinstall any shims that were present originally.
2. Attach outer end of pivot to knuckle support and when assembly is completed and car resting on floor, check and adjust caster and camber.

Front Spring, Replace—

1. Place jack under lower control arm, raise wheel off floor and remove wheel and tire assembly.
2. Disconnect stabilizer link from lower control arm.
3. Remove shock absorber retaining nut from lower side of spring seat.
4. Support car frame with another jack.
5. Unfasten lower control arm shaft from frame crossmember.
6. Slowly lower jack under control arm until spring is loose and can be taken out. It is not necessary to remove shock absorber.
7. Reverse foregoing operations to install spring.

Lower Control Arm Service—Check the control arm for distortion or cracks and be sure new bushings fit tight in control arm. When bushings are installed in a new arm they cut threads in the arm and fit tight. New bushings installed in an arm already threaded must also fit tight.

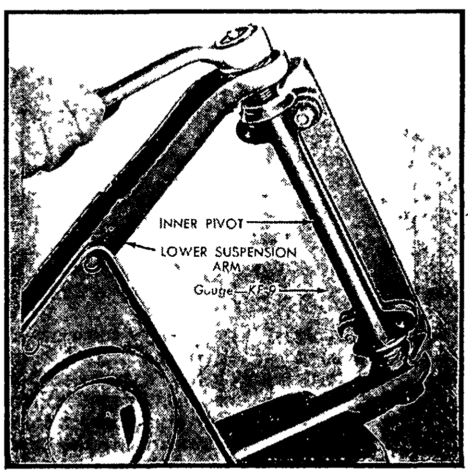


Fig. 31 Installing l w r c ntr l arm inn r piv t. 1947-52

1. Remove front spring as outlined previously. Then remove lower control arm from knuckle support.
2. Turn inner pivot bushings out of control arm and inner pivot shaft.
3. Move pivot seals away from arm to permit moving shaft endwise enough to clear arm at one end. Then pull other end out of arm.
4. Place new rubber seals on shaft, one on each end with cupped side out.
5. Fit pivot shaft into arm and mount arm in a vise close to the end to prevent springing or distortion.
6. Start bushings in control arm. Use a large wrench and turn bushings slowly. Do not use cutting oil.
7. Use a suitable spreader tool, Fig. 31, between inner ends of arm so bushings will screw on pivot shaft properly and so pivot shaft bolt holes will line up with holes in frame crossmember.
8. Turn bushings into arm and onto pivot shaft until hex heads of bushings bottom against control arm.
9. Remove spreader gauge and move seals on pivot shaft and over ends of bushings and against side of arm. Do not turn pivot shaft after removing spreader gauge or the equalized spacing between the sides of the arm and the bolt holes in the pivot shaft will change, causing it to be incorrect.
10. Install grease fitting in the end of each bushing and install control arm on car in the reverse order of its removal.

Front Shock Absorber, Replace — Front shock absorbers may be removed without taking out the coil springs.

1. Raise front end of car with jack under frame side rail to relieve tension of front spring.
2. Unfasten shock absorber from lower spring seat.
3. Compress shock absorber until stud in lower end clears spring seat and shock absorber lower support.
4. Remove support which sets on top of spring seat by pulling it out between coils of spring This will permit withdrawal of shock absorber through opening in lower spring seat after removing retaining nut from upper end of shock absorber.
5. Reverse foregoing operations to install shock abosrber.

STEERING GEAR

STEERING GEAR REMOVAL

1947-52—After pulling off the steering wheel the steering column jacket with transmission gearshift mechanism attached is pulled upward through the toe board into the inside of the body. Then the steering gear, including the column, is moved forward toward the radiator and removed by lifting it out through the engine compartment.

LINCOLN

INDEX OF SERVICE OPERATIONS

Specifications are tabulated on the pages immediately following this index. For service procedure, see the Ford chapter, using the index below to find the job in which you are interested

Year	Model Designation	Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	186 @ 1800	30 @ 30
1936	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	186 @ 1800	30 @ 30
	Zephyr V12 901	122	In Block	$2\frac{3}{4}$ x $3\frac{3}{4}$	267.3	6.70	110 @ 3900	186 @ 1800	30 @ 30
1937	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	312 @ 1200	30 @ 30
	Zephyr V12 HB	122	In Block	$2\frac{3}{4}$ x $3\frac{3}{4}$	267.3	6.70	110 @ 3900	186 @ 1800	30 @ 30
1938	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	312 @ 1200	40 @ 50
	Zephyr V12 86H	125	In Block	$2\frac{3}{4}$ x $3\frac{3}{4}$	267.3	6.70	110 @ 3900	186 @ 2000	30 @ 55
1939	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	312 @ 1200	30 @ 30
	Zephyr V12 96H	125	In Block	$2\frac{3}{4}$ x $3\frac{3}{4}$	267.3	6.70	110 @ 3900	186 @ 2000	30 @ 30
1940	V12 K	136–145	In Block	$3\frac{1}{8}$ x $4\frac{1}{2}$	414.0	6.38	150 @ 3400	312 @ 1200	30 @ 30
	Zephyr V12, Cont. V12 06H	125	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	186 @ 2000	30 @ 30
1941	Zephyr V12, Cont. V12 16H	125	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	226 @ 1800	30 @ 30
	Custom V12 168H	138	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	226 @ 1800	30 @ 30
1942	Zephyr V12, Cont. V12 26H	125	In Block	$2\frac{15}{16}$ x $3\frac{3}{4}$	305.0	7.00	130 @ 3800	226 @ 1800	30 @ 30
	Custom V12 268H	138	In Block	$2\frac{15}{16}$ x $3\frac{3}{4}$	305.0	7.00	130 @ 3800	226 @ 1800	30 @ 30
1946	V12 66H	125	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	235 @ 1800	30 @ 30
1947	V12 76H	125	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	212 @ 1800	30 @ 30
1948	V12 876H	125	In Block	$2\frac{7}{8}$ x $3\frac{3}{4}$	292.0	7.20	120 @ 3500	214 @ 1600	30 @ 30
1949	Lincoln V8 9EL	121	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	152 @ 3600	265 @ 2000	50 @ 50
	Cosmopolitan V8 9EH	125	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	152 @ 3600	265 @ 2000	50 @ 50
1950	Lincoln V8 OEL	121	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	152 @ 3600	265 @ 2000	50 @ 50
	Cosmopolitan V8 OEH	125	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	152 @ 3600	265 @ 2000	50 @ 50
1951	Lincoln V8 1EL	121	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	154 @ 3600	275 @ 1800	50 @ 50
	Cosmopolitan V8 1EH	125	In Block	$3\frac{1}{2}$ x $4\frac{3}{8}$	336.7	7.0	154 @ 3600	275 @ 1800	50 @ 50
1952	Cosmopolitan V8	123	In Head	3.8 x 3.5	317.5	7.5	160 @ 3900	284 @ 1800	40
	Capri V8	123	In Head	3.8 x 3.5	317.5	7.5	160 @ 3900	284 @ 1800	40

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchromesh Transmission	Automatic Transmission	
1935–40	Lincoln	CH-7	.025	.020	36	A	B	Negative			
1936–37	Zephyr	CH-H10	.025	.015	36	A	D	Positive	450–500		C
1938–41	Zephyr	CH-H10	.028	.015	36	A	D	Positive	450–500		C
1942–48	All	CH-H10	.028	.015	36	A	D	Positive	450–500		C
1949–51	All	CH-H10	.030	.015	28	E	F	Positive	450–500	375–400	G
1952	All	CH-H10	.030	.015	28	E	F	Positive	450–500	375–400	80–90

A—Firing order 1-4-9-8-5-2-11-10-3-6-7-12. As viewed from rear, odd numbers left bank, even numbers right bank.

B—On 1935–37, "A2" mark on flywheel; 1938–40, "TDC" mark on flywheel.

C—Aluminum heads, 40 lbs.; cast iron, 50.

D—There are no timing marks. Spark may be advanced or retarded by adjusting vacuum brake set screw on distributor housing.

E—Firing order 1-5-4-8-6-3-7-2. Starting with front cylinder of right bank as viewed from rear of engine, firing order is 1R, 1L, 4R, 4L, 2L, 3R, 3L, 2R.

F—Timing mark on vibration damper.

G—Nuts 50–55; cap screws 65–70.

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1936–37	Zephyr	.013C	.013C	.013	45	19.5	16.5	51@2⅛	.0015–.0035	.0015–.0035	.3105	.3105
1938	Zephyr	Zero	Zero	Zero	45	19.5	16.5	51@2⅛	.0015–.0035	.0015–.0035	.3105	.3105
1939–40	Zephyr	Zero	Zero	Zero	45	10.5	8	51@2⅛	.0015–.0035	.0015–.0035	.3105	.3105
1941–48	All	Zero	Zero	Zero	45	10.5	8	51@2⅛	.0015–.0035	.0015–.0035	.3105	.3105
1949–50	All	Zero	Zero	Zero	45	14	16	62@1$^{11}/_{16}$	.0015–.003	.0025–.004	.3417	.3405
1951	All	Zero	Zero	Zero	45	5	8	62@1$^{11}/_{16}$	.0015–.003	.0025–.004	.3417	.3405
1952	All	Zero	Zero	Zero	45	18	20	57@1.80	.001–.002	.0015–.0025	.3420	.3415

A—BTDC means before top dead center; ATDC means after top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Shim Thickness To Use	Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A) Compression	Ring Gap Oil	Clearance in Groove Compression	Clearance in Groove Oil	Pins Type	Pins Fit
1935–40	Series K	Below	.002	4 to 8	.012	.012	.0015–.002	.001–.0015	B	C
1936–40	Zephyr	Above	.002	4 to 8	.012	.008	.0015–.002	.001–.0015	B	C
1941–48	All	Above	.002	4 to 8	.012	.011	.0015–.002	.001–.0015	B	C
1949–51	All	Above	.002	4 to 8	.010	.010	.0015–.002	.001–.0015	B	C
1952	All	Above	.001	4 to 8	.010	.010	D	.0015–.003	B	C

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Floating type. Pin retained by snap rings in piston bosses.
C—Thumb push fit in piston and rod but with piston heated.
D—Top ring .0015-.003″, second ring .001-.0025″.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935-40	K			2.4995–2.5005	.0015–.0035	.009–.019	55–60	2.625	.001–.003	.004–.007	110–120
1936-42	Zephyr	.002–.004	.001–.003	2.125–2.1255	.0015–.003	.009–.019	45–50	2.400–2.4005	.0015–.003	.002–.006	60–70
1946-48	All	.002–.004	.001–.003	2.2500	.001–.0025	.009–.019	45–50	2.400–2.4005	.0015–.003	.002–.006	60–70
1949-50	All	.002–.004	.001–.003	2.400	.0005–.003	.006–.014	52–60	2.874	FREE-.0025	.004–.008	120–130
1951	All	.002–.004	.001–.003	2.400	.0003–.0019	.007–.013	52–60	B	C	.006	120–130
1952	All	Zero	.0013–.0028	2.2482–2.2490	.0004–.002	.006–.014	45–50	2.6235–2.6243	.0008–.0026	.004–.008	120–130

A—Thrust taken by rear bearing prior to 1952. For 1952, center main.
B—Front and center, 2.8729–2.8740; rear, 2.8724–2.8735.
C—Front and center, .0014–.0019; rear, .0009–.0024.

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil: Above +32°F.	ENGINE: Grade of Oil: Above +10°F.	ENGINE: Grade of Oil: Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil: Summer	TRANSMISSION: Grade of Oil: Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil: Summer	DIFFERENTIAL: Grade of Oil: Winter
1935-40	K	32	26	12	30	20W	10W	6	90	80	6	140	90
1936	901	27	19	6	30	20W	10W	2½	90	80	2½	140	90
1937	HB	27	19	6	30	20W	10W	2½	90	80	2½	140	90
1938	86H	30	19	6	30	20W	10W	3½	90	80	4	90H	90H
1939	96H	30	19	5	30	20W	10W	3½	90	80	4	90H	90H
1940	06H	27	19½	5	30	20W	10W	2¾	90	80	4	90H	90H
1941-42	All	27	19½	5	30	20W	10W	2¾ (A)	90	80	4	90H	90H
1946	All	24	19½	5	30	20W	10W	2¾ (A)	90	80	4	90H	90H
1947-48	All	24½	19½	5	30	20W	10W	2¾ (A)	90	80	4	90H	90H
1949-50	All	34½	19½	6	20	10W	10W	3½	80	80	4	90EP	90EP
1951	Lincoln	34½	19½	6	20	10W	10W	3½ (B)	C	C	4	90EP	90EP
	Cosmopolitan	34½	21½	6	20	10W	10W	3½ (B)	C	C	4	90EP	90EP
1952	All	21½	21	5	20	10W	10W	3½(B)	C	C	4	90EP	90EP

A—With overdrive, 3¾ pints.
B—For Hydra-Matic, approximately 12 qts.; with overdrive, 5 pints.
C—For synchromesh transmission, 80; for Hydra-Matic, use Hydra-Matic fluid.
H—Hypoid gear lubricant.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1936-37	All	.006-.010	None	Nut	.000-.015
1938-48	All	.002-.004	None	Nut	.000-.015
1949-52	All	.003-.008	Shims	Shims	.003-.006

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935-40	Series K	+1½	+1	⅛	7½
1936	Zephyr	+6	+ ½	1/16	8⅛
1937-40	Zephyr	+4	+ ½	1/16	4¼
1941-42	All	+4	+ ½	1/16	4¼
1946-48	All	+4	+ ⅞	3/32	4⅝
1949-51	All	Zero	+ ⅜	⅛	5
1952	All	−¾	+ ⅜	⅛	7

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935-40	K	Molded	33½	2½	¼	⅜
1936-40	Zephyr	A	23⅞	1¾	7/32	⅜
1941-48	All	A	25.9	1¾	7/32	⅜
1949-50	All	Molded	25.9	(B)2¼ (C)2	.212	⅜
1951-52	All	Molded	23	(B)2¼ (C)2	.212	⅜

A—Primary shoe, molded. Secondary, woven.
B—Front wheel. C—Rear wheel

FIRST SERIAL & ENGINE NUMBERS

LOCATION—Series K: Serial number on right front of dash; engine number on left side of crankcase. 1936-48: Serial and engine number on top of transmission. 1949-51: Serial number and engine number on plate on dash. 1952: Right front body pillar.

Year	Model	
1935	K	K-3501
1936	K	K-5501
	901	H-1
1937	K	K-7500
	HB	H-15550
1938	K	K-9001
	86H	H-45530
1939	K	K-9451
	96H	H-64641
1940	K	Note A
	06H	H-85641
1941	16H	H-107688
	168H	H-107688
1942	26H	H-129691
	268H	H-129691
1946	66H(B)	H-136255
1947	76H	7H-152840
1948	876H	8H-174290
1949	9EL	9EL-1
	9EH	9EH-1
1950	OEL	50-5001L (c)
	OEH	50-5001H(c)
1951	1EL	51-5101L (c)
	1EH	51-5101H(c)
1952	All	52-5001H(c)

A—Continuation of 1939 models.
B—Production prior to January 10, 1946, 1942 engine was used.
C—Additional letters in serial number denote assembly plant.

MERCURY

INDEX OF SERVICE OPERATIONS

Specifications are tabulated on the pages immediately following this index. For service procedure, see the Ford chapter, using the index below to find the job in which you are interested

Year	Model Designation		Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1939	V8	99A	116	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.0	6.15	95 @ 3800	170 @ 2100	30 @ 30
1940	V8	09A	116	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.0	6.15	95 @ 3800	170 @ 2100	30 @ 30
1941	V8	19A	118	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.0	6.15	95 @ 3800	176 @ 2100	30 @ 30
1942	V8	29A	118	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.0	6.40	100 @ 3800	176 @ 2100	30 @ 30
1946	V8	69M	118	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	30 @ 30
1947	V8	79M	118	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	30 @ 30
1948	V8	89M	118	In Block	$3\frac{3}{16}$ x $3\frac{3}{4}$	239.4	6.75	100 @ 3800	180 @ 2000	30 @ 30
1949	V8	9CM	118	In Block	$3\frac{3}{16}$ x 4	255.4	6.80	110 @ 3600	200 @ 2000	45 @ 50
1950	V8	OCM	118	In Block	$3\frac{3}{16}$ x 4	255.4	6 80	110 @ 3600	200 @ 2000	50 @ 60
1951	V8	1CM	118	In Block	$3\frac{3}{16}$ x 4	255.4	6 80	112 @ 3600	206 @ 2000	50 @ 60
1952	V8		118	In Block	$3\frac{3}{16}$ x 4	255.4	7.20	125 @ 3700	211 @ 1900	50 @ 60

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchromesh Transmission	Automatic Transmission	
1939–42	All	CH-H10	.025	.015	36	A	B	Positive	450–475		C
1946–48	All	CH-H10	.030	.015	36	A	B	Positive	450–475		50–60
1949–52	All	CH-H10	.030	.015	28	A	D	Positive	450–475	425	65–70

A—Firing order 1-5-4-8-6-3-7-2. Starting with front cylinder of right bank as viewed from rear of engine, firing order is 1R, 1L, 4R, 4L, 2L, 3R, 3L, 2R.

B—There are no timing marks. Spark can be advanced or retarded by adjusting vacuum brake set screw on distributor housing.

C—Cast iron heads, 50–60; aluminum heads, 35–40.

D—Grooved mark on crankshaft pulley.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1938–48	All	.012C	.014C	.012	45	B	6	37@$2\frac{1}{8}$	.0025–.0045	.0025–.0045	.3095	.3095
1949–50	All	.012C	.014C	.015	45	10	10	37@$2\frac{1}{8}$	.001 –.003	.0015–.0035	.3415	.3410
1951–52	All	.014C	.018C	.015	45	10	10	37@$2\frac{1}{8}$	.001 –.003	.0015–.0035	.3415	.3410

A—BTDC means before top dead center; ATDC means after top dead center.

B—Top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Ring Gap, Minimum (Note A)		Clearance in Groove		Type	Fit
					Compression	Oil	Compression	Oil		
1939–42	All	Above	B	6 to 10	.012	.012	.0015–.003	.0015–.003	E	F
1946–48	All	Above	C	6 to 12	.014	.014	.0015–.003	.0015–.003	E	F
1949–50	All	Above	.002	6 to 12	D	.010	.0015–.003	.0015–.003	E	F
1951–52	All	Above	.002	6 to 12	.007	.010	.0015–.003	.0015–.003	E	F

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Steel pistons .003″; aluminum .0025″.
C—With sleeves and aluminum pistons .0025″; without sleeves .002″.
D—Top ring .007″, second ring .010″.
E—Floating type. Pins retained by snap rings in piston bosses.
F—Thumb push fit in piston and rod but with piston heated.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil			Capacity, Pounds or Pints	Grade of Oil		Capacity, Pounds or Pints	Grade of Oil	
					Above +32°F.	Above +10°F.	Above −10°F.		Summer	Winter		Summer	Winter
1939	All	22	15	5	30	20W	10W	2½	90	80	2½	140	90
1940	All	22	15	5	30	20W	10W	2¾	90	80	2½	140	90
1941	All	25½	17	5	30	20W	10W	2¾	90	80	2½	140	90
1942-48	All	22	17	5	30	20W	10W	2¾	90	80	2½	140	90
1949-51	All	22	19½	5	20	10W	10W	3½(A)	80(B)	80(B)	3	90EP	90EP
1952	All	22	19½	5	20	10W	10W	3(C)	80(B)	80(B)	3½	90EP	90EP

A—Cars with Merc-O-Matic transmission use 9 quarts. B—For Merc-O-Matic transmission, use automatic transmission oil.
C—With overdrive, 4½ pints. Merc-O-Matic, 9 quarts.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1939-48	All	.003	.002	2.1390	.0017-.0038	.006-.014	40	2.4990	.000-.003	.002-.006	80
1949-50	All	.003	.002	2.1390	.0005-.003	.006-.014	45-50	2.4990	.000-.003	.002-.006	90-105
1951-52	All	.003	.002	2.1390	.0005-.003	.006-.020	45-50	2.4990	.001-.0026	.002-.006	90-105

A—Thrust taken by rear bearing.

MERCURY

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1939-48	All	.006-.010	None	Nut	.000-.015
1949-52	All	.003-.008	Shims	Shims	.001-.006

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1939-48	All	+6¾	+ ⅝	$\frac{1}{16}$	8
1949-51	All	Zero	+ ⅜	⅛	5
1952	All	+¾	+ ⅜	⅛	5

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1939-40	All	A	$23\frac{9}{32}$	1¾	⅕	⅜
1941	All	Molded	23¼	1¾	⅕	⅜
1942	All	Molded	$23\frac{5}{32}$	1¾	⅕	⅜
1946-48	All	Molded	24	1¾	$\frac{3}{16}$	⅜
1949	All	Molded	24	2	.212	⅜
1950-52	All	Molded	21	(B)2 (C)1¾	.212	⅜

A—Primary shoe, woven. Secondary, molded.
B—Front
C—Rear

FIRST SERIAL & ENGINE NUMBERS

LOCATION—1939-48: On top of clutch housing and on left frame near cowl. 1949-51: On plate on dash.

Year	Model	
1939	99A	99A-1
1940	09A	99A-101701
1941	19A	99A-257101
1942	29A	99A-466701
1946	69M	99A-650280
1947	79M	799A-1412708
1948	89M	899A-2005028
1949	9CM	9CM-101
1950	0CM	50-10001M(A)
1951	1CM	51-10001M(A)
1952	All	52-10001M(A)

A—Additional letters in serial number denote assembly plant.

NASH & LAFAYETTE

INDEX OF SERVICE OPERATIONS

Year	Model Designation	Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Lafayette 6 3510	113	In Block	3¼ x 4⅜	217.8	5.54	75 @ 3200		20 @ 20
	Advanced 6 3520	120	In Head	3⅜ x 4⅜	234.8	5.25	88 @ 3200		20 @ 20
	Advanced 8 3580	125	In Head	3⅛ x 4¼	260.8	5.25	100 @ 3400		20 @ 20
1936	Lafayette 6 3610	113	In Block	3¼ x 4⅜	217.8	5.54	83 @ 3200		20 @ 20
	Ambassador 6 3620	125	In Head	3⅜ x 4⅜	234.8	5.25	93 @ 3400		20 @ 20
	"400" Standard 6 3640	117	In Block	3⅜ x 4⅜	234.8	5.58	90 @ 3400		20 @ 20
	"400" De Luxe 6 3640A	117	In Block	3⅜ x 4⅜	234.8	5.58	90 @ 3400		20 @ 20
	Ambassador 8 3680	125	In Head	3⅛ x 4¼	260.8	5.25	102 @ 3400		20 @ 20
1937	Lafayette 6 3710	117	In Block	3⅜ x 4⅜	234.8	5.61	90 @ 3400		30 @ 20
	Ambassador 6 3720	121	In Head	3⅜ x 4⅜	234.8	5.80	95 @ 3400		30 @ 20
	Ambassador 8 3780	125	In Head	3⅛ x 4¼	260.8	5.25	105 @ 3400		30 @ 20
1938	Lafayette 6 3810	117	In Block	3⅜ x 4⅜	234.8	5.83	95 @ 3400	175 @ 1000	30 @ 20
	Ambassador 6 3820	121	In Head	3⅜ x 4⅜	234.8	6.00	105 @ 3400	190 @ 1050	30 @ 20
	Ambassador 8 3880	125	In Head	3⅛ x 4¼	260.8	6.00	115 @ 3400	200 @ 1200	30 @ 20
1939	Lafayette 6 3910	117	In Block	3⅜ x 4⅜	234.8	6.30	99 @ 3400	179 @ 1200	30 @ 20
	Ambassador 6 3920	121	In Head	3⅜ x 4⅜	234.8	6.00	105 @ 3400	190 @ 1050	30 @ 20
	Ambassador 8 3980	125	In Head	3⅛ x 4¼	260.8	6.00	115 @ 3400	200 @ 1200	30 @ 20
1940	Lafayette 6 4010	117	In Block	3⅜ x 4⅜	234.8	6.30	99 @ 3400	179 @ 1200	30 @ 20
	Ambassador 6 4020	121	In Head	3⅜ x 4⅜	234.8	6.00	105 @ 3400	190 @ 1050	30 @ 20
	Ambassador 8 4080	125	In Head	3⅛ x 4¼	260.8	6.00	115 @ 3400	200 @ 1250	30 @ 20
1941	"600" Six 4140	112	In Block	3⅛ x 3¾	172.6	6.70	75 @ 3600	136 @ 1200	30 @ 20
	Ambassador 6 4160	121	In Head	3⅜ x 4⅜	234.8	6.30	105 @ 3400	195 @ 1600	30 @ 20
	Ambassador 8 4180	121	In Head	3⅛ x 4¼	260.8	6.30	115 @ 3400	200 @ 1600	30 @ 20
1942	"600" Six 4240	112	In Block	3⅛ x 3¾	172.6	6.87	76 @ 3600	138 @ 1200	30 @ 20
	Ambassador 6 4260	121	In Head	3⅜ x 4⅜	234.8	6.50	105 @ 3400	203 @ 1600	30 @ 20
	Ambassador 8 4280	121	In Head	3⅛ x 4¼	260.8	6.60	115 @ 3400	200 @ 1600	30 @ 20
1946	"600" Six 4640	112	In Block	3⅛ x 3¾	172.6	7.00	82 @ 3800	138 @ 1600	30 @ 20
	Ambassador 6 4660	121	In Head	3⅜ x 4⅜	234.8	7.02	112 @ 3400	208 @ 1600	30 @ 20
1947	"600" Six 4740	112	In Block	3⅛ x 3¾	172.6	7.00	82 @ 3800	138 @ 1600	30 @ 20
	Ambassador 6 4760	121	In Head	3⅜ x 4⅜	234.8	7.02	112 @ 3400	208 @ 1600	30 @ 20
1948	"600" Six 4840	112	In Block	3⅛ x 3¾	172.6	7.00	82 @ 3800	138 @ 1600	30 @ 20
	Ambassador 6 4860	121	In Head	3⅜ x 4⅜	234.8	7.02	112 @ 3400	208 @ 1600	30 @ 20
1949	"600" Six 4940	112	In Block	3⅛ x 3¾	172.6	7.00	82 @ 3800	138 @ 1600	50 @ 30
	Ambassador 6 4960	121	In Head	3⅜ x 4⅜	234.8	7.02	112 @ 3400	208 @ 1600	50 @ 30
1950	Rambler 6 5010	100	In Block	3⅛ x 3¾	172.6	7.25	82 @ 3800	138 @ 1600	30 @ 20
	Statesman 6 5040	112	In Block	3⅛ x 4	184.0	7.00	85 @ 3800	140 @ 1600	30 @ 20
	Ambassador 6 5060	121	In Head	3⅜ x 4⅜	234.8	7.30	115 @ 3400	210 @ 1600	30 @ 20
1951	Rambler 6 5110	100	In Block	3⅛ x 3¾	172.6	7.25	82 @ 3800	138 @ 1600	30 @ 20
	Statesman 6 5140	112	In Block	3⅛ x 4	184.0	7.00	85 @ 3800	140 @ 1600	30 @ 20
	Ambassador 6 5160	121	In Head	3⅜ x 4⅜	234.8	7.30	115 @ 3400	210 @ 1600	30 @ 20
1952	Rambler 6 5210	100	In Block	3⅛ x 3¾	172.6	7.25	82 @ 3800	138 @ 1600	50 @ 30
	Statesman 6 5240	114¼	In Block	3⅛ x 4¼	195.6	7.00	88 @ 3800	150 @ 1600	50 @ 30
	Ambassador 6 5260	121¼	In Head	3½ x 4⅜	252.6	7.30	120 @ 3700	220 @ 1600	50 @ 30

Year	Model	Spark Plugs Type	Spark Plugs Gap, Inch	Breaker Gap, Inch Note A	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M. Synchro-mesh Trans-mission	Engine Idle Speed, R. P. M. Auto-matic Trans-mission	Cylinder Head Torque, Lbs. Ft.
1935	3510	CH-15	.025	.020	35–38	153624	B	Positive	475		60
	3520	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	3580	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1936	3610	CH-7	.025	.020	35–38	153624	B	Positive	475		60
	3640	CH-15	.025	.020	35–38	153624	B	Positive	475		60
	3620	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	3680	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1937	3710	CH-8	.025	.020	35–38	153624	B	Positive	475		60
	3720	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	3780	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1938	3810	AL-B7	.025	.020	35–38	153624	B	Positive	475		60
	3820	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	3880	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1939–40	10	AL-B7	.025	.020	35–38	153624	C	Positive	475		60
	20	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	80	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1941–42	40	AL-7	.025	.020	35–38	153624	B	Positive	475		60
	60	AC-45	.025	.020	35–38	153624	B	Positive	475		65
	80	AC-45	.025	.017	27–30	16258374	B	Positive	475		65
1946–48	40	AL-A5	.025	.020	35–38	153624	B	Positive	475		60
	60	E	.025	.020	35–38	153624	B	Positive	475		65
1949	40	AL-A5	.030	.022	31–37	153624	B	Positive	475		60
	60	AC-44	.025	.022	31–37	153624	B	Positive	475		65
1950–51	10, 40	AL-A5	.030	.022	31–37	153624	D	Positive	475	375	60
	60	AL-A5	.030	.022	31–37	153624	D	Positive	475	375	65
1952	10, 40	AL-A7A	.030	.022	31–37	153624	D	Positive	500	375	60
	60	AL-A7A	.030	.022	31–37	153624	D	Positive	500	375	65

A—Plus or minus .002″.
B—IGN mark on vibration damper.
C—TDC mark on flywheel.
D—TDC mark on vibration damper.
E—Auto-LiteA5 or AC Type 44.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Fitting Pistons With Scale: Shim Thickness To Use	Fitting Pistons With Scale: Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A): Compression	Rings: Ring Gap, Minimum (Note A): Oil	Rings: Clearance in Groove: Compression	Rings: Clearance in Groove: Oil	Pins: Type	Pins: Fit
1935–39	All	B	.002	10	.015	.015	C	C	F	G
1940	Six	Above	.002	12 to 18	.010	.010	.002–.004	.002–.004	F	G
	Eight	Below	.0025	8 to 15	.010	.010	.002–.004	.002–.004	F	G
1941–42	Six	Above	D	D	.010	.010	.002–.004	.002–.004	F	G
	Eight	Below	.0025	8 to 15	.010	.010	.002–.004	.002–.004	F	G
1946–48	All	Above	D	D	.010	.010	.002–.004	.002–.004	F	G
1949–52	10, 40	Above	D	D	.010	.010(E)	.002–.004	.002–.004	H	J
1949–52	60	Above	D	D	.010	.010(E)	.002–.004	.002–.004	F	G

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Above on sixes; below on eights.
C—Top ring .002-.0035″, second ring .0015-.003″, third ring .0015-.0025″, fourth ring .001-.0025″.
D—Each piston is fitted so that it supports its own weight in any portion of the cylinder with all parts clean and dry.
E—No gap on U-Flex oil ring; ends butt.
F—Floating type. Pins retained by snap rings in piston bosses.
G—Thumb push fit in piston and rod but with piston heated.
H—Clamped in rod.
J—Thumb push fit with parts at 70° (normal room temperature).

Year	Model	Operating Clearance H-Hot C-Cold: Intake	Operating Clearance H-Hot C-Cold: Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A): Intake Opens Degrees BTDC	Valve Timing (Note A): Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance: Intake	Valve Stem Clearance: Exhaust	Valve Stem Diameter: Intake	Valve Stem Diameter: Exhaust
1935–36	10, 40	.015H	.015H	.015	45	C	C	45@2	.002–.004	.002–.004	.3730	.3730
	20	.015H	.015H	.015	45	C	C	B	.002–.004	.002–.004	.3730	.3730
	80	.015H	.015H	.015	45	C	C	B	.002–.004	.002–.004	.3407	.3407
1937–40	10	.015H	.015H	.015	45	C	C	68@2	.002–.004	.002–.004	.3730	.3730
	20	.015H	.015H	.015	45	C	C	B	.002–.004	.002–.004	.3730	.3730
	80	.015H	.015H	.015	45	C	C	B	.002–.004	.002–.004	.3407	.3407
1941–42	40	.015H	.015H	.015	45	C	C	37@$1\frac{3}{4}$	.002–.004	.002–.004	.3410	.3410
	60, 80	.015H	.015H	.015	45	C	C	B	.002–.004	.002–.004	.3410	.3410
1946–47	40	.015H	.015H	.019	45	6	10	37@$1\frac{3}{4}$	.002–.003	.002–.003	.3410	.3410
	60	.015H	.015H	.0225	45	24	5	65@$1\frac{11}{16}$	.002–.004	.002–.004	.3410	.3410
1948–49	40	.015H	.015H	.019	45	6	10	37@$1\frac{3}{4}$	.002–.003	.002–.003	.3410	.3410
	60	.015H	.015H	.0225	45	$4\frac{1}{2}$	$16\frac{1}{2}$	48@$1\frac{11}{16}$	.002–.004	.002–.004	.3410	.3410
1950	10, 40	.016C	.018C	.019	45	6	10	37@$1\frac{3}{4}$	.002–.003	.002–.003	.3410	.3410
	60	.012H	.016H	.0225	45	$8\frac{1}{2}$	$10\frac{1}{2}$	53@$1\frac{13}{16}$	.002–.004	.002–.004	.3410	.3410
1951–52	10, 40	.016C	.018C	.019	45	6	10	37@$1\frac{3}{4}$	.002–.003	.002–.003	.3410	.3410
	60	.012H	.016H	.0225	D	$12\frac{1}{2}$	$10\frac{1}{2}$	53@$1\frac{13}{16}$	.002–.004	.002–.004	.3730	.3730

A—BTDC means before top dead center; ATDC means after top dead center.
B—Inner spring 21 @ $1\frac{3}{8}$"; outer spring 38 @ $1\frac{11}{16}$".
C—Checked by timing sprocket marks.
D—Intake 30, exhaust 45.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-40	All	.004–.006	.001–.003	1.9995–2.0005	.0005–.003	.006–.012	50–55	2.4785–2.4795	.0005–.003	.006–.010	70
1941-42	40	.004–.006	.001–.003	1.875	.0015–.002	.006–.012	27–30	2.4785–2.4795	.002	.006–.008	70
	60, 80	.004–.006	.001–.003	1.9995–2.0005	.0015–.002	.006–.014	50–55	2.4785–2.4795	.0005–.003	.006–.010	70
1946-48	40	.004–.006	.001–.003	1.875	.0015–.002	.006–.012	27–30	2.4785–2.4795	.002	.006–.008	70
	60	.004–.006	.001–.003	1.9995 2.0005	.0015–.0025	.006–.014	50–55	2.4785–2.4795	.0005–.003	.006–.010	70
1949	4940	.004–.006	.001–.003	2.094–2.095	.001–.002	.006–.014	27–30	2.4785–2.4795	.002	.006–.008	70
	4960	.004–.006	.001–.003	2.000–2.001	.001–.002	.006–.014	50–55	2.4785–2.4795	.002	.006–.008	70
1950–52	10 40	.004–.006	.001–.003	2.094–2.095	.001–.003	.005–.015	27–30	2.4785–2.4795	.0002–.0025	.003–.007	70
	60	.004–.006	.001–.003	2.000–2.001	.001–.003	.005–.015	50–55	2.4785–2.4795	.0002–.0025	.003–.007	70

A—On 1941–52 Series 10, 40, thrust is taken by the front bearing; on all other models, thrust is taken by the center bearing.

NASH & LAFAYETTE

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil, Above +32°F.	ENGINE: Grade of Oil, Above +10°F.	ENGINE: Grade of Oil, Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil, Summer	TRANSMISSION: Grade of Oil, Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil, Summer	DIFFERENTIAL: Grade of Oil, Winter
1935	3510	19	15	6	20	20W	10W	3	70	50	3	90EP	90EP
	3520	17½	19	7	20	20W	10W	3	70	50	6	90EP	90EP
	3580	21	19	7	20	20W	10W	3 (A)	70	50	6	90EP	90EP
1936	3610	19	15	6	20	20W	10W	3 (A)	70	50	3	90EP	90EP
	3620	17½	19	7	20	20W	10W	3 (A)	70	50	6	90EP	90EP
	3640	18	15	6	20	20W	10W	3 (A)	70	50	3	90EP	90EP
	3680	21	19	7	20	20W	10W	3 (A)	70	50	6	90EP	90EP
1937	3710	20	20	6	20	20W	10W	3½ (B)	70	50	4	90EP	90EP
	3720	17	20	7	20	20W	10W	3½ (B)	70	50	4	90EP	90EP
	3780	18	20	7	20	20W	10W	3½ (B)	70	50	6	90EP	90EP
1938-39	10	20	20	6	20	20W	10W	3½ (B)	70	50	4	90H	90H
	20	16	20	7	20	20W	10W	3½ (B)	70	50	4	90H	90H
	80	17	20	7	20	20W	10W	3½ (B)	70	50	6	90H	90H
1940	4010	18	20	6	20	20W	10W	3½ (B)	70	50	4	90H	90H
	4020	17	20	6	20	20W	10W	3½ (B)	70	50	4	90H	90H
	4080	17	20	7	20	20W	10W	3½ (B)	70	50	5	90H	90H
1941-42	40	14	20	5	20	20W	10W	1 (C)	70	50	3	90H	90H
	60	17	20	6	20	20W	10W	4 (B)	70	50	4	90H	90H
	80	16	20	7	20	20W	10W	4 (B)	70	50	4	90H	90H
1946-48	40	14	20	5	20	20W	10W	2¼ (D)	90	80	3	90H	90H
	60	17	20	6	20	20W	10W	4 (B)	90	80	4	90H	90H
1949	4940	14	20	5	20	20W	10W	2¼ (F)	90	80	3	90H	80H
	4960	17	20	6	20	20W	10W	2¼ (F)	90	80	4	90H	80H
1950-52	10	11	20	5	20	10W	10W	1½ (K)	90	80	3	90H	80H
	40	14	20	5	20	10W	10W	2¼ (G)	90(J)	80(J)	3	90H	80H
	60	17	20	6	20	10W	10W	2¼ (G)	90(J)	80(J)	4	90H	80H

A—With overdrive, 5½ pints.
B—With overdrive, 6 pints.
C—With overdrive, 3 pints.
D—With overdrive, 4¼ pints.
EP—Extreme pressure (mild) lubricant.
F—With Overdrive, 3½ pints
G—With overdrive, 3½ pints; with Hydra-matic 11 quarts.
H—Hypoid gear lubricant.
J—For Hydra-matic transmission, use only Hydra-matic fluid.
K—With overdrive, 2¾ pints.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935–36	All	+2½	+1¼	⅛	7
1937–39	All	+1½	+1¼	1/32	7
1940	All	− ¼	+ ½	1/16	4½
1941–42	40	Zero	+ ¼	1/32	5½
	60, 80	− ¼	+ ½	1/16	4½
1946–48	40	+ ½	+ ½	5/32	7½
	60	− ¼	+ ½	1/16	4½
1949	All	+ ¼	Zero	⅛	8½
1950	5010	+1	+ ½	¼	8½
	5040, 5060	+ ¼	Zero	⅛	8½
1951	5110	+1	+ ½	¼	8½
	5140, 5160	Zero	Zero	⅛	8½
1952	5210	+1	+½	3/16	8
	5240, 5260	+¼	Zero	⅛	6½

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-40	All	.005–.007	Shims	Shims	.004–.006
1941-47	All	.005–.007	Shims	Shims	.002–.004
1948-52	All	.004–.006	Shims	Shims	.002–.004

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	3510	Molded	$23\frac{3}{4}$	$1\frac{3}{4}$	$\frac{5}{32}$	$\frac{3}{8}$
	3520	Molded	$23\frac{13}{16}$	$1\frac{3}{4}$	$\frac{5}{32}$	$\frac{3}{8}$
	3580	Molded	$23\frac{13}{16}$	$2\frac{1}{4}$	$\frac{5}{32}$	$\frac{3}{8}$
1936	3610	Molded	$22\frac{1}{16}$	2	$\frac{3}{16}$	$\frac{3}{8}$
	3620	Molded	$23\frac{13}{16}$	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	3640	Molded	$22\frac{1}{2}$	2	$\frac{3}{16}$	$\frac{3}{8}$
	3680	Molded	$23\frac{13}{16}$	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1937	Six	Molded	$22\frac{1}{16}$	2	$\frac{3}{16}$	$\frac{3}{8}$
	Eight	Molded	24	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1938	Six	A	22	2	$\frac{7}{32}$	$\frac{3}{8}$
	Eight	A	24	$2\frac{1}{4}$	$\frac{7}{32}$	$\frac{3}{8}$
1939	Six	Molded	22	2	$\frac{7}{32}$	$\frac{3}{8}$
	Eight	Molded	24	$2\frac{1}{4}$	$\frac{7}{32}$	$\frac{3}{8}$
1940	Six	Molded	22	2	$\frac{3}{16}$	$\frac{3}{8}$
	Eight	Molded	24	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1941-42	40	Molded	$20\frac{1}{2}$	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	60, 80	Molded	22	2	$\frac{3}{16}$	$\frac{3}{8}$
1946-48	40	Molded	$20\frac{1}{2}$	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	60	Molded	22	2	$\frac{3}{16}$	$\frac{3}{8}$
1949	4940	Molded	$17\frac{1}{2}$	B	$\frac{3}{16}$	$\frac{3}{8}$
	4960	Molded	22	2	$\frac{3}{16}$	$\frac{3}{8}$
1950-52	10	Molded	$16\frac{27}{32}$	C	$\frac{3}{16}$	$\frac{3}{8}$
	40	Molded	$17\frac{1}{2}$	B	$\frac{3}{16}$	$\frac{3}{8}$
	60	Molded	20	2	$\frac{3}{16}$	$\frac{3}{8}$

A—Primary shoe, molded. Secondary, woven.
B—Primary shoe, 2″. Secondary, $1\frac{3}{4}$″.
C—Front primary, $1\frac{3}{4}$″; front secondary, $1\frac{1}{2}$″; rear primary, $1\frac{1}{4}$″ rear secondary, 1″.

ENGINE

ENGINE REMOVAL

1935-52 Except Rambler—The general procedure for removing the engine is as follows: Raise or remove the hood, drain the cooling system, and remove the battery, if necessary. Remove radiator.

Disconnect successively the fuel pump, exhaust pipe at manifold, throttle and choke controls, heat indicator unit at cylinder head, coil and generator wires, clutch pedal linkage and windshield wiper vacuum line.

Remove the front and rear engine support bolts. Attach a hoist to the engine and lift it out.

1950-52 Rambler—On these models the engine is removed from below the car.

1. Remove hood and radiator and disconnect all necessary wiring, lines and carburetor linkage.
2. Remove the exhaust pipe from the engine and wire it upward and clear of the exhaust pipe mounting studs.
3. Attach a lifting rig to the cylinder head studs and raise the car preferably on a two-post lift. If a lift is not available, support the front of the car with high jacks located under the body side

FIRST SERIAL NUMBER

LOCATION—1935-42 except 4140, 4240: On right frame side rail under hood. 4140: On right side of body. 4240 and 1946-51 (Exc. Ser. 10): On dash panel under right side of hood. 1950-51 Series 10: On wheelhouse panel under right side of hood.

Year	Model	
1935	3510	L-13701
	3520	R-294725
	3580	B-75010
1936	3610	L-23101
	3620	R-303301
	3640	C-1001
	3640A	C-9501
	3680	B-77325
1937	3710	L-50781
		H-1001
	3720	R-309311
	3780	B180031
1938	3810	L-106281
		H-10501
	3820	R-324311
	3880	B-86031
1939	3910	H-19450
	3920	R-331400
	3980	B-89000
1940	4010	H-57000
	4020	R 340000
	4080	B-106300

A—Kenosha, Wis.
B—El Segundo, Cal.

Year	Model	
1941	4140	K-5001
	4160	R-353001
	4180	B-110001
1942	4240	K-56001
	4260	R-384001
	4280	B-114001
1946	4640	K-77701
	4660	R-393101
1947	4740	K-136001
	4760	R-429201
1948	4840	K-196901
	4860	R-468501
1949	4940	K-260501(A)
	4940	KC-1001 (B)
	4960	R-515501(A)
	4960	RC-1001 (B)
1950	5010	D-1001(A)
	5010	DC-1001(B)
	5040	K-340001(A)
	5040	KC-9501 (B)
	5060	R-556001(A)
	5060	RC-3501 (B)
1951	5110	D-12501 (A)
	5110	DC-1501 (B)
	5140	K-438001(A)
	5140	KC-23501 (B)
	5160	R-600501(A)
	5160	RC-8701 (B)

FIRST ENGINE NUMBER

LOCATION—1935-48 except 3910, 4010: On right side of crankcase. 3910, 4010: On left front of crankcase. 1949-51 Series 10, 40: On right side of engine above exhaust pipe. 1949-51 Series 60: On upper right hand corner of engine.

Year	Model	
1935	3510	LE-13201
	3520	E-46125
	3580	B-87710
1936	3610	LE-22601
	3620	E-54701
	3640	CE-501
	3640A	CE-9001
	3680	B-90025
1937	3710	LE-50281
		HE-501
	3720	E-60711
	3780	B-92731
1938	3810	LE-105781
		HE-10001
	3820	E-75711
	3880	B-98731
1939	3910	HE-18950
	3920	E-82800
	3980	B-101700
1940	4010	HE-56500
	4020	E-339500
	4080	B-105800

Year	Model	
1941	4140	K-5001
	4160	R-353001
	4180	B-110001
1942	4240	K-56001
	4260	R-384001
	4280	B-114001
1946	4640	K-77701
	4660	R-393101
1947	4740	K-146001(A)
	4760	R-429201(B)
1948	4840	KE-55001
	4860	RE-40001
1949	4940	S-1001
	4960	A-1001
1950	5010	F-1001
	5040	S-92001
	5060	A-46001
1951	5110	F-13001
	5140	S-207001
	5140	A-97001

A—Starting with serial number K-153245 first engine number is KE-1001.

B—Starting with serial number D-440923 first engine number is RE-1001.

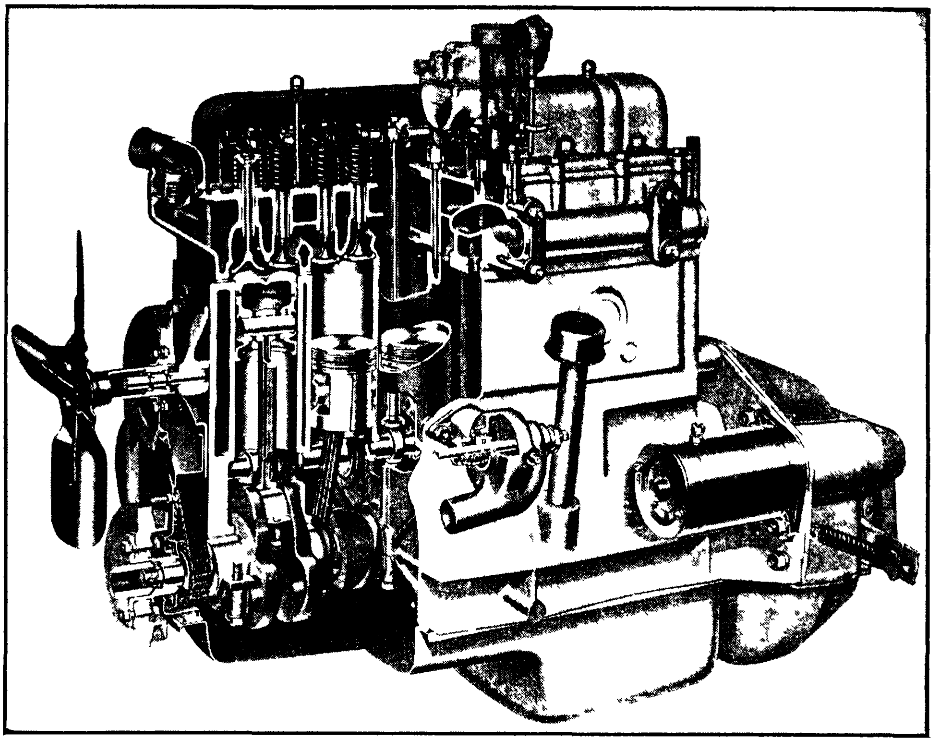


Fig. 1 Cutaway vi w of 1950-51 Ambassad r ngin . Typical f 1952

sills just behind the rear engine support crossmember

4. Then disconnect the cross tie rod from the steering linkage, the shift rods from the transmission, and the clutch linkage to the clutch beam

5. Drain the engine oil and transmission Disconnect the speedometer cable at the transmission and remove the speedometer driven gear.

6 Attach a block and tackle or crane to the lifting fixture and adjust to support the engine's weight

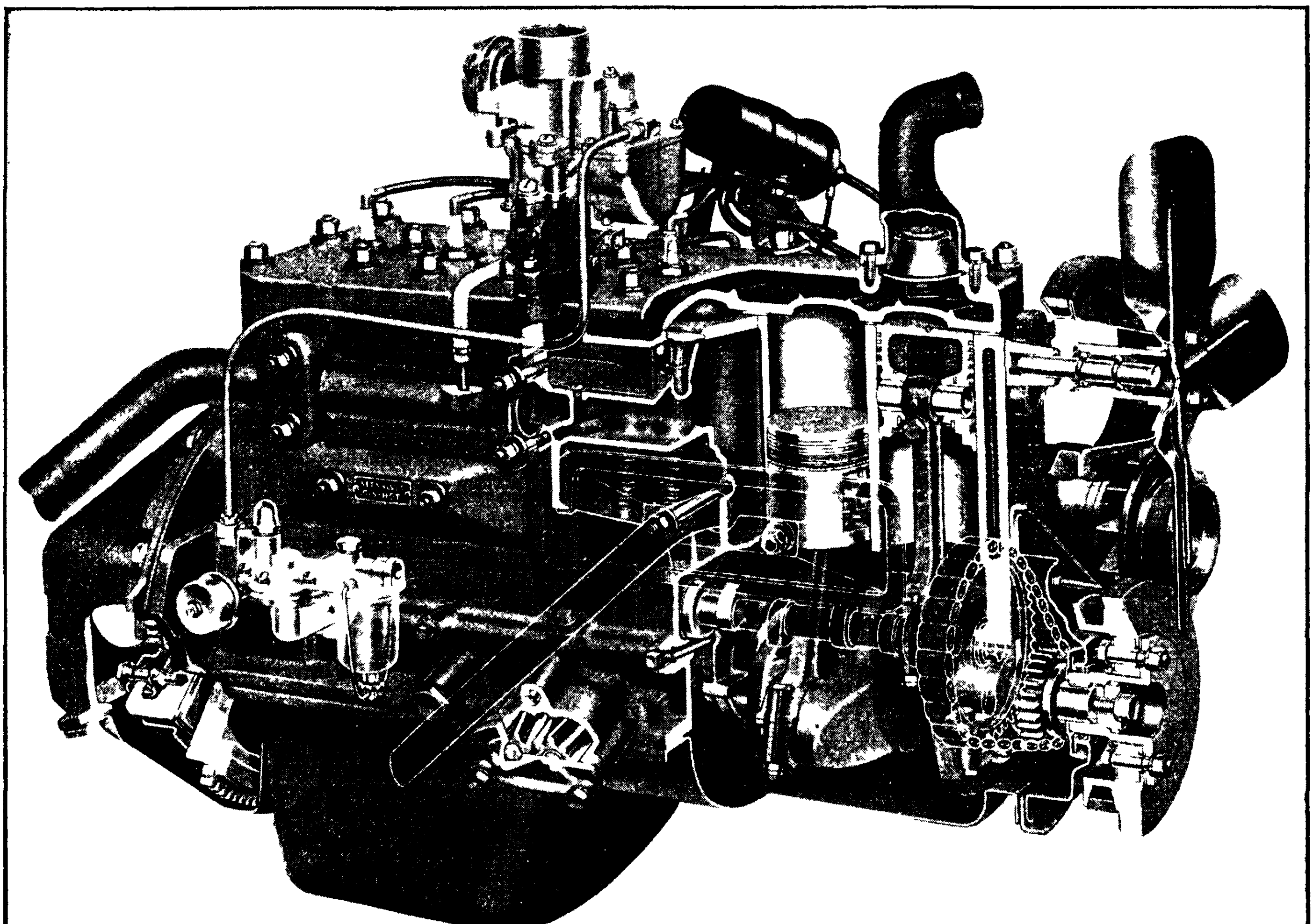
7. Remove the four bolts holding the front support crossmember to the body side sills

8. Remove rear engine mounting diagonal braces, and the four bolts which attach the rear engine support crossmember to the body side sills.

9. Lower the engine slightly and a little forward and slip the universal joint from the transmission shaft

10 The engine can be lowered to the floor with front and rear engine support crossmembers attached.

Fig. 2 Cutaway view of 1950-51 Stat sman engine. Typical of 1952



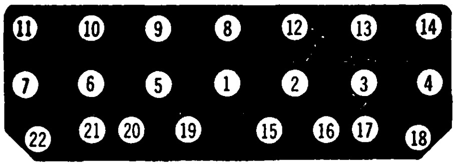


Fig. 3 Head tightening. 1941-52 Series 10, 40

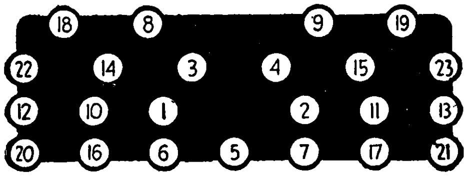


Fig. 4 Head tightening. 1935-40 Series 10

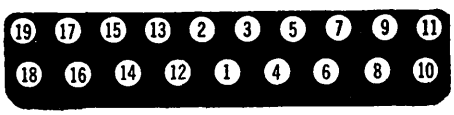


Fig. 5 Head tightening. 1935-42 Series 80

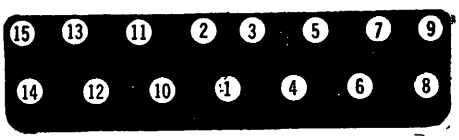


Fig. 6 Head tightening. 1935-52 Series 20, 60

CYLINDER HEAD

1935-52—Tighten cylinder heads in the order shown in Figs. 3 to 6, and to the tension listed in the *Tune Up Data* table. On overhead valve engines be sure to check and adjust the valves after the tightening operation.

ROCKER ARMS & SHAFTS

1935-52 OVERHEAD — To remove the rocker arms, take off the rocker arm cover, unfasten the rocker arm shafts, support bolts and oil fittings, then lift off the assembly.

CAUTION — When disassembling the rocker shaft assembly, place all parts on the bench in their proper relationship to assure correct assembly. And to prevent the possibility of bending or twisting push rods, they should always be removed before taking off the cylinder head, and replaced after the head is installed.

VALVE CLEARANCE, ADJUST

1935-52—Overhead valve engines should always be adjusted whenever the cylinder head has been removed or tightened.

The clearances given in the *Valve Data* table should be maintained at all times for normal driving conditions. Check the clearance when the engine is at normal operating temperature and at idling speed. For continuous high speed driving, an additional .003″ is recommended.

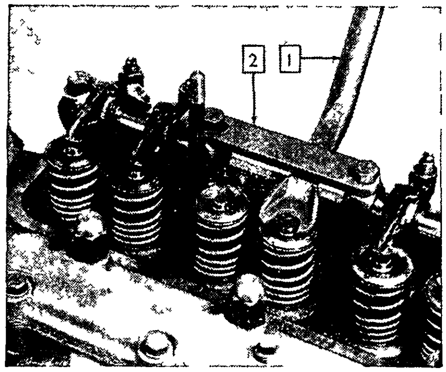


Fig. 7 Removing valve spring on overhead valve engines using pry bar (1) and brace (2). 1935-52

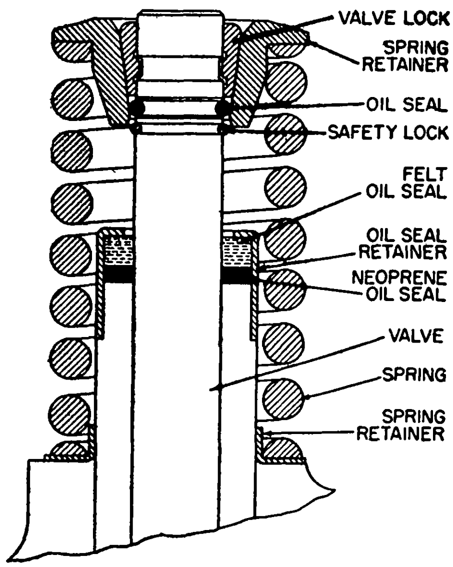


Fig. 7A Valve stem oil seals on 1951-52 Ambassador

On overhead valve engines where tappet noise is objectionable, and the car is driven at low speeds continuously, a reduction of .003″ in the specified clearance is permissible.

On Rambler engines, due to the location of the valve mechanism, the valves may be adjusted cold. Short open end wrenches may be used to set the clearance.

VALVES & SPRINGS

1935-52 OVERHEAD — To remove the valves and springs, take off the rocker arm cover and cylinder head. Compress the valve springs, take out the locking keys and lift out the valves and springs.

NOTE—It is not necessary to remove the cylinder head in order to remove a valve spring from these engines. First remove the spark plug from the cylinder that requires a valve spring replacement and insert an adapter in the plug hole. This adapter can be made from the body of a spark plug from which the porcelain has been removed, and an air hose connection threaded into the body

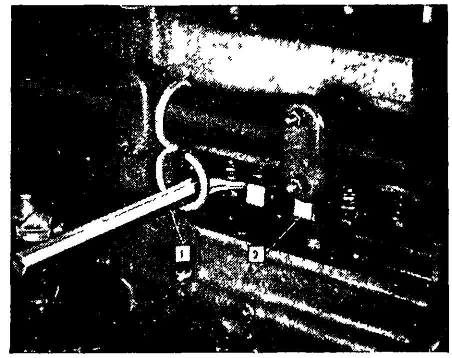


Fig. 8 Method of compressing valve springs on 1941-52 Series 10, 40. Th adapt rs (2) are used to hold up valv lifters when necessary to remov camshaft

of the plug. Then, while the spring is being removed, maintain about 90 pounds air pressure in the cylinder. The air pressure will hold the valves against their seats so that the valve lock and retainer can be removed. To hold the valve spring down while the parts are removed, use a pry bar and brace as shown in Fig. 7.

The 1951-52 Ambassador series valve incorporates a new valve stem oil seal installed as shown in Fig. 7A. This oil seal serves a two-fold purpose. The felt retains oil for initial starting lubrication, while the neoprene seal prevents excessive oil passage past the valve stems.

1935-52 L-HEAD—To remove the valves, drain the cooling system and remove the cylinder head. Take off the valve covers and plug the holes in the cylinder block around the valve tappets so that the valve locks will not drop into the oil pan when the locks are removed. Compress the valve spring, remove the valve lock and lift out the valve, Fig. 8.

VALVE STEM GUIDES

1935-52—Valve guides are removed and replaced with special pullers and drivers made for the purpose. If this equipment is not available, carefully measure with a steel scale the amount each guide projects from the valve port before removing it so that the position of the new guide will be properly located when it is driven in. After the guides are installed, they should be reamed to provide a clearance within the limits given in the *Valve Data* table.

VALVE REFACING

1935-52 — It is important when valves are refaced that just enough metal be ground off to clean up the face. A valve should be replaced if, after refacing, there would be less than approximately $\frac{1}{16}$″ thickness of metal left on the outer diameter of the valve head. This is known as valve margin and is illustrated in Fig. 9. A heavy valve margin aids in the dissipation of heat and helps avoid valve warpage.

VALVE LIFTERS & GUIDES

1935-52 — Since the lifters are of the mushroom type and the guides are cast integral with the cylinder block, it is necessary to remove the camshaft before

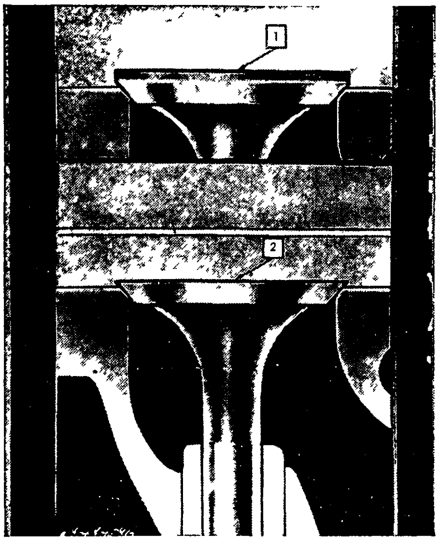


Fig. 9 C rr ct (1) and incorrect (2) valve refacing. Note margin left on valv head in upper view. 1935-52

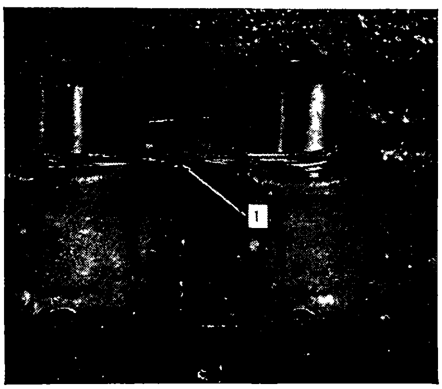


Fig. 10 H lding valve lifters up with rubb r bands while removing camshaft n 1935-52 overhead valve engines

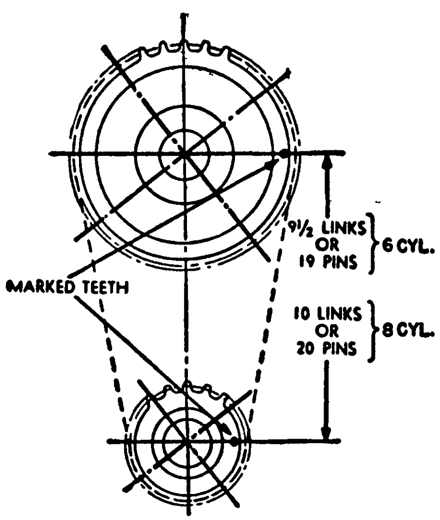


Fig. 11 C rr ct relati nship f sprocket marks f r valv timing. 1940-52

the lifters can be taken out. Follow the instructions for removing the camshaft under that heading, then remove the oil pan and take the lifters out through the bottom.

To make removal of the camshaft easier, hold up the lifters with the adapters shown in Fig. 8 on L-head engines, or with rubber bands, Fig. 10, on overhead valve engines.

TIMING CASE COVER

1935-52—The timing chain cover is provided with a felt seal to prevent leakage of oil around the crankshaft pulley hub. To prevent damage to the seal, it is important that the cover be properly aligned when installing the vibration damper. This is accomplished by leaving the cover loose until the damper has been partially installed. Then tighten the cover screws.

An oil slinger is used inside the cover and is held in place by the crankshaft sprocket.

TIMING CHAIN & SPROCKETS

1935-52 — When installing new parts, line up the marked teeth on a centerline drawn through the center of the camshaft and crankshaft. After installing the chain on 1940 and later models, check the valve timing according to the diagram shown in Fig. 11.

CAMSHAFT & BEARINGS

1935-52—To remove the camshaft, it is not necessary to remove the cylinder head or valves. Take off the radiator core, timing case cover, chain and camshaft sprocket.

On the eights, remove the oil pump and push rods. On all models, take off the distributor and fuel pump. Remove the screws which fasten the front camshaft bearing to the crankcase (except series 10 and 40) and take out the bearing. Prop up the valve lifters as shown in Figs. 8 and 10 and withdraw the camshaft, rotating it so that it will clear any obstruction during the process.

After removing the camshaft, use a suitable puller to remove and replace the bearings. Original camshaft bearings should never be removed unless severely damaged. Bearings that are slightly scored may be retained if the surface of the bearings and camshaft are polished and the fit is free.

If necessary to replace bearings, they should be pressed in place and line-reamed to provide a clearance within the limits given in the *Engine Bearing* table. Be sure that the oil holes in the bearings are in line with the oil holes in the crankcase and that these holes are clean and open to assure proper lubrication.

NOTE—On all models except Series 10 and 40, camshaft end thrust is controlled by the front bearing. On Series 10 and 40, the thrust is taken by a plate at the front of the camshaft.

PISTONS & RODS, ASSEMBLE

1935-48—When assembled in the block, the oil spray hole in the upper half of the big end of the connecting rod should face the camshaft side of the engine with the slotted side of the piston facing away from the camshaft.

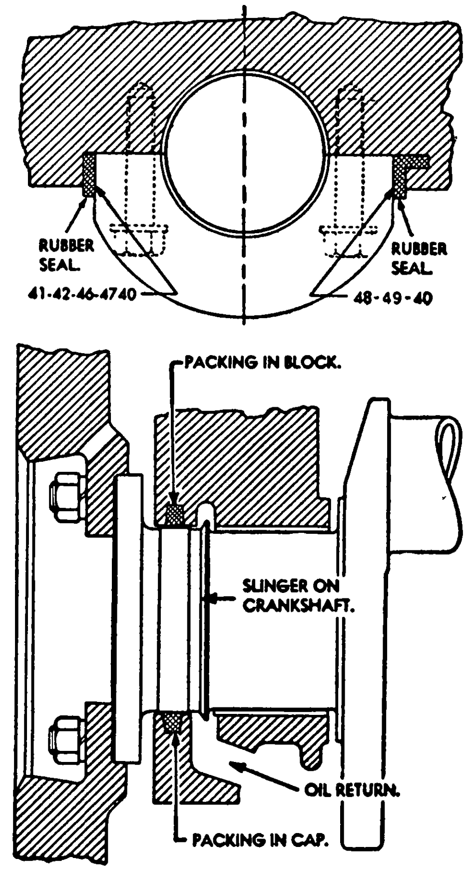


Fig. 12 Rear main bearing il seal. 1941-52 Series 10, 40

1949-52—On Series 10 and 40, the pistons have no vertical slot but are equipped with bushings for the piston pin. Rods are not rifle drilled and the piston pins are clamped to the rod.

On series 60, the same construction is used as in 1948 models.

PISTONS

1935-52—Pistons should be fitted according to the instructions given in the *Piston & Ring Data* table. Be sure all parts are clean and dry when fitting them.

Before fitting pistons, check the cylinder bores for out-of-round or tapered condition. This check is made with a cylinder gauge or dial indicator. If the bore is found to be out-of-round in excess of .004", it should be trued up with a rigid-type hone.

PISTON RINGS

1935-52—Piston rings are furnished in standard sizes and oversizes of .010 and .020 inch. Always use standard size rings in cylinder bores that are *standard at the bottom, regardless of the amount of taper.* Rings may have ample clearance in the upper part of the cylinder but at the bottom of the piston stroke the ends jam, causing the rings to buckle and distort. Always see that ends gaps are within specifications at the *bottom of the cylinder.* When fitting

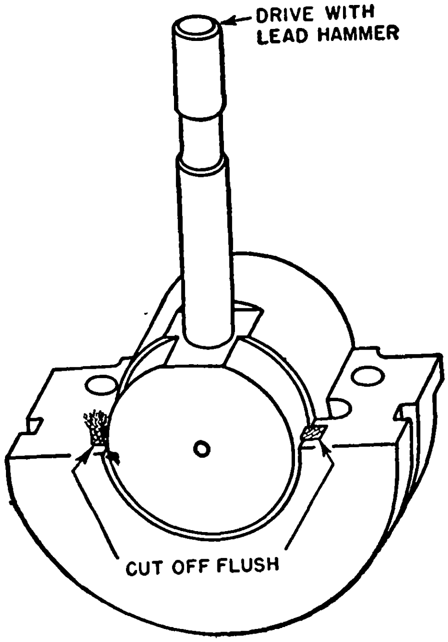


Fig. 13 Crankshaft rear oil seal installing t l. 1941-52 Series 10, 40

rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side when installed in the piston.

Before removing pistons, the ridge at the top of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder wall, never try to remove the last traces of the ridge; this can be done afterward by honing.

New rings should be fitted according to the instructions given with the ring package. Ring grooves must be clean and free from carbon and must show no perceptible wear. Oversizes ordered must be determined by the measurement of the smallest portion of the bore.

PISTON PINS

1935-48—Piston pins are furnished in standard sizes and oversizes of .001 and .003 inch. The fit of the pin in the rod bushing should require a tight thumb push with the parts at normal room temperature. Heat the piston in hot water to allow it to expand before inserting the pin so that the piston skirt will not be distorted by driving the pin in place.

1949-52 — Pistons and pins in the 60 series are the same as 1948. However in Series 10 and 40, bushings are pressed in the piston bosses and the pins are clamped in the rods. With this construction, fit the pins in the piston bushings with both parts at normal room temperature.

CONNECTING RODS

1935-52—Rod bearings are furnished in standard sizes and undersizes of .002 and .010 inch. They are of the replaceable shell type and when worn can be replaced simply by removing the caps and replacing the upper and lower halves.

MAIN BEARINGS

1935-52—Main bearings are furnished in standard sizes and undersizes of .002 and .010 inch. Shell type bearings are used and if worn should be replaced. No attempt should be made to file, shim or otherwise take up worn bearings.

To install new bearings, remove the cap and take out the worn lower shell. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil hole in the shaft to contact the bearing and force it out.

Place a new upper shell on the crankshaft journal with the locating notch in the correct position and rotate the shaft to turn the shell in place. Install the lower shell in the cap and install the cap.

CRANKSHAFT END THRUST

1935-52—On all models except Series 10 and 40, crankshaft end play is controlled at the center main bearing which is flanged for the purpose.

On 1941-48 Series 40, a thrust plate at the front main bearing controls end thrust, while on 1949-52 Series 10 and 40, the front main bearing is flanged for the purpose of controlling end play.

To check the amount of end play, pry the shaft toward the front and check the clearance between the bearing flange and shaft (on 1949-52 Series 10 and 40, check between thrust plate and shaft). Then if the clearance is .004" greater than the limits given in the *Engine Bearing* table, the bearing (or thrust plate) should be replaced.

CRANKSHAFT REAR OIL SEALS

1941-52 Series 10 and 40—Besides an oil slinger to return excess oil to the crankcase, Fig. 12, a packing is installed in the block and cap. This prevents leakage of oil that gets by the slinger, and also prevents dust from entering the engine.

The rear main bearing cap is also provided with rubber seal plugs to seal the outside edges of the cap against the recess in the block.

When installing the bearing oil seal, the crankshaft and bearing must be removed to replace the upper half. When installing the seal, the tool shown in Fig. 13 should be used to force and shape the seal in the groove.

1935-52 Series 20, 60—On models prior to 1948, the oil slinger used is a threaded section which is part of the crankshaft (left view, Fig. 14). This thread rotates in line with a cored groove in the block and cap. Oil holes in the cap return the oil to the oil pan.

In these models, .006 to .008" clearance must be held between the bore in the cap and block. This clearance is checked after the bearing cap is placed in position. Use a feeler gauge and check the clearance in two or three places to insure against an eccentric oil thread. To increase the clearance, reduce the outside diameter of the thread by placing the crankshaft between lathe centers and filing the thread. Do not alter the bore in the bearing cap.

In 1948-52 series 60, the threaded oil return has been eliminated and replaced by a steel-backed synthetic rubber seal (right view, Fig. 14). The rubber seal is in halves and fits closely over the edge of the rear bearing oil return groove. It bears firmly on the smooth area of the crankshaft.

The wooden plugs formerly used to seal the sides of the rear bearing cap are replaced by synthetic rubber key strips overlapping the bearing cap and sealing the sides as well as the mating surfaces.

1935-42 Series 80—The oil slinger is similar to that used in series 40 engines but there is no packing at the rear of the oil slinger on the shaft. Clearance must be held between the rear end of the bearing cap and shaft, the same as that of the series 60 engines.

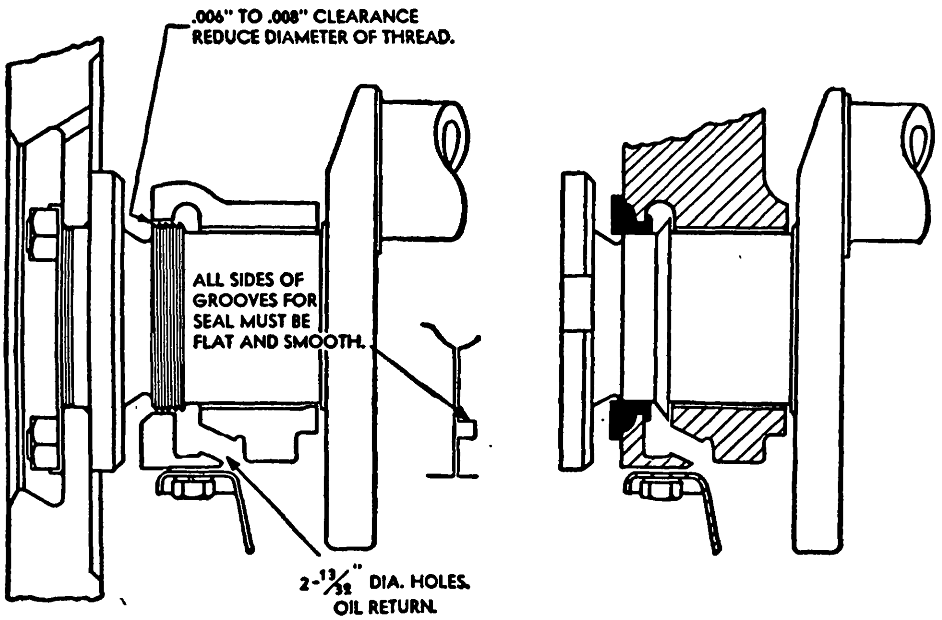


Fig. 14 Crankshaft rear il seals n S ries 20. 60. Right vi w 1948-52; l ft vi w 1947 and arli r

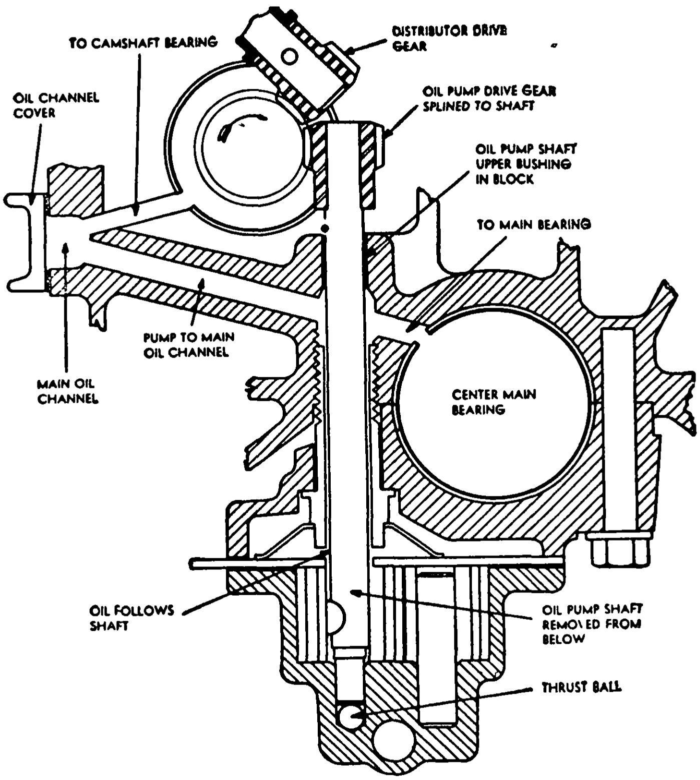


Fig. 17 Oil pump mounting. 1935-52 Series 20, 60

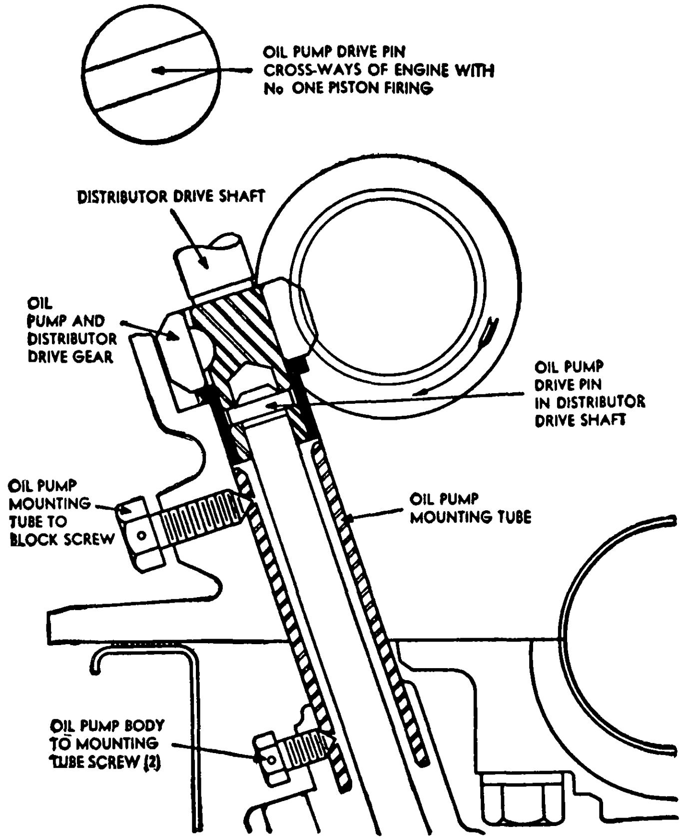


Fig. 18 Oil pump mounting. 1935-42 S ries 80

ENGINE OILING

OIL PAN

1935-51 Except 1941-42 Series 40—When replacing the pan, it is good practice to use a couple of guide studs to aid in the pan's installation These studs can be made by cutting off the heads of spare oil pan cap screws and sawing a slot in the head so they can be removed with a screwdriver after the pan is positioned properly These headless screws not only prevent the gasket from shifting but help to guide the oil pan into correct alignment with the crankcase

On 1946-51 Series 40, the removal of the pan is made easier if the front of the engine is lifted This will allow the front pan bolt, just below the generator, to be removed without difficulty

On 1946-51 Series 60, it is necessary to raise the front of the engine about three inches to make room for the removal of the front pan bolts, and to make it possible to remove the pan without interference with No 1 and 2 crank throws

On 1950-52 Ramblers, the oil pan may be removed without difficulty after removing the steering linkage cross tie rod.

1941-42 Series 40 — To remove the oil pan on these models, disconnect the front shock absorbers at the upper end Remove the accelerator rod to the dash, and the steering tie rod from above the cylinder head.

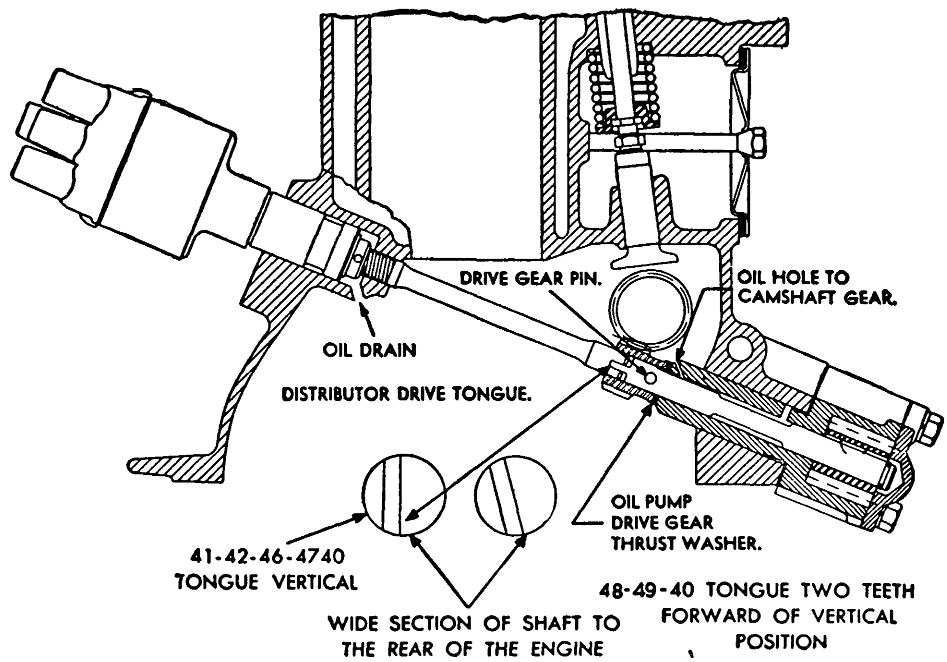


Fig. 19 Oil pump and distributor drive. 1941-52 Series 10, 40

After draining the cooling system, disconnect the upper water hose Disassemble the engine front shackles Remove the four front oil pan attaching screws, raise the engine 4 or 5 inches with a jack placed at the front engine support just behind the vibration damper, after which remove the balance of the oil pan screws and drop the pan

NOTE—After replacing the oil pan and steering tie rod, check the front end alignment as described in the *Front Suspension* section.

OIL PUMP

1935-52 Series 20, 60 — The oil pump drive gear which meshes with the camshaft gear is splined to the top end of the oil pump shaft. The spline is a free fit so that it may be removed from below after the oil pump is dropped. The oil pump drive gear is installed from above after the distributor bracket and gear have been removed, Fig. 17.

Since the oil pump is driven from a separate gear from the distributor drive gear, no particular attention is necessary in engaging the oil pump drive gear with the camshaft gear.

1935-42 Eights—The oil pump on these models is installed from below, and in installing the distributor drive shaft with the distributor and oil pump drive gear keyed to its lower end from above, the gear must be engaged with the camshaft gear so that the oil pump drive pin, located at the lower end of the distributor drive shaft, is crossways of the engine with No. 1 piston in the firing position, as shown in Fig. 18.

1941-52 Series 10, 40—The oil pump on these models consist of a drive and driven gear. The drive shaft, Fig. 19, being keyed to the drive gear at the lower end, is driven by a gear at the upper end which engages with the camshaft gear. The distributor drive is taken from the top end of the oil pump drive shaft. A wire snap ring is used on the undercut on the lower end of the shaft to prevent the shaft from disengaging the lower gear when the oil pump is removed.

When installing the pump, the drive gear at the upper end of the oil pump drive shaft must be meshed with the camshaft gear so that the drive tongue is located as shown in Fig. 19. Note that the drive tongue is offset so that with No. 1 piston in the firing position, the wide area at the end of the shaft must be to the front of the engine. This is important in order that the distributor be properly located for timing.

OIL PRESSURE REGULATOR

1935-40 Except 4010—The oil pressure relief valve is built into the pump body. The pressure can be adjusted by turning the adjusting screw clockwise to increase the pressure, and vice versa.

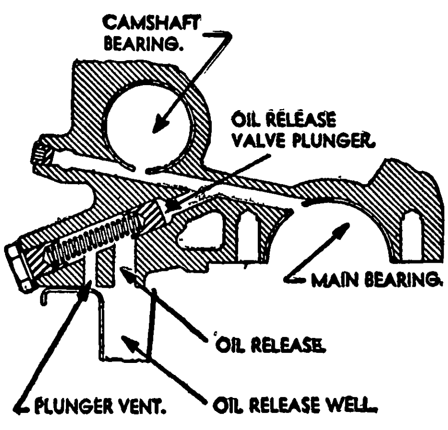


Fig. 20 Oil pr ssur regulat r. 1941-52 S ri s 10, 40

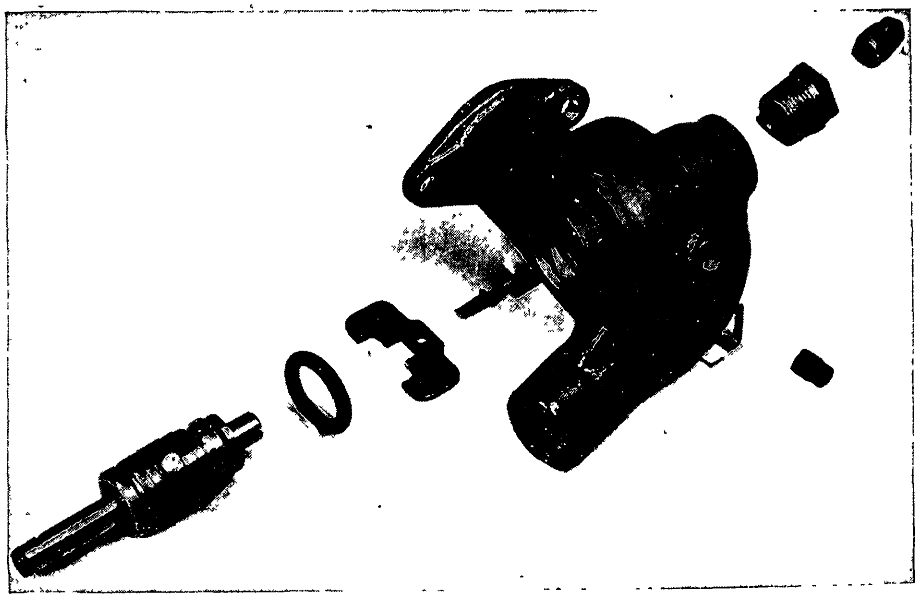


Fig. 21 Layout of 1949-52 water pump parts

4010, 1941-52 Series 60, 80—The oil pressure relief valve is located in the pump body and is not adjustable. It consists of plunger, spring and spring retainer, with the retainer located at the bottom end of the spring.

1941-52 Series 10, 40—The oil pressure relief valve is not adjustable and is located in the engine block just to the rear of the point where the oil pump housing is mounted to engine, Fig. 20.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-41—Drain the cooling system and remove the hood, radiator brace rods, fan blades and hose connections. Unbolt the core and lift it out over the top of the engine.

1942-52—On the sixes, the unit is removed through the top. On 4280, remove the left front brace rod, bottom pans and fan. Then loosen the core, turn it to the right and lower it out through the bottom of the chassis.

WATER PUMP, REMOVE & OVERHAUL

1935-39 — Disconnect the hose coupling from the water pump elbow, and the shaft coupling. Remove the pump body mounting bolts and lift the pump off the engine. Remove the cover screws and pry the cover off of the pump body. Remove the impeller and shaft. If the bushing is worn, take it out with a bushing remover and press a new bushing in place. Use a new cover gasket coated with shellac or gasket cement when reassembling, to insure a watertight assembly.

1940-48—To remove the water pump, drain the cooling system. Remove the rear bolt from the flexible coupling on the pump shaft. Take the lower hose from the water pump. Remove the two capscrews that hold the pump housing to the engine block.

In disassembling the pump, note that the water pump impeller or blade is installed in the slotted end of the water pump shaft, held in place by a tubular brass rivet. A removable plug in the pump body permits the removal and installation of this rivet. By removal of the plug and supporting the shaft through the water outlet hole, the rivet can be driven out with a small punch. Remove the packing nut and take out the shaft. Clean out the packing so that the bushing can be removed.

To reassemble the pump, install a new bushing in the pump body and ream it just enough to provide a free turning shaft with no side play. Then reinstall the pump parts in the reverse order of their removal.

When installing the new packing, use three packing rings, installing one at a time, drawing each ring down with the packing nut. After the last ring is installed, do not draw the packing nut up tight until the pump has been installed on the engine, lubricated and allowed to run.

1949-52—A "packless" sealed type pump is used. The seal is of 'cartridge" construction, installed and serviced as a unit. The sealing member is enclosed in a metal cartridge which is mounted and sealed in the pump body by means of a flexible rubber ring. The sealing member is pressed against the shaft by constant spring pressure exerted through the bushings. The spring chamber also acts as a reservoir for the lubricant.

To disassemble the pump, Fig. 21, remove the impeller and pull out the seal and shaft assembly.

To assemble, insert a new rubber retainer in the pump body. Then apply a small amount of rubber lubricant to the inner part of the rubber ring. This will aid in installing the shaft and seal as-

sembly. Install the impeller on the shaft and use a new brass rivet to fasten it thereon.

ELECTRIC SYSTEM

IGNITION TIMING

1935-41 OVERHEAD ENGINES — The twin ignition used on these cars includes duplicates of a single ignition system. It has 2 sets of spark plugs and cables, two coils and one distributor with two sets of condensers and breaker points. Since both plugs in each cylinder must fire at the same instant, it is therefore necessary that both breaker gaps be identical.

To synchronize the two sets of breaker points, two timing lights are required. Attach the ground lead of each light to any suitable ground on the engine or distributor base. Connect the timing light leads to each of the distributor primary terminals without disconnecting the wires from the coil. Now with the ignition on and the car in high gear, roll the car forward until the fixed points just break and the light comes on. If correctly synchronized, the light connected to the adjustable points will light at the same time. If not, loosen the three screws holding the distributor sub-plate and move the sub-plate by turning a screwdriver in the slot provided until both sets of points open at the same instant. Then tighten the screws to hold the sub-plate securely in position and rotate the distributor several times by cranking the engine with the starter and recheck the synchronization.

With the points properly synchronized, proceed to set the ignition timing. If, when bringing the engine into timing position, the timing mark passes the pointer, it will be necessary to turn the engine back at least one-half revolution and then forward again up to the timing mark in order that the backlash will be taken up. Turn the distributor base in its mounting to adjust the timing of the distributor to the engine.

1939-52 L-HEAD & 1942-52 OVERHEAD—With the breaker gap set to the clearance given in the *Tune Up Chart,* crank the engine to bring No. 1 piston up on its compression stroke and stop when the pointer on the timing case cover is in line with the specified timing mark on the vibration damper—given in the *Tune Up Chart.*

Locate No. 1 spark plug wire on the distributor cap, place the cap in position on the distributor and mark the housing opposite No. 1 terminal so that its relative position will be known when the cap is removed.

With the octane selector set midway between advance and retard, loosen the distributor body clamp and rotate the distributor until the points close. Then rotate the distributor in the opposite direction until the points just begin to open, after which, tighten the clamp bolt.

NOTE—For the best results, use a Neon timing light or a suitable test lamp to check the timing. Advance or retard the octane selector to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

INSTRUMENT CLUSTER

1949-50—Fig. 22 shows the wiring diagram of the instrument cluster gauges. The gauge units can be removed separately and replaced. Each is held in the cluster plate by two mounting screws.

To replace a gauge, remove the instrument cluster head from its housing. This is done by removing the cluster retaining bolt from the back of the cluster housing.

CAUTION—Whenever any work is to be performed on the cluster, disconnect one battery lead from its terminal at the battery to insure against short circuits. If removing more than one wire in the gauge cluster, each wire should be labeled with its location as it is removed to insure proper rewiring.

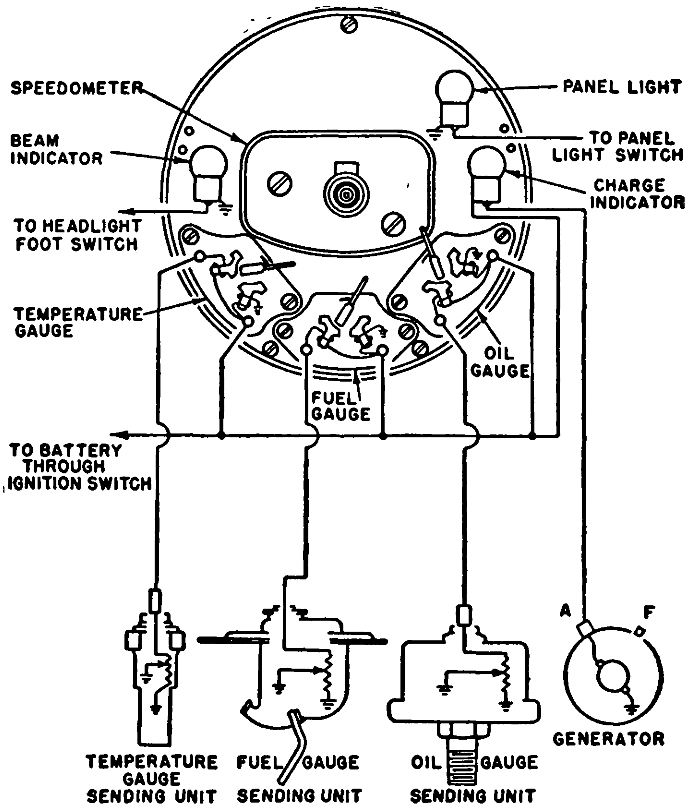


Fig. 22 1949-50 instrum nt clust r wiring diagram

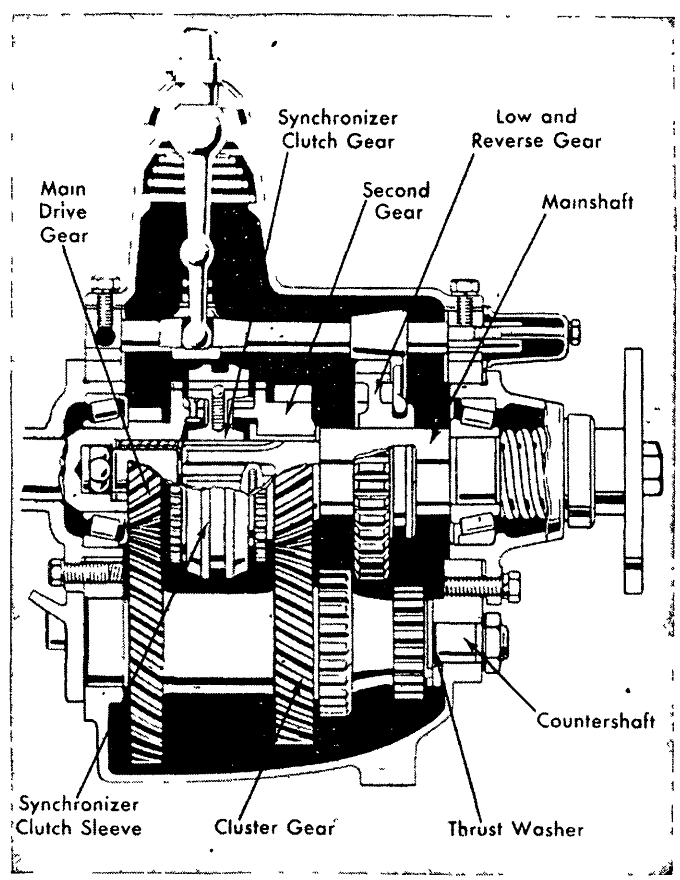


Fig. 27 Transmissi n d - sign typical f all 1935-38

CLUTCH

CLUTCH PEDAL, ADJUST

1935-39 — Loosen the adjusting bolt in the pedal link slot, Fig. 23, and move the link to a position that will secure ¾ to 1 inch free pedal travel. Tighten the adjusting bolt, check coincidental starter switch as described in the *Starter Switch* chapter.

1940—The clutch pedal should have not less than ¾ and not more than 1 inch free movement. To increase the pedal play, loosen the upper adjusting nut on the link rod, Fig. 24, and tighten the lower adjusting nut. After making the adjustment, be sure to tighten both nuts to the swivel block and lock the lock nuts.

1941-48—The clutch pedal should be adjusted to obtain from ¾ to 1 inch free movement. On series 40, loosen the outer nut and tighten the inner nut to decrease the pedal travel, Fig. 25. After obtaining the desired movement of the pedal, tighten the adjusting nuts until there is a slight tension on the rubber cushions, after which, tighten the lock nuts.

On series 60 and 80, Fig. 26, loosen the inner nut and tighten the outer nut on the operating link to decrease the amount of free pedal movement.

1949-52—Adjustment for free pedal play is made by varying the length of the throwout lever rod. Lengthening this rod reduces the pedal play, and shortening it, increases the play. Free play of from ½ to ¾" should be maintained at all times.

CLUTCH REMOVAL

1935-52—Remove the floor board. Disconnect the release fork pull-back spring and remove the clevis pin from the end of the release fork rod. Disconnect the release fork at the pivot and pull the fork out as far as possible. Remove the transmission as described under *Transmission, Remove & Replace.*

Remove the clutch housing pan and mark the clutch cover and flywheel so that the clutch may be installed in the same relative position. Loosen the clutch cover bolts gradually and evenly until the clutch spring pressure is entirely relieved. Remove the bolts, and the clutch assembly may be removed from below.

Before installing, pack a teaspoonful of short fibre grease into the crankshaft pilot bearing. Clean the surface of the pressure plate and flywheel thoroughly.

When making the installation, place the disc in position and bolt the clutch cover to the flywheel loosely, being sure that the marks—which were made before the clutch was removed—match. If an aligning tool is not available, place a spare clutch shaft through the clutch and into the crankshaft pilot bearing. Tighten the clutch cover to the flywheel gradually and evenly until all are tight.

Remove the aligning clutch shaft and replace the transmission, and, after the assembly is completed, adjust the clutch pedal free travel as described under *Clutch Pedal, Adjust.*

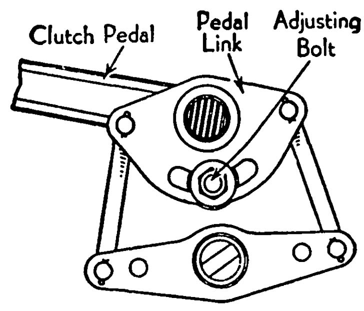


Fig. 23 1935-39 clutch pedal linkage

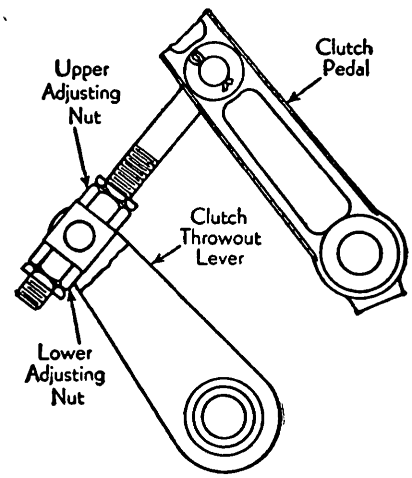


Fig. 24 1940 clutch pedal linkage

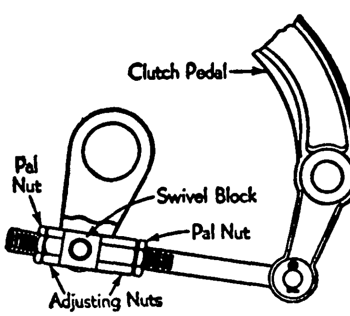


Fig. 25 1941-48 Series 40 clutch pedal linkage

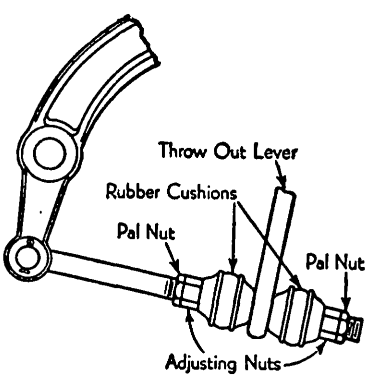


Fig. 26 1941-48 Ambassador clutch p dal linkage

TRANSMISSION

TRANSMISSION REMOVAL

1935-52—On the 1941-48 Series 40 and all 1949-51, the transmission is removed in the same manner as described below except that the rear axle assembly must first be removed (not on Rambler).

(1)—On 1935-38 cars, remove the floor boards. On cars with steering gearshift, the floor boards need not be removed. (2)—For 1938 cars with vacuum shift, loosen the shift lever fulcrum and disengage the lever from the rods. (3)—For cars with steering gearshift, disconnect the control rods from the levers at the transmission. (4)—If equipped with overdrive, detach the overdrive control cable from the lever at the overdrive case. (5)—Uncouple the speedometer cable. (6)—Disconnect the front and rear universals and remove the propeller shaft assembly. (7)—Unbolt the transmission support. (8)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper holes. (9)—Slide the transmission straight back on the pilot studs until the clutch shaft is free of the clutch disc hub. (10)—Lift the assembly out through the driver's compartment, or, if equipped with overdrive, lower the unit onto a suitable dolly.

Replace the unit in the reverse order, being sure to use the pilot studs to guide the assembly safely into position.

TRANSMISSION, OVERHAUL

NOTE—When ordering parts for any transmission, order by the number on the plate attached to the side of the transmission.

STANDARD NASH TRANSMISSION, OVERHAUL

1935-38—Fig. 27. After removing the transmission cover, remove the rear cover over the shifter rods. Remove the universal joint flange and the rear bearing retainer. Tap the mainshaft rear bearing out through the rear of the case. Lift the mainshaft assembly together with the sliding gears and synchronizer mechanism out through the top of the case. Remove the drive gear bearing retainer and bearing. Remove the clamp screw and lock at the rear of the countershaft, and the cap at the front. Drive the countershaft out through the front of the case. Remove the reverse idler gear shaft and idler gear.

To disassemble the mainshaft, remove the key and thrust washer between the synchronizing clutch and the second speed clutch gear, and remove the gears from the mainshaft. When disassembling the synchronizing mechanism, wrap a cloth around the unit to catch the balls and springs.

ASSEMBLY DETAILS—The end play of the second speed gear should not exceed .008". Thrust washers of various thicknesses are available to make this adjustment. When installing the synchronizer mechanism, the side marked "FRONT" should be placed to the front of the transmission. The omitted tooth in the hub should be installed on the mainshaft in line with the thrust washer

retaining key. The end play of the clutch gear should be ⅛". This is controlled by shims and should be measured between the outside of the clutch and the outside of the gears.

When assembling the thrust ball assembly, use an adhesive oil to hold them in position. Do not use cup grease as it will obstruct the notches around the outside of the washers.

Before installing the mainshaft and main drive gear, the countershaft gear assembly must be installed. Drive the shaft in from the front. Make sure that the bronze washers are located between the gears and the steel washers. The clamp screw at the end of the shaft may be temporarily inserted to insure correct location of the rear steel washer.

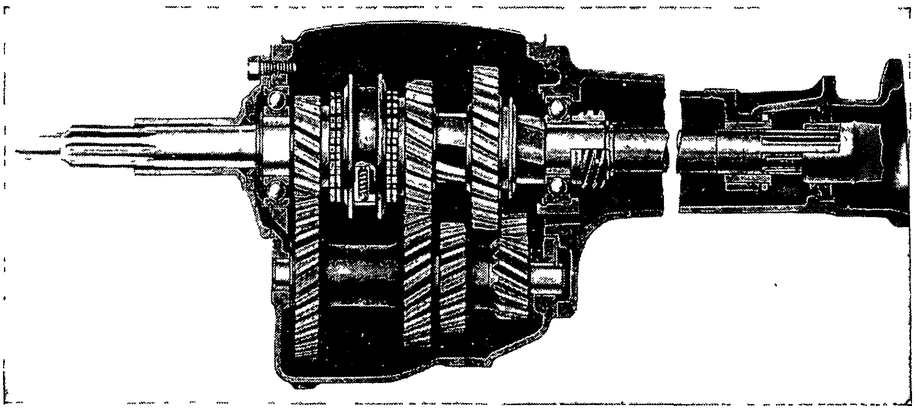


Fig. 28 1949-52 Series 40 transmission. Except for the extension housing the design is similar to 1946-48 Series 40

STANDARD TRANSMISSION, OVERHAUL

1939-40—See *Transmission, Remove & Replace* and proceed as follows: Remove the bearing cap and oil seal at the front of the countershaft. Using a dummy shaft, drive the countershaft out forward and with the dummy shaft in place to hold the bearings and thrust washers in position, allow the countershaft gear assembly to remain in the bottom of the case.

Remove the two operating levers from the top of the cover and remove the cover. Place a large nut or spacer over the upper end of each shift shaft and install the original nuts over these, which will prevent disassembly of the interlocks and speed finders. Straighten the metal lock plates on the fork studs and remove the fork stud nuts. Lift the shift mounting plate and the shift shafts out of the case. Remove the shift forks, being careful not to drop the shoes into the case.

Remove the universal joint flange and the mainshaft rear bearing retainer, which contains an oil seal. Withdraw the mainshaft assembly through the rear. Drive the main drive gear out through the front. Lift the countershaft assembly from the case. Remove the reverse idler shaft and gear.

To disassemble the mainshaft, remove the snap ring at the front of the shaft, and slide off the synchronizing mechanism. Remove the second speed gear thrust washer retaining key and remove the thrust washer and second speed gear. The thrust washer located between the first and second speed gear can now be removed as well as the first speed gear. Remove the snap ring from the rear of the mainshaft rear bearing and remove the bearing, reverse gear and its thrust washer.

To disassemble the main drive gear, remove the retaining ring which holds the mainshaft front pilot bearing in the main drive gear and remove the bearing. Remove the snap ring and washer from the main drive gear and press the bearing from the shaft.

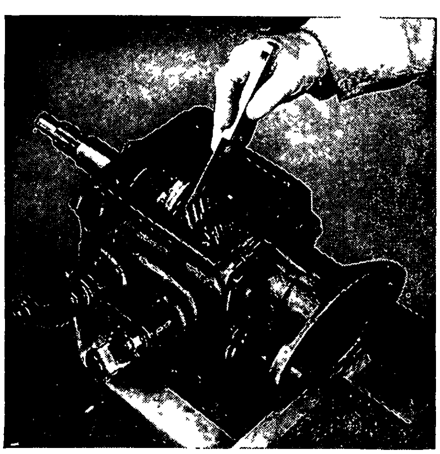


Fig. 29 Measuring clearanc b tw en synchr niz r c llar and sec nd speed gear. 1946-52 S ri s 40

ASSEMBLY DETAILS—Install the reverse idler gear with its shoulder to the front of the case and drive the shaft in through the rear with the key in line with the notch in the case.

Install the countershaft assembly in the case with the dummy shaft in place using cup grease to hold the thrust washers in position. Do not install the regular countershaft until after the mainshaft assembly is installed. Make sure that the projections on the countershaft thrust washers align with the notches above the shaft holes in the case.

When installing the main drive gear assembly, saturate the oil seal before installation. Make sure that sufficient gaskets are installed to retain the main drive gear bearing snap ring firmly against the front of the case without any clearance between the retaining cap and the case.

When installing the synchro-clutch on the mainshaft, make sure that the bronze friction ring on the second speed gear cone is located with its notches aligned with the blocks on the clutch. The end play of the bronze ring should be .020" for 1939 units, and .010" for 1940 units. This end play is controlled by shims located between the mainshaft rear bearing cap and the transmission case.

TRANSMISSION, OVERHAUL

1941-48 Ambassador — These transmissions come with or without overdrive, the only difference being that a larger mainshaft is used with the overdrive.

It is not necessary to disassemble both the transmission and overdrive to work on either one. Either unit may be disassembled independently of the other. The only time when both units must be disassembled is when the transmission mainshaft must be replaced.

Similarly, if the shifter mechanism needs repairs, it can be removed from the case without removing the gears. If the transmission is to be completely overhauled, the shifter mechanism can be left in the case until the gears have been removed.

Th following procedure deals with the transmission only. If repairs are needed on the overdrive unit, consult the *Overdrive* chapter elsewhere in this book. To disassemble the transmission, proceed as follows:

1. Remove cover, baffle and oil trough.
2. If the shifter mechanism is to be removed, mark the location of the shift levers so they can be reinstalled in the same position. Then drive out the lock pins from the bottom and take off the levers.
3. Take out the shift forks.
4. With an aligning tool, drive the countershaft out through the front of the case, leaving the tool in the cluster gear to hold the thrust washers and bearings in place.
5. Unfasten the overdrive and adapter plate from the transmission and, after separating these parts, fasten the overdrive to the adapter plate to keep the overdrive parts together. On cars without overdrive, remove the companion flange.
6. Remove the mainshaft and gears through the rear of the case.
7. To disassemble the mainshift, depress the lock pin in the synchronizer with a pointed tool and rotate the retainer lock until it clears the spline. Then slide the retainer off the shaft and take out the lock pin and spring.
8. Strip the mainshaft but be sure to mark the rear synchronizer friction ring so it can be replaced in the same position.
9. Take off the clutch shaft bearing cap and pull the shaft and bearing out through the front of the case.
10. Lift out the cluster gear and thrust washers.
11. Drive the reverse idler shaft out

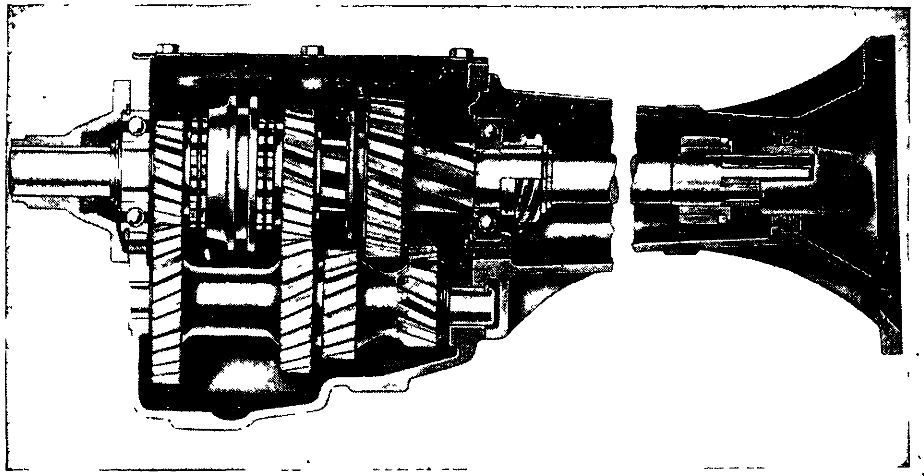


Fig. 33 1949-52 Ambassador transmission

through the rear and lift out the gear.

Assembly Details—Reverse the order of the above procedure to assemble the unit, noting the following:

1. Install the reverse idler gear with the chamfered teeth toward the front.
2. Drive in the reverse idler shaft with the notched end toward the rear.
3. Countershaft thrust washers must be placed so that the lip of the washers line up with the notch in the case.
4. Clutch shaft bearing snap rings are available in several thicknesses and one should be selected that just fills the groove in the shaft.
5. The steel thrust washer goes behind the second speed mainshaft gear.
6. When installing the bronze synchronizer thrust washer, see that the projections of the tongues of the washer are toward the front of the shaft. When seated, rotate it just enough to put the tongues just behind the splines on the shaft.
7. The synchronizer retainer comes in three thicknesses. Select one which will provide from .002 to .004" end play of the second speed gear. If the smallest retainer cannot be installed, inspect the synchronizer thrust washers for proper alignment.
8. As the transmission is assembled, give close attention to the spacing and clearances of the synchronizer friction rings. Excessive friction ring clearance may cause second speed gear disengagement. Special gauges, .075" thick, are available to check these clearances. Place one gauge between the front face of the front friction ring and the rear face of the clutch gear. Place the other gauge between the rear friction ring and the second speed gear. These gauges center the shifting collar and should slip in freely. Working with the front gauge, it should be a tight fit to .015" clearance. To increase clearance, add shims between the overdrive adapter or rear bearing cap. To decrease clearance, remove shims.

TRANSMISSION OVERHAUL

1946-52 Series 10, 40—To disassemble the transmission, proceed as follows, Fig. 28.

1. Remove the cover and inspect the vent hole at the front to be sure it is clear.
2. Engage the transmission in second gear and measure the clearance between the rear face of the synchronizer collar and the front face of the second speed gear, Fig. 29. If this clearance is less than .028", either the shifter fork or the quadrant is distorted and should be replaced.
3. The shifting mechanism is not removed until after the mainshaft has been taken out. However, it is necessary to drive the low and reverse shifter shaft toward the outside of the case to provide clearance for the gears.
4. On 1946-48 cars without overdrive, unfasten the rear bearing cap, and turn it clockwise to expose the countershaft lock. After removing the lock, drive the countershaft out from the front to the rear.
5. On 1949-52 cars without overdrive, unfasten the extension housing from the transmission. Then move the housing and mainshaft assembly toward the rear. When the mainshaft is disengaged from the synchronizer, the low and reverse shifter fork should be removed. When this is done, withdraw the mainshaft from the case.
6. On 1949-52 cars with overdrive, the lower left stud must be removed in order to withdraw the mainshaft and overdrive unit as an assembly.
7. On 1946-48 units, as the mainshaft is being removed, the synchronizer will slip off the shaft, being held in the case by the shifter fork. Turn the synchronizer at right angles and remove it from the shifter fork. The shoes will drop out of position as the synchronizer is removed. Take them off the fork.
8. To disassemble the mainshaft, remove the clutch ring driver. Turn the second speed gear thrust washer and slide it along the mainshaft grooves. When this washer is removed, take off the gears.
9. After, removing the clutch shaft bearing retainer, pull the shaft and bearing out from the front of the case.
10. Drive the reverse idler shaft out through the rear and lift out the gear.

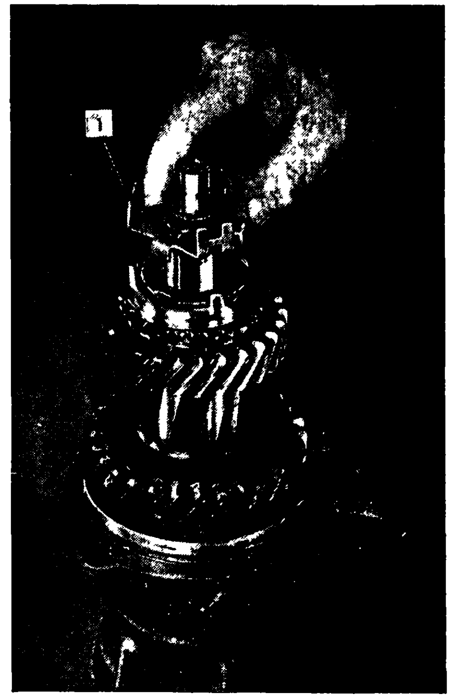


Fig. 30 Installing clutch ring driver. 1946-52 Series 40

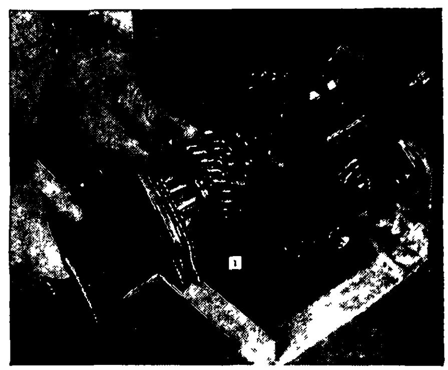


Fig. 31 Location of shim and gaskets. 1946-52 Series 40

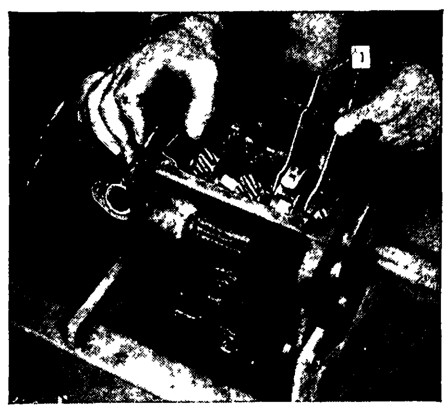


Fig. 32 Gauging front fricti n ring cl arance which sh uld be .105". 1946-52 S ri s 40

11. Remove the gearshift mechanism.

12. Lift out the cluster gear and thrust washers.

Assembly Details—Reverse the order of the above procedure to assemble the unit, noting the following:

1. The low and reverse shifter shaft (with smaller quadrant) must be installed in the case before the reverse idler gear is installed.

2. Install the reverse idler gear with the beveled side of the gear toward the front.

3. Lubricate the countershaft front thrust washer and install it so its lip is lined up with the slot in the transmission case. The rear thrust washer is installed through the rear of the case after the cluster gear is lowered into position.

4. Mainshaft rear snap rings are available in several thicknesses and should be selected so they just fill the grooves in the shaft.

5. When installing the second speed gear thrust washer, place it in the recess in the mainshaft and turn it one spline to lock it in place. When installed, see that there is from .002 to .010" clearance. Measure this clearance with a feeler gauge placed between the rear face of the second speed gear and the shoulder of the mainshaft.

6. The clutch ring driver, Fig. 30, is installed with the short prongs pointing toward the second speed gear. Line up these prongs with the recesses in the second speed gear thrust washer. This locks the washer to the shaft at the same time. Line up the prongs on the clutch friction ring with the slots in the driver.

7. To install the synchronizer, place it in the shifter fork and turn it so that the long end of the hub is toward the front. Then install the mainshaft.

8. The shim that determines friction ring clearance goes between the rear bearing cap and the case, Fig. 31. Gaskets are placed on either side of the shim.

9. As the mainshaft is being worked into the case, line up the three recesses in the synchronizer hub with the three prongs on the clutch ring driver.

10. With the synchronizer and mainshaft assembled in the case, hold the rear bearing cap tight against the case and measure the clearance of the front friction ring. Special gauges, .105" thick, are available to check these clearances. Place the gauges as shown in Fig. 32 and, working with the front gauge, it should just fit between the front face of the front friction ring and the rear face of the clutch gear. If the gauge fits tight, add shims between the rear bearing cap and base. If the gauge is loose, remove shims.

TRANSMISSION, OVERHAUL

1949-52 Ambassador—The transmissions used in this series are supplied with or without overdrive. Fig. 33 is a sectional view of the unit without overdrive. The major design difference affecting overhaul procedure is that the transmission without overdrive is *furnished* with a longer mainshaft and rear bearing cap to permit the use of one propeller shaft and torque tube on all models.

The overhaul procedure given below is for the overdrive transmission. However, if repairs are needed on the overdrive unit, consult the *Overdrive* chapter.

1. Take off the cover.

2. After removing the front bearing cap and oil seal, remove both snap rings and use a puller to remove the clutch shaft bearing.

3. Separate the overdrive from the transmission and, to keep the overdrive parts intact, bolt the adapter plate to the overdrive case.

4. Tilt the front end of the clutch shaft downward out of mesh with the countershaft gear and remove the clutch shaft from the case.

5. Move the mainshaft to the extreme right and disengage the shifter forks from the sliding gear and synchronizer collar. The mainshaft assembly can then be removed from the rear of the case.

6. Before disassembling the mainshaft, mark the relationship of the synchronizer parts so that, if taken apart, they may be assembled in the same relative position. Then release the snap ring and strip the mainshaft.

7. Drive out the reverse idler and countershaft lock and, using a cut countershaft which is the same length as the cluster gear, drive the countershaft out of the rear of the case. Then lift out the cluster gear and thrust washers.

8. Drive the reverse idler shaft out through the rear and lift out the gear.

9. The shifter mechanism may now be removed, if necessary.

Assembly Details—Reverse the order of the above procedure to assemble the unit, noting the following:

1. Install the reverse idler gear with the chamfered side of the teeth toward the front of the case.

2. Use the cut countershaft to hold the needle bearings and thrust washers in position after loading them. The two small projections on the face of the bronze rear thrust washer must index with the grooves in the countershaft gear. Install the assembly in the case and position the front thrust washer. The countershaft may then be driven in from the rear. Line up the slots in the reverse idler and countershafts and install the lock plate.

3. Install the synchronizer, being sure that the gear and sleeve are in the original position.

4. The front friction ring is installed together with the clutch shaft to prevent its dropping out of place during installation of the mainshaft assembly.

5. When the synchronizer hub is pressed tight against the snap ring, there should be from .003 to .010" clearance between the second speed gear and the shoulder on the mainshaft. Measure this clearance with a feeler gauge placed between these parts.

HYDRA-MATIC DRIVE

1950-52—A step-by-step service procedure on this unit is given elsewhere in this manual under the chapter heading *Hydra-Matic Drive*. The following material covers the external adjustments as applied to Nash cars.

THROTTLE CONTROL LINKAGE—Linkage operation will not be satisfactory if binding or excessive wear exists.

1. Disconnect throttle rod from transmission lever, Fig. 37.

2. Adjust engine idle speed to 375 rpm with engine at normal operating temperature, transmission warm and selector lever in neutral.

3. Disconnect throttle valve link clevis at upper bell crank.

4. Install linkage adjusting pin through holes in upper throttle bell crank, Fig. 38.

5. Adjust throttle valve link so clevis pin will enter clevis and bell crank lever while idle adjusting screw is seated against its stop. Tighten lock nut securely and assemble clevis to bell crank. Leave adjusting pin installed.

6. Install linkage adjusting pin through holes in lower bell crank, Fig. 39. If pin does not pass through holes freely, adjust front throttle valve rod at upper end. Tighten lock nut securely and reassemble trunnion to upper bell crank. Leave adjusting pins installed.

7. Tighten clamp bolt in transmission outer throttle lever.

8. Check position of outer throttle lever as follows: (A) Clean machined surface at back of transmission case and place throttle lever checking gauge flat against surface with edge of gauge against transmission side cover, Fig. 40. (B) With outer lever held against its stop (toward rear of transmission) move gauge upward toward a clevis pin installed in lever. When gauge is moved upward, notch in gauge should pass over pin, and inside face of throttle control lever should just touch outer side face of gauge, Fig. 41. (C) If gauge does not pass over pin freely, bend throttle lever as required, Figs. 42 and 43. Avoid twisting lever or springing shaft during bending operation. (D) Recheck, using gauge, Figs. 40 and 41, and correct until gauge passes freely over pin in lever and just touches inside face of throttle control lever.

CAUTION—Rear transmission throttle rod must operate freely. Bend rod if necessary to secure proper alignment with throttle lever without bind at front end of rod.

9. Adjust rear transmission throttle rod trunnion to transmission throttle lever. After trunnion has been adjusted so that it will pass freely into transmission throttle lever opening, loosen front trunnion lock nut *two complete turns* and tighten rear lock nut securely. This adjustment is necessary to insure correct throttle valve operation.

10. Connect trunnion to throttle lever.

11. Remove linkage adjusting pins from upper and lower bell cranks.

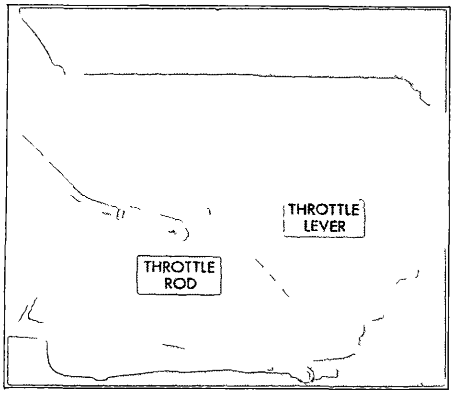


Fig. 37 Throttle rod disconnected from thr ttle lever. Hydra-Matic transmission

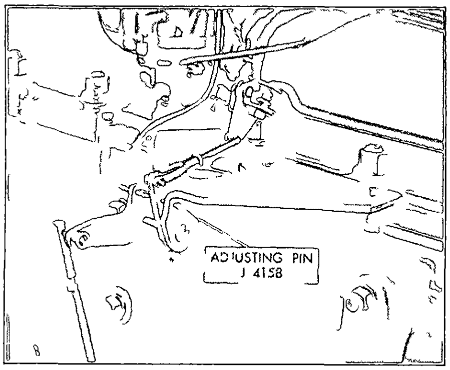


Fig. 38 Adjusting pin installed in upper throttle valve bell crank

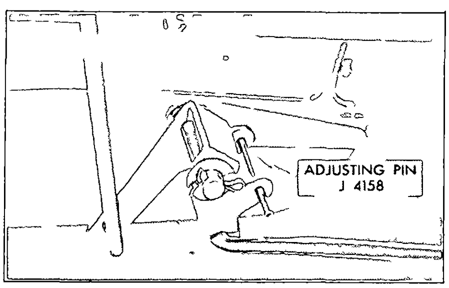


Fig. 39 Adjusting pin installed in l wer thr ttle valve bell crank

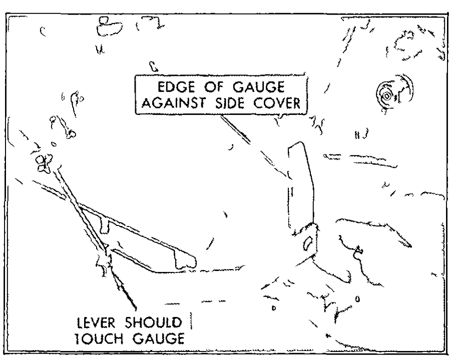


Fig. 40 Installing throttle lever checking gauge J-2545

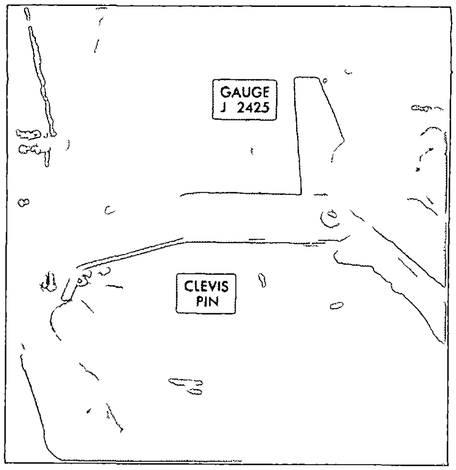


Fig. 41 Checking location of pin in outer throttle lever

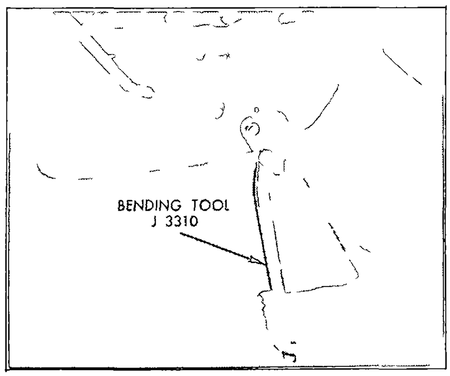


Fig. 42 Throttle lever bending tool J-3310

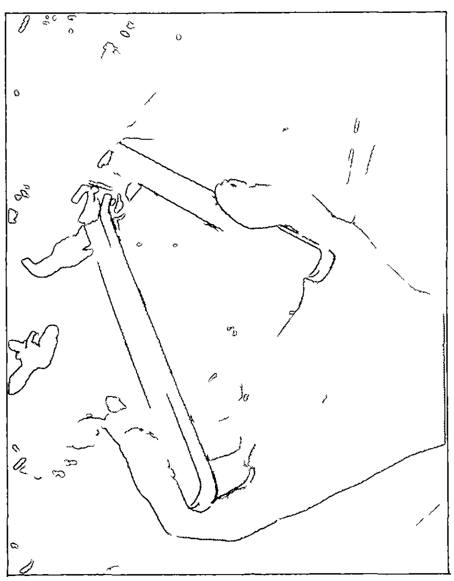


Fig. 43 Bending throttle lever

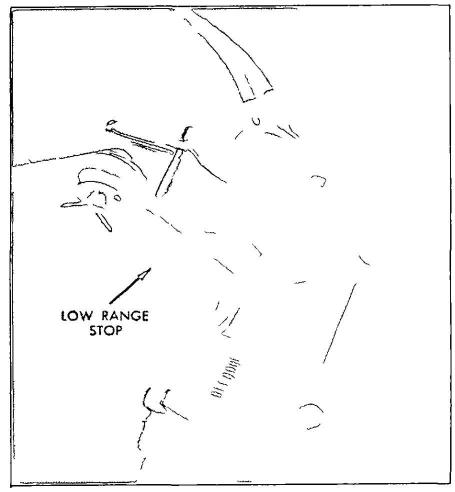


Fig. 44 Selector lever linkage at jacket tube

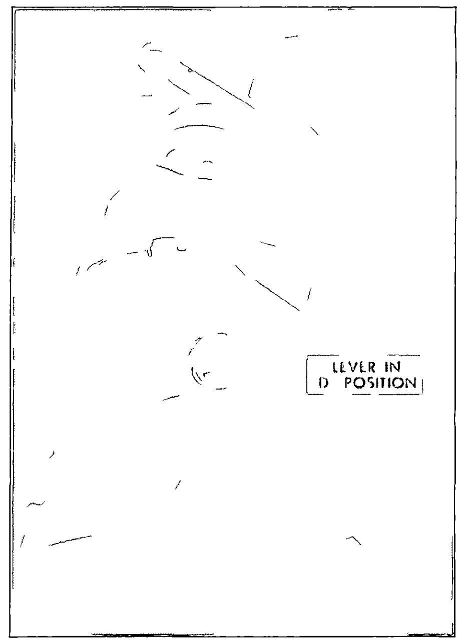


Fig. 45 Neutral safety switch with operating lever in Drive (D) position

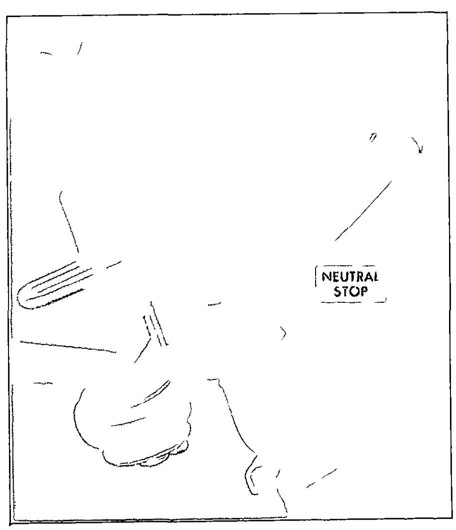


Fig. 46 Neutral safety switch with operating lever in Neutral (N) position

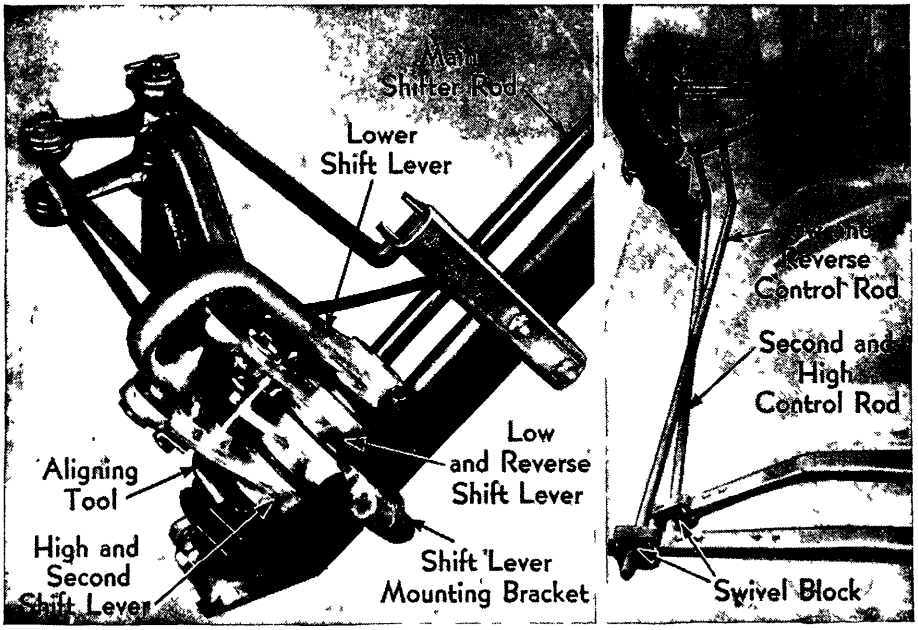


Fig. 47 1940 gearshift mechanism

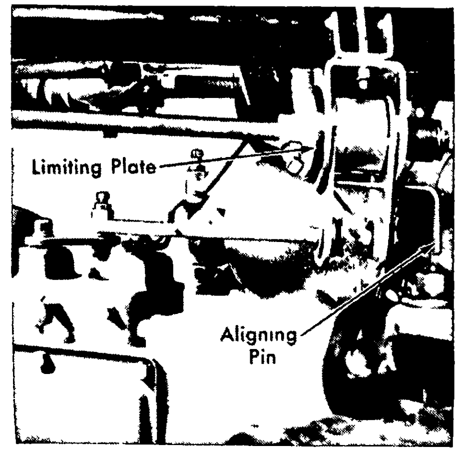


Fig. 48 1941-48 gearshift mechanism

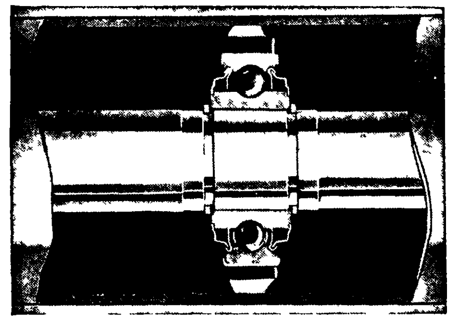


Fig. 50 1949-52 propeller shaft center bearing. Series 40, 60 with ut Hydra-Matic

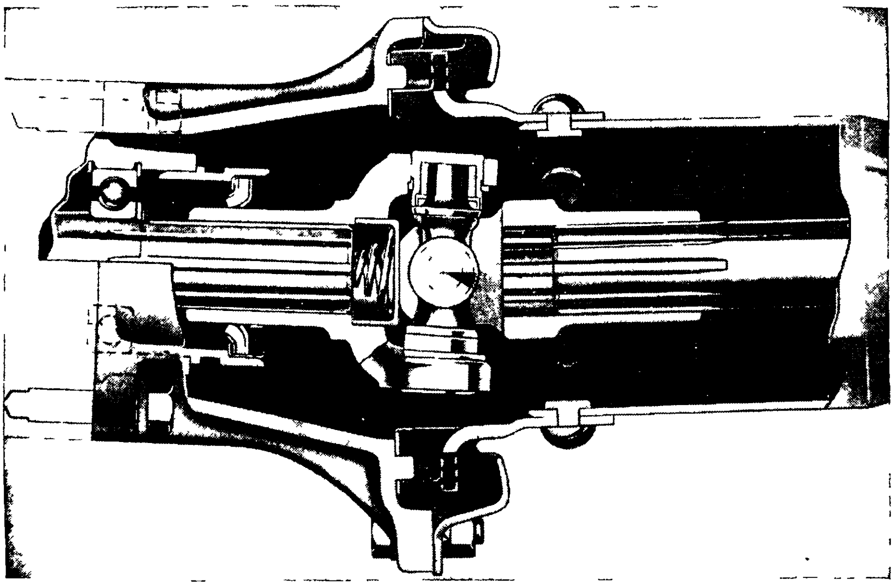


Fig. 49 1949-52 Ambassador sealed universal joint

SELECTOR LEVER LINKAGE—

1. Place selector lever in Low position (operating lever must be against low range stop on neutral safety switch bracket, Fig. 44).

2. Remove clevis pin from control rod to shift lever at side of transmission.

3. Move shift lever (at transmission) to LO position (first detent in front of reverse position).

4. Adjust control rod clevis so that pin passes freely through hole in transmission shift lever. Be sure that operating lever is against low range stop on neutral safety switch bracket. After this adjustment has been made, lengthen control rod by turning clevis *one full turn.* This adjustment will insure proper detent location in transmission together with a full reverse engagement.

5. Install clevis pin and secure with a cotter pin.

NEUTRAL SAFETY SWITCH—

1. Place selector lever in Drive position. On 1952, place selector over left arrow (4-speed range) in DR range.

2. Adjust neutral safety switch to a position where the starter circuit will be open and starter will *not operate* when starter button is depressed, Fig 45

3. Place selector lever in Neutral position. With lever in this position, neutral safety switch will permit starter operation, Fig. 46.

GEARSHIFT

OVERSHIFT STOPS, ADJUST

1939-40—Fig. 47. The first, second and reverse overshift stops can be adjusted without removing the transmission cover.

To adjust the second speed position, loosen the set screws which hold the operating rods to the transmission shift lever and shift the second and high operating lever (the bent one) into second gear. Loosen the second speed overshift set screw, which is the forward screw on the right side of the transmission case, and carefully feel to determine that the poppet is seated in its notch. Then tighten the screw to permit a slight overshift of the lever to the rear. The first speed position can be adjusted in the same manner, after moving the first and reverse operating lever (the rear, straight one) forward to engage first speed gear, making sure that the poppet is seated in its notch. Tighten the rear set screw to permit a slight overshift to the front.

To adjust the reverse position, place the operating lever in position to engage reverse gear, making sure that the poppet is seated in its notch, and set the angle clip, located at the rear left transmission cover bolt, with its flat side parallel with the side of the first and reverse operating lever with a minimum of clearance.

Before tightening the operating rod set screws to the operating levers, align

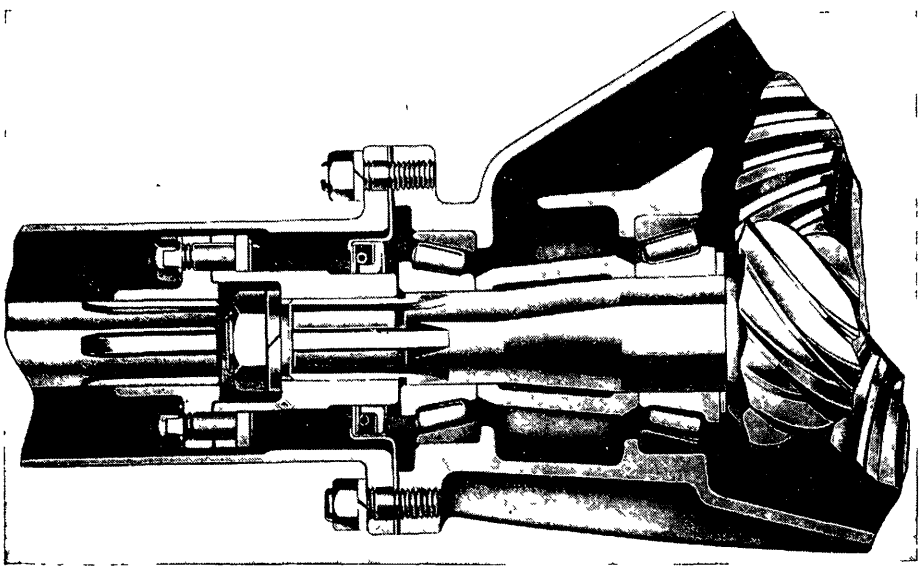


Fig. 51 1949-52 Ambassador. Connection between rear axle and propeller shaft

the steering post shift levers and the notch in the support bracket, making sure that the levers on the transmission are in neutral position, with the speed finder poppets seated.

1941-52—Fig. 48. The control rods are it is necessary to use a special aligning pin (Tool No. J-1390). (2)—Install the aligning pin through the second and high and the low and reverse levers, and also through the notch in the bearing tube bracket at the bottom of the steering column. (3)—Loosen the bearing tube bracket lock nut and screw. (4)—The lower shift lever which is clamped and keyed to the main control rod should be moved up or down to be sure that its tapered points enter the rubber grommets in the second and high and low and reverse levers cleanly. (5)—When the correct position is obtained, tighten the bearing tube bracket lock nut and screw.

(6)—With the control lever in neutral and the aligning pin in place, loosen the set screws in the swivel blocks at the transmission end of the control rods. (7)—Make sure that the transmission levers are in neutral and then tighten the swivel lock screws without moving the levers or rods out of their neutral positions.

1941-52—Fig. 48. The control rods are adjusted by installing the special aligning pin through the holes in both levers in the same manner as described for 1940 cars. Loosen the set screws at the transmission end of the shift control rods. Set the levers at the transmission in their exact neutral position and tighten the set screws.

The limiting plate should be adjusted with relation to the main control shaft so that the selector key will not rub on the lower inside surface of the shift bracket. To make this adjustment, engage the selector key with the second and high shift lever, then raise the main control shaft slightly to provide clearance. Lock the limiting plate with the set screw and lock nut.

TORQUE TUBE DRIVE

1941-48 "600" & 1949-52 (Except Rambler)—Fig. 49 shows the fully sealed universal joint used on the 1948 Ambassador, while Fig. 50 pictures the propeller shaft center bearing construction used on all 1949-52 models without Hydra-Matic. The center bearing is sealed and lubricated for life and needs no attention in normal service.

The propeller shaft on 1941-48 "600" series is supported on a plain bearing and when necessary to replace this bearing, do not clamp it until both ends of the torque tube have been secured, permitting the bearing to align itself. The center bearing retainer on these models is jacketed to provide an oil reservoir and the bearing requires lubrication every 5,000 miles, using engine oil. The oil is injected in the hole provided in the top side after removing the locating screw. After this screw is installed, wire it in place.

Fig. 51 shows the flanged type spline connection used at the rear axle to connect the propeller shaft to the drive pinion shaft on the 1949-52 Ambassador.

REAR AXLE

REAR AXLE REMOVAL

1935-48 Series 10, 20, 60, 80, Rambler—Raise and support the frame and body. Disconnect the brake cables at the rear brakes. Remove the brake tubes. Disconnect the propeller shaft, unfasten the springs from the axle housing and slide the axle from under the car.

1941-48 Series 40 & 1949-52 (Except Rambler)—Raise and support the rear end of the car. Disconnect the brake cables at the equalizer. Unfasten the torque tube at the transmission, and the stabilizer bar at the axle. Remove the brake tube connections. Disconnect the shock absorbers and springs from the axle housing, permitting them to hang suspended from the body.

REAR AXLE SERVICE SPICER TYPE

1941-52 Series 10, 40—Fig. 52. In this type axle, the drive pinion is held in position by the shoulders in the differential carrier upon which the pinion bearing cups seat. The pinion position is maintained by a washer located between the rear bearing and the rear shoulder in the cone are used to adjust pinion bearings.

The shimmed type of differential bearing adjustment is employed. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle* chapter.

The axle tubes are pressed into the differential carrier to form a one-piece housing. To overhaul the unit, therefore, the axle assembly must be removed from the chassis.

PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, take off the oil seal retainer and pinion retaining nut. The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and force the rear bearing cone from the shaft. When replacing the cone, select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when being pressed on the shaft. Drive the front bearing cup out of the carrier toward the front. If the rear bearing cup is to be replaced, remove it also.

PINION BEARINGS, ADJUST—The only occasion for adjusting the drive pinion bearings is when a new pinion or

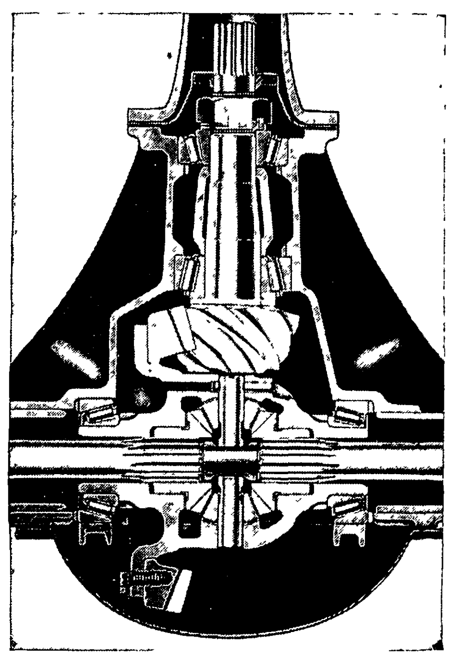


Fig. 52 1941-52 Series 40 rear axle

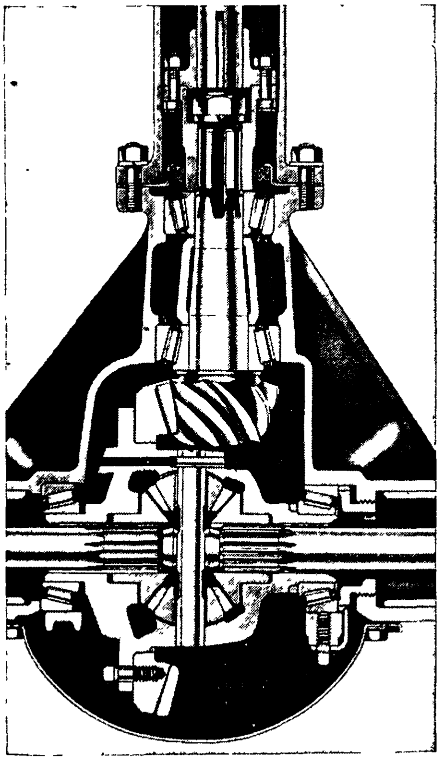


Fig. 53 1949-52 Ambassador rear axle. During 1951 pr duction the rear axle side b aring adjusting nut was eliminated and th adjustm nt is accomplished in the same manner as Stat sman and Rambler axles

differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and the front bearing so that when the pinion retaining nut is tightened, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

PINION, ADJUST—After adjusting the pinion bearings, the position of the pinion should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the pinion and, if the pinion is to be moved toward the center of the axle, install a thicker washer. If the pinion has to be moved away from the center of the axle, install a thinner washer.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*. After satisfactory tooth contact has been established, lock the adjustment with the pinion shaft nut.

TIMKEN TYPE

1935-36 Series 20, 80; 1937-39 Series 80—In this design, the threaded nut type of differential bearing adjustment is employed. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle Chapter*.

Inasmuch as the driven pinion set-up is similar to the Spicer type described above, except that shims are used instead of a washer for adjusting the pinion, follow the same procedure as given for the Spicer design.

NASH TYPE

1935-36 Series 10, 40; 1937-39 Series 10, 20; 1940 All; 1941-52 Series 60, 80—Fig. 53. The differential unit is the same as that shown in Fig. 52 except that on the left side, shims are used between the differential case hub and the bearing to control ring gear and pinion backlash. The differential bearings are adjusted by means of the conventional type adjusting nut on the right side of the differential case.

During 1951 production of Ambassador rear axles the side bearing adjusting nut was eliminated and adjustment is accomplished in the same manner as Statesman and Rambler axles. The pinion gear bearing spacer was also eliminated and a shoulder machined on the pinion. Pinion bearing preload adjustment then being accomplished in the same manner as the Statesman and Rambler axles.

Follow the procedure outlined in the *Rear Axle Chapter* for the assembly of the differential case, replacing the ring gear, checking ring and pinion backlash, and other differential case operations. However, when adjusting differential bearings, draw up the nut until there is no side movement in the bearings, then tighten the nut two more notches.

When checking backlash between the ring gear and pinion, the bearing cap must be tight and the differential bearings properly adjusted. Check the backlash in three or four places to secure an average and, if more than .007 inch, add shims; if less than .005 inch, remove shims.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-52—To remove an axle shaft, remove the wheel and use a puller to take off the hub and drum. Block the brake pedal so it cannot be depressed, then disconnect the hydraulic brake line from the wheel cylinder. Remove the nuts and take off the outer oil seal, shims and brake support. Pull out the axle shaft and bearing, and inner oil seal.

Replace the parts in the reverse order of their removal. If the old parts are replaced and the shims have not been disturbed, the axle shaft end play should be correct when the parts are assembled. However, if a new shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

The end play can be checked when all parts have been replaced except the wheel and hub. To make this check, rap each axle shaft after the nuts are tight to be sure the bearing cups are seated. Then place a dial indicator so that its stem contacts the end of the shaft and work the shaft in and out to determine the amount of existing end play. If an adjustment is necessary, remove the outer oil seal and brake support and add or remove shims as required. When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain a central position of the differential thrust block.

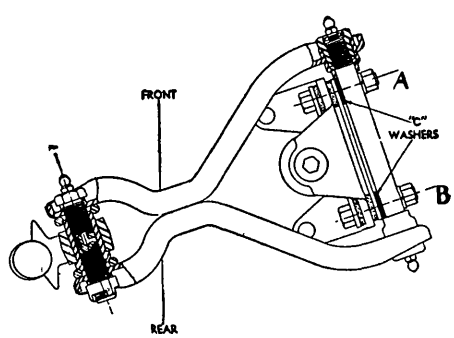


Fig. 54 Cast r and camb r adjustments. Typical of all 1941-51 m d ls exc pt 1941-42 "600" and Rambler

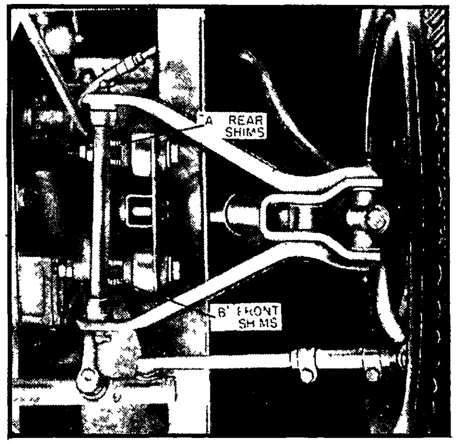


Fig. 54A Showing cast r and camb r adjusting shims at the l wer c ntr l arm pivot bar mounting. 1950-52 Rambler

WHEEL ALIGNMENT

CASTER & CAMBER, ADJUST

1935-39—Caster up to about two degrees can be corrected by inserting tapered caster plates between the axle and spring seats. To increase caster, place the thick side of the plates toward the rear of the car. To decrease caster, the thick side of the plates should be toward the front of the car. If the axle is out more than two degrees, the axle must be straightened in order to change the angle of the spring seats.

If camber is out, the only way to correct it is to bend the axle ends as required to bring it within correct limits.

1940—Both caster and camber are adjusted by turning the threaded eccentric upper control arm pivot pin.

To adjust caster, loosen the clamp bolt, remove the grease fitting and turn the pivot pin clockwise with an Allen wrench to increase caster and vice versa.

After adjusting caster, turn the pivot pin a fraction of a turn to obtain the correct camber setting. Full camber adjustment is made within ½ turn of the pivot pin.

1941-51 Except 4140, 4240 & Rambler—

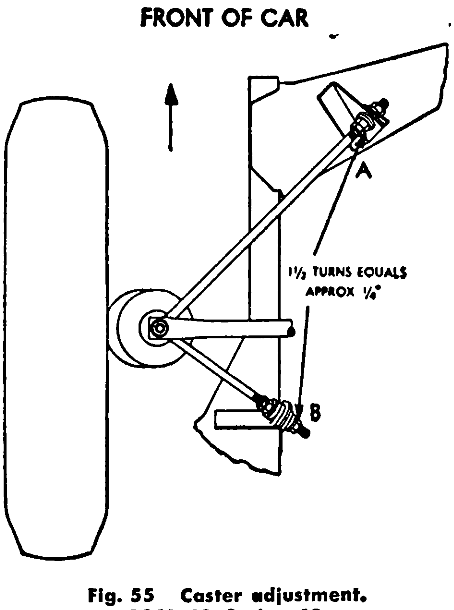


Fig. 55 Caster adjustment. 1941-42 Series 40

To adjust caster, loosen the nuts at the inner end of the upper control arm pivot bar mounting screws and insert additional spacer shims at points "A" or "B", Fig. 54, as required. Adding shims at point "A" decreases caster angle, and adding shims at "B" increases it.

To increase camber angle, add an equal number of shims at both "A" and "B". To decrease camber, remove an equal number of shims.

1950-51 Rambler & All 1952—Fig. 54A. To adjust caster, loosen the nuts at the inner end of the lower control arm pivot bar mounting screws and insert additional spacer shims at either point "A" or "B" as required. Adding shims at "A" decreases caster and adding them at "B" increases caster.

To increase camber angle, add an equal number of shims at both points "A" and "B". To decrease camber, remove an equal number of shims.

CAMBER & CASTER, ADJUST

1941-42 Series 40—Figs. 55 and 56. To decrease caster, shorten long rods and lengthen short rods. To decrease caster, lengthen long rods and shorten short rods.

To increase right hand camber, lengthen both right hand rods and shorten both left hand rods. To decrease right hand camber, shorten both right hand rods and lengthen both left hand rods. One and one-half turns of nuts "A" and "B", Fig. 55, are equal to approximately ¼ degree.

TOE-IN, ADJUST

1935-39—Toe-in is adjusted by loosening the clamps at each end of the tie rod and turning the rod in the proper direction to obtain the desired result.

The drag link should be adjusted so that the steering wheel is in its central position when the wheels are in their straight-ahead position.

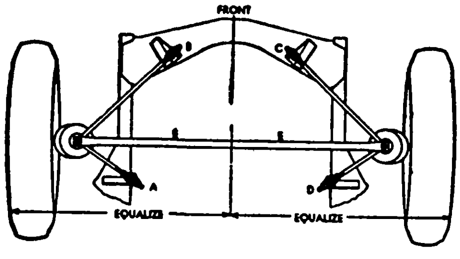


Fig. 56 Camber adjustment. 1941-42 Series 40

1940-52 (Except 4140, 4240)—To adjust toe-in, loosen the clamps at both ends of the adjustable tubes on each tie rod. Turn the tubes an equal amount until the toe-in is correct. Turning the right tube in the direction the wheels revolve when the car is going forward increases the toe-in and turning the left tube in the opposite direction increases toe-in. To decrease toe-in turn the right tube backward and the left tube forward. It is important that both tubes be turned an equal amount in order to maintain the correct position of the steering wheel. When adjustment is complete, tighten all clamp bolts.

1941-42 Series 40—To make an adjustment, loosen the clamp screw at each end of both tie rod adjustable sleeves and turn the sleeves. Adjust the length of the tie rod by shortening one and lengthening the other an equal amount until the wheels are straight ahead. Then lengthen or shorten each tie rod an equal amount until the toe-in is correct. When the adjustment is complete, tighten the clamp screws.

FRONT END

FRONT END SERVICE, 1940

Front Wheel Bearings, Adjust—Tighten the spindle nut until the bearings are preloaded at least one hex on the nut. Rotate the wheel at least one revolution to make sure bearings are seated. Then back off the spindle nut until bearings are slightly loose and retighten until all bearing looseness is just removed and line up the nut to the nearest cotter pin hole and install cotter pin.

Kingpins & Bushings, Replace—

1. Jack up car and remove front wheel with hub and drum.
2. Remove brake plate and steering arm from steering knuckle. Do not disconnect brake hose but support brake plate out of way to avoid strain on brake hose.
3. Drive out kingpin lock pin.
4. Remove upper dust plug from knuckle by piercing with a sharp punch and prying it out.
5. Drive kingpin down and out, which will drive lower dust plug from knuckle. Remove thrust bearing and shims.
6. Remove grease fittings and press out old bushings from knuckle.
7. Press new bushings in place, being sure oil holes in bushings line up with hole for grease fittings.
8. Expand bushings tightly with a burnisher. Then line ream them to provide .0005 to .0025 in. clearance on the kingpin. Install grease fittings.
9. Install the steering knuckle by reversing the removal procedure. Use shims as required between lower boss of knuckle and thrust bearing to provide .003 in. end play of knuckle on knuckle support. Use new dust plugs at both ends of kingpins.
10. Lubricate and adjust front wheel bearings and check and adjust wheel alignment.

Upper Control Arm Pivot, Replace—

1. Jack up under lower control arm and remove wheel.
2. Remove clamp bolt and unscrew pivot pin bushings and remove seals.
3. Loosen clamp bolt in knuckle support and remove pivot pin, using an Allen wrench.
4. Hold knuckle support in line with hole through control arm and screw new pivot pin into knuckle support with adjusting wrench hole in pin toward split side of control arm.
5. Turn pivot pin until large diameter section is centralized in knuckle support and tighten clamp bolt. Install rubber seals on both ends of pin.
6. Centralize knuckle support boss in upper control arm yoke and start externally threaded bushing on threads of pivot pin and into threads of control arm.
7. Start the plain bushing on the threads of the pivot pin, then turn opposite bushing up tight. Turn plain bushing up until hex is just clear of control arm, then install and tighten clamp bolts.
8. Install grease fitting in bushing. Install wheel assembly, adjust front wheel bearings and wheel alignment.

Front Spring, Replace—

1. Raise car with jack under lower control arm and take off wheel.
2. Support weight of car with another jack under frame side rail.
3. Disconnect stabilizer link from lower control arm and disconnect outer end of tie rod from steering arm if necessary.
4. Unfasten lower control arm inner shaft from frame crossmember.
5. Slowly lower jack under lower control arm until spring is loose and can be taken out.
6. To install, reverse the foregoing operations.

Lower Control Arm Service—If the lower control arm is bent or broken it should be replaced with a new assembly which includes shaft, bushings and dirt seals. The riveted parts of the assembly are not furnished separately.

1. Remove front spring as outlined previously.
2. Remove lower control arm from knuckle support.
3. To install new parts, first install a new rubber seal over each threaded end of the control arm shaft.
4. Insert one end of the shaft in control arm end and force opposite end of shaft into other side of arm.
5. Fasten the control arm securely in a vise close to one end to prevent springing or distortion. Apply a liberal amount of white lead or Lubriplate to both bushings before installing them in arm.

6. Start the first bushing on the shaft and into the control arm at the same time. Turn the bushing until its head is tight against the arm and tighten securely.

7. Center the shaft between the arms and install the second bushing as in Step 6, turning the shaft as required to thread into the bushing so that no binding exists.

8. Install the spring and check and adjust wheel alignment.

Front Shock Absorber, Replace—A front shock absorber can be replaced by removing the upper control arm pivot pin as outlined previously, and the shock absorber attaching bolts.

FRONT END SERVICE

1941-49 Ambassador—The front end used on these models is very similar to that used on 1940 cars except that direct-acting shock absorbers are used inside the coil springs in place of the arm type shock absorber which forms the upper control arm on 1940 models.

Except for the shock absorbers which can be removed from below after disconnecting it at the upper and lower end without removing the spring, all other operations are similar to that outlined for 1940 models.

FRONT END SERVICE

1941-42 Series 40—To remove the unit, Fig. 57, loosen the two clamp screws which hold the rubber boot in position and lower the boot. Raise the wheels from the floor and hook the special spring clamps (tool No. J-1608-SA-1) into the top coil of the spring. Lower the car and tighten the clamps. Disconnect the tie rod from the steering knuckle arms, and again raise the car.

Remove the front wheel, brake backing plate, shock absorber, and the steering knuckle pin screw which holds the lower end of the kingpin to the front axle. Raise the lower boot and insert a wrench to the flats of the kingpin to prevent its turning.

Loosen the nuts which fasten the caster and camber rods where they are attached to the car frame and remove the tie rod. The caster and camber rods may then be slipped off the top of the kingpin extension, after which the knee action unit may be removed from the car.

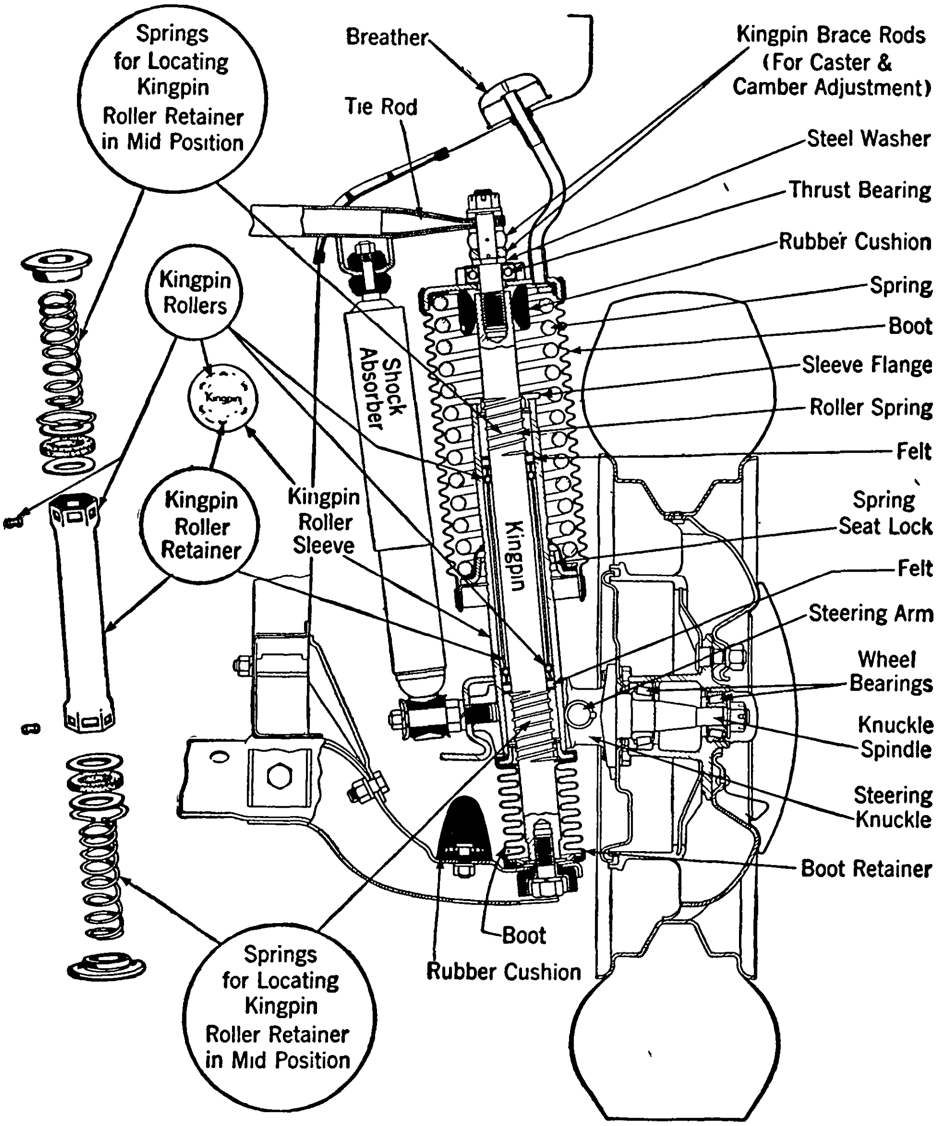


Fig. 57 Front suspension. 1941-42 Series 40

After the unit has been removed as already described, fasten it in a vise. With the boot lowered and the spring clamps in position as described when removing the unit, remove the nut which holds the kingpin upper extension in place and remove the extension. The spring, boot and related parts may now be removed from the kingpin.

Tap lightly on the retainer spring and remove the retainer spring and the upper flange, after which the lower spring seat and locks may be removed.

Fasten the unit in the vise in such a position so that the lower kingpin screw may be removed, which will permit the removal of the lower boot and cushion.

Push the kingpin toward the upper end of the sleeve sufficiently to permit the removal of the lower snap ring. The upper snap ring may now be removed by pushing the kingpin toward lower end of the sleeve, after which the kingpin, roller retainer and the rollers may be removed from the sleeve, being careful to grasp the roller retainer and shaft in such a manner as to prevent dropping the rollers. Remove the knuckle from the sleeve by tapping it off with a light hammer.

Assembly may be made in the reverse order but the following precautions should be taken. Wash all the parts thoroughly in clean gasoline and when

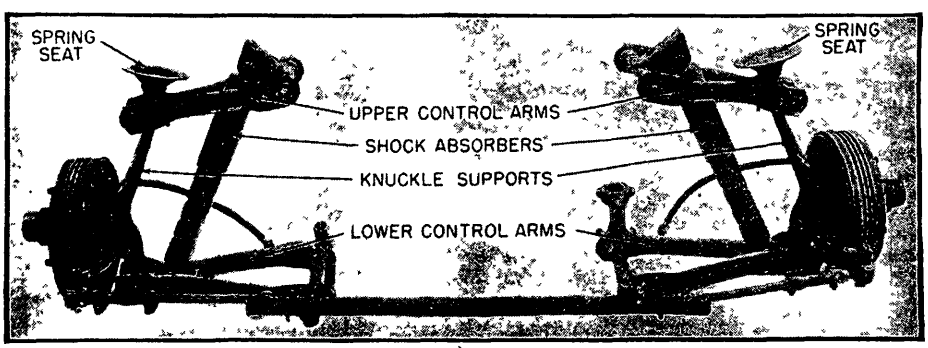


Fig. 58 1950-52 Rambler fr nt susp nsi n. C il springs (n t sh wn) act directly at steering knuckle supp rts. C ntr l arms s rv nly f r alignm nt purp ses. Fr nt suspensi n cross m mb r is liminat d—suspensi n units ar c nnect d directly t b dy structur . Design typical f 1952 Stat sman and Ambassador

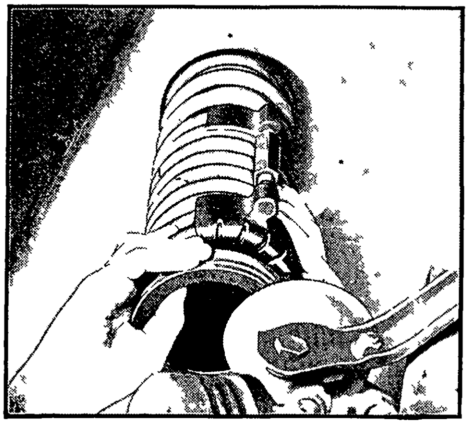


Fig. 59 Removing front spring with special spring compressor. 1950-51 Rambler and All 1952

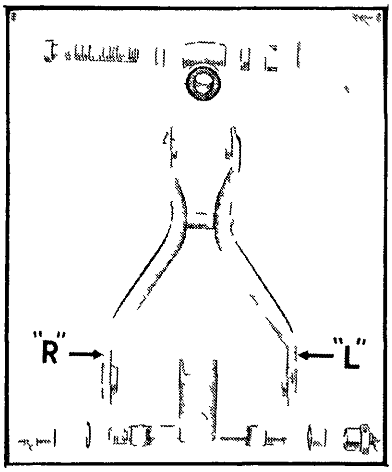


Fig. 60 Lay ut f upper control arm parts. 1950-51 Rambler and All 1952

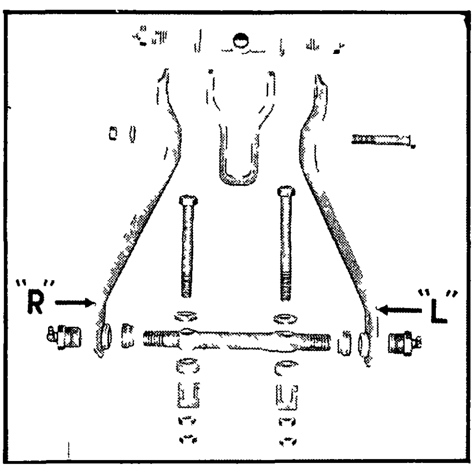


Fig. 61 Layout f lower control arm parts. 1950-51 Rambl r and All 1952

assembling the unit, do not allow any dirt or foreign matter to enter the unit

When installing the kingpin in the sleeve, a generous supply of lubricant should be applied to the kingpin It is recommended that special Nash lubri-

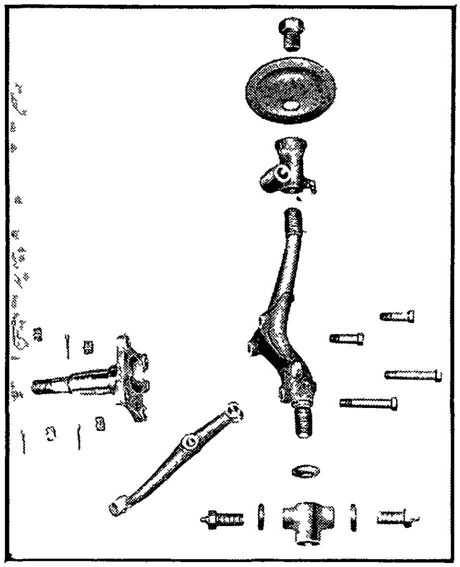


Fig. 62 Layout of steering knuckle and pin parts. 1950-51 Rambler and All 1952

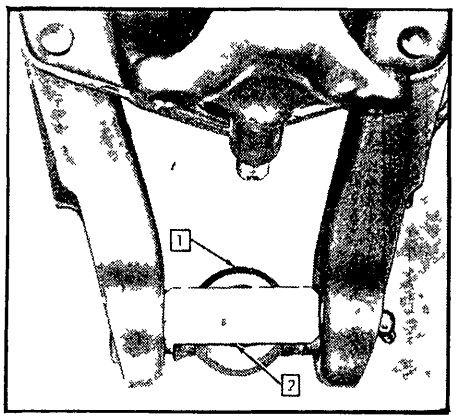


Fig 63 Centering gauge (2) used to center lower control arm trunnion (1). 1950-51 Statesman and Ambassador

cant, part No 3107687, be used for this purpose Make sure that the lubricant is applied generously between the roller retainer and kingpin

When installing the rollers and the roller retainer, make sure that all the rollers are in place, and when inserting the retainer in the sleeve, fasten the kingpin in the vise and work the sleeve up and down on the kingpin to make sure that the knuckle has the proper sliding and rolling action

FRONT END SERVICE

1950-51 Rambler & All 1952—In contrast to the conventional type knee action, this design Fig 58, has the springs located above the upper control arms and can be removed and replaced with the use of a special spring compressor To do this, support the front end of the car with a stationary jack under the frame and place an adjustable jack under the suspension unit. Take off the wheel and

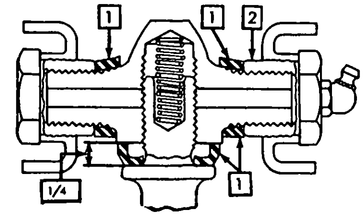


Fig. 64 Cross section thr ugh upper c ntr l arm trunnion on 1950-51 Stat sman and Ambassador. A clearance of ¼ in. should be allowed between lower edg f trunnion and seal seat. 1. Rubb r s als. 2. Trunnion bushing

lower the suspension so the spring is distended Then install the special spring compressor on the coils of the spring, Fig 59, and compress the spring by means of the turnbuckle When sufficiently compressed, lift the spring from its lower seat and take it out of its upper seat

The upper and lower control arms are interchangeable from right to left suspension units However, the front and rear horizontal arms have been provided with a two-degree twist at the inner ends and are identified with a stamping "R" and "L', Figs 60 and 61 Therefore, when assembling either an upper or lower control arm, the front and rear horizontal arms must be installed in pairs, one stamped R' and one stamped "L"

Fig 62 is a layout of the steering knuckle assembly Prior to installing the knuckle pin into the upper control arm trunnion, the spring seat must be bolted to the trunnion Then install the knuckle pin, turn it up tight, and loosen it one complete turn This will prevent the end of the pin bottoming when the front wheels are turned

When installing a steering knuckle pin into a lower control arm trunnion, a clearance of approximately ¼ in must be provided between the upper edge of the seal seat and the trunnion

FRONT END SERVICE

1950-51 Statesman & Ambassador, Also Typical of 1946-49 '600"—All operating parts of the front suspension can be removed for inspection or replacement without disturbing the crossmember mounting If the front end should become severely damaged, it may be advisable to remove the complete assembly This assembly is an integral part of the body and serves as the body side sill extensions It is mounted in position by four rubber insulated bolts

Upper & Lower Control Arms—The upper and lower control arms are provided with threaded bushings at the pivot bar and trunnion ends The threaded bushings and bolt connecting the outer ends of the upper and lower control arms are provided with rubber seals to retain lubricant and prevent the entrance of dirt When assembling these parts, the threaded bushing clearances must be equalized between the ends of the control arms A trunnion centering gauge, Fig 63, can be used to center the lower control arm trunnion

When installing a steering knuckle pin

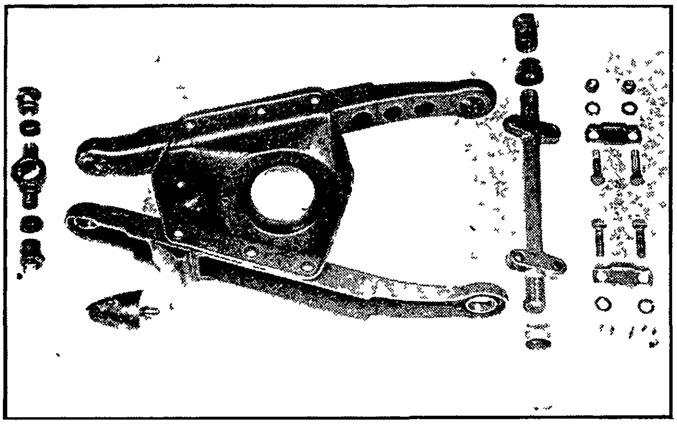


Fig. 65 Layout of lower control arm parts n 1950-51 Statesman and Ambassador

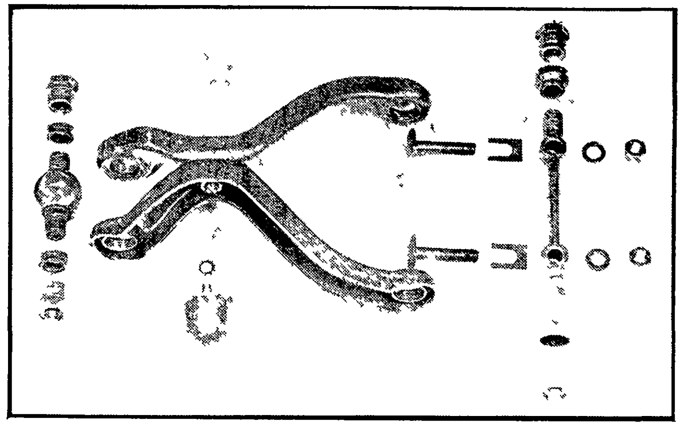


Fig. 66 Layout of upper control arm parts on 1950-51 Statesman and Ambassad r

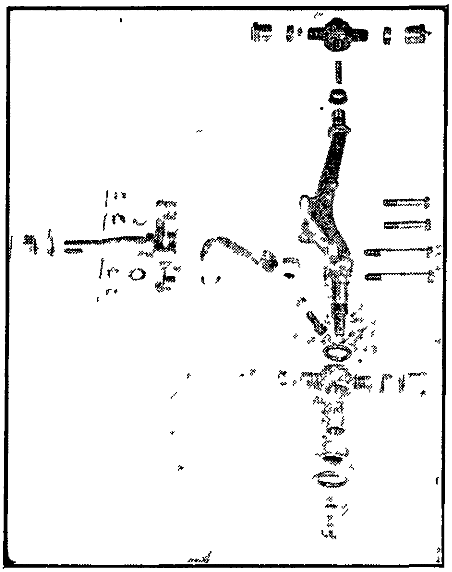


Fig. 67 Lay ut of steering knuckle parts n 1950 Stat sman and Ambassador. 1951 is th sam xcept that the lower control arm trunnion is threaded and the bushing and thrust bearing used in 1950 are liminated

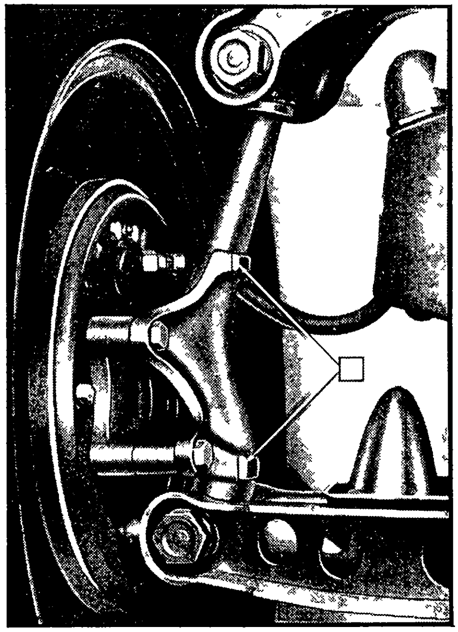


Fig. 68 Gauge points (1) on steering knuckle pin to check caster and camber. 1950-51 Statesman and Ambassador

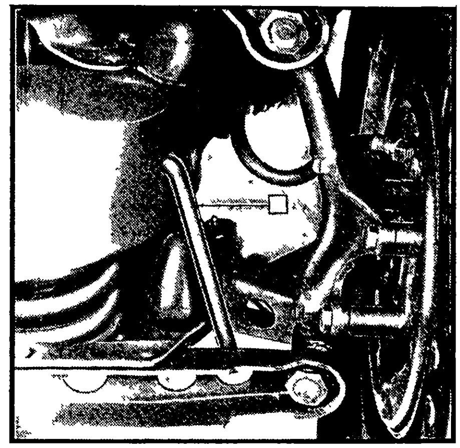


Fig. 69 Showing spring holding h k (1) in place. Hook is used t hold spring compressed when rem ving steering knuckle pin r trunni n. 1950-51 Statesman and Ambassad r

into the upper control arm trunnion, a clearance of approximately ¼ in. must be provided between the lower edge of the trunnion and the seal seat of the knuckle pin, Fig. 64. Figs. 65 and 66 are layouts of the parts that make up the upper and lower control arms.

Steering Knuckle Spindle & Pin—Fig. 67 is a layout of the parts that make up this assembly. The steering knuckle spindle can be replaced without disturbing wheel alignment settings. Gauge points are provided on the steering knuckle pin to check caster and camber, Fig. 68.

To remove the steering knuckle pin from the upper and lower control arms, use special spring holding hooks, Fig. 69. Apply weight on the car to compress the spring until a hook can be installed in the lower control arm and into the hole provided in the front end extension.

STEERING GEAR

STEERING GEAR REMOVAL

1935-48—To remove the gear, take off the horn button and steering wheel. Loosen the steering column jacket clamp and, with a suitable puller, remove the pitman arm. On cars with steering gearshift, detach the connections at the column. Then, on all models, remove the bolts which fasten the gear to the frame and lift the assembly out of the car.

Replace in the reverse order and adjust the gearshift as described under that heading.

1949-51 (Except Rambler)—

1. Pull off steering wheel.
2. Remove shift rods from levers.
3. Remove left heat deflector and control knob bracket.
4. Disconnect jacket from dash panel.
5. Loosen clamp bolt at lower end of jacket tube.
6. Turn jack tube 90° to the right to prevent damage to instrument panel while withdrawing steering gear.
7. Disconnect pitman arm from steering gear and the tie rod on left side.
8. With front of car raised, disconnect steering gear housing from body side sill and remove steering gear from below.

1950-52 Rambler—Pull off the steering wheel. Disconnect the pitman arm from the steering gear and the tie rod from the steering arm.

With the front of the car raised, drain the radiator and remove the radiator-to-water pump tube. Remove steering gear-to-body sill mounting bolts. The steering gear may then be removed from the bottom, over the lower control arm.

OLDSMOBILE

INDEX OF SERVICE OPERATIONS

OLDSMOBILE

Year	Model Designation	Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Six F35	115	In Block	3 5/16 x 4 1/8	213.3	6.00	90 @ 3400		30 @ 30
	Eight L35	121	In Block	3 x 4 1/4	240.3	6.20	100 @ 3400		30 @ 30
1936	Six F36	115	In Block	3 5/16 x 4 1/8	213.3	6.00	90 @ 3400		30 @ 30
	Eight L36	121	In Block	3 x 4 1/4	240.3	6.20	100 @ 3400		30 @ 30
1937	Six F37	117	In Block	3 7/16 x 4 1/8	229.7	6.10	95 @ 3400	180 @ 1600	30 @ 30
	Eight L37	124	In Block	3 1/4 x 3 7/8	257.1	6.20	110 @ 3600	200 @ 1800	30 @ 30
1938	Six F38	117	In Block	3 7/16 x 4 1/8	229.7	6.10	95 @ 3400	180 @ 1600	33 @ 30
	Eight L38	124	In Block	3 1/4 x 3 7/8	257.1	6.20	110 @ 3600	200 @ 1800	33 @ 30
1939	Six "60" F39	115	In Block	3 7/16 x 3 7/8	216.0	6.20	90 @ 3200	170 @ 1600	33 @ 30
	Six "70" G39	120	In Block	3 7/16 x 4 1/8	229.7	6.10	95 @ 3300	180 @ 1600	33 @ 30
	Eight "80" L39	120	In Block	3 1/4 x 3 7/8	257.1	6.20	110 @ 3500	200 @ 1800	33 @ 30
1940	Six "60" F40	116	In Block	3 7/16 x 4 1/8	229.7	6.10	95 @ 3400	180 @ 1400	33 @ 30
	Six "70" G40	120	In Block	3 7/16 x 4 1/8	229.7	6.10	95 @ 3400	180 @ 1400	33 @ 30
	Eight "90" L40	124	In Block	3 1/4 x 3 7/8	257.1	6.20	110 @ 3600	200 @ 2000	33 @ 30
1941	Special 6 "66" F41	119	In Block	3 1/2 x 4 1/8	238.1	6.10	100 @ 3400	190 @ 1400	33 @ 30
	Dynamic 6 "76" G41	125	In Block	3 1/2 x 4 1/8	238.1	6.10	100 @ 3400	190 @ 1400	33 @ 30
	Custom Cruiser 6 "96" H41	125	In Block	3 1/2 x 4 1/8	238.1	6.10	100 @ 3400	190 @ 1400	33 @ 30
	Special 8 "68" E41	119	In Block	3 1/4 x 3 7/8	257.1	6.30	110 @ 3600	200 @ 2000	33 @ 30
	Dynamic 8 "78" J41	125	In Block	3 1/4 x 3 7/8	257.1	6.30	110 @ 3600	200 @ 2000	33 @ 30
	Custom Cruiser 8 "98" L41	125	In Block	3 1/4 x 3 7/8	257.1	6.30	110 @ 3600	200 @ 2000	33 @ 30
1942	Special 6 "66" F42	119	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	190 @ 1400	33 @ 30
	Dynamic 6 "76" G42	125	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	190 @ 1400	33 @ 30
	Special 8 "68" E42	119	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	200 @ 2000	33 @ 30
	Dynamic 8 "78" J42	125	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	200 @ 2000	33 @ 30
	Custom Cruiser 8 "98" L42	127	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	200 @ 2000	33 @ 30
1946	Special 6 "66"	119	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	185 @ 1200	33 @ 30
	Dynamic 6 "76"	125	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	185 @ 1200	33 @ 30
	Dynamic 8 "78"	125	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	204 @ 2000	33 @ 30
	Custom Cruiser 8 "98"	127	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	204 @ 2000	33 @ 30
1947	Special 6 "66"	119	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	185 @ 1200	33 @ 30
	Dynamic 6 "76"	125	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	185 @ 1200	33 @ 30
	Special 8 "68"	119	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	204 @ 2000	33 @ 30
	Dynamic 8 "78"	125	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	204 @ 2000	33 @ 30
	Custom Cruiser 8 "98"	127	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	204 @ 2000	33 @ 30
1948	Special 6 "66"	119	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	190 @ 1200	30 @ 35
	Dynamic 6 "76"	125	In Block	3 1/2 x 4 1/8	238.1	6.50	100 @ 3400	190 @ 1200	30 @ 35
	Special 8 "68"	119	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	210 @ 2000	30 @ 35
	Dynamic 8. "78"	125	In Block	3 1/4 x 3 7/8	257.1	6.50	110 @ 3600	210 @ 2000	30 @ 35
	Custom Cruiser 8 "98"	127	In Block	3 1/4 x 3 7/8	257.1	7.00	115 @ 3600	218 @ 2000	30 @ 35
1949	Six 76	119 1/2	In Block	3 17/32 x 4 3/8	257.1	6.50	105 @ 3400	202 @ 1400	30 @ 35
	V8 88	119 1/2	In Head	3 3/4 x 3 7/16	303.7	7.25	135 @ 3600	263 @ 1800	40 @ 35
	V8 98	125	In Head	3 3/4 x 3 7/16	303.7	7.25	135 @ 3600	263 @ 1800	40 @ 35
1950	Six 76	119 1/2	In Block	3 17/32 x 4 3/8	257.1	6.50	105 @ 3400	202 @ 1400	40 @ 35
	V8 88	119 1/2	In Head	3 3/4 x 3 7/16	303.7	7.25	135 @ 3600	263 @ 1800	40 @ 35
	V8 98	122	In Head	3 3/4 x 3 7/16	303.7	7.25	135 @ 3600	263 @ 1800	40 @ 35
1951	V8 88A	119 1/2	In Head	3 3/4 x 3 7/16	303.7	7.50	135 @ 3600	263 @ 1800	40 @ 35
	V8 Super 88	120	In Head	3 3/4 x 3 7/16	303.7	7.50	135 @ 3600	263 @ 1800	40 @ 35
	V8 98	122	In Head	3 3/4 x 3 7/16	303.7	7.50	135 @ 3600	263 @ 1800	40 @ 35
1952	V8 De Luxe 88	120	In Head	3 3/4 x 3 7/16	303.7	7.50	145 @ 3600	280 @ 1800	40 @ 50
	V8 Super 88	120	In Head	3 3/4 x 3 7/16	303.7	7.50	160 @ 3600	283 @ 1800	40 @ 50
	V8 Classic 98	124	In Head	3 3/4 x 3 7/16	303.7	7.50	160 @ 3600	283 @ 1800	40 @ 50

Year	Model	Spark Plugs Type	Spark Plugs Gap, Inch	Breaker Gap, Inch	Cam Angle, Degrees Note A	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M. Synchro-mesh Trans-mission	Engine Idle Speed, R. P. M. Auto-matic Trans-mission	Cylinder Head Torque, Lbs. Ft.
1935	Six	AC-86	.025	.022	31–37	153624	B	Negative	425		60–70
	Eight	AC-86	.025	.016	21–30	16258374	B	Negative	425		60–70
1936	Six	AC-86	.032	.022	31–37	153624	C	Negative	425		60–70
	Eight	AC-86	.032	.016	21–30	16258374	D	Negative	425		60–70
1937–48	Six	AC-45	.040	.022	31–37	153624	C	Negative	425	375	60–70
	Eight	AC-45	.030	.016	21–30	16258374	D	Negative	425	375	60–70
1949–50	Six	AC-45	.040	.022	31–37	153624	C	Negative	425	350(G)	60–70
	V8	AC-46-5	.030	.016	26–33	18736542(F)	E	Negative	425	350(G)	60–70
1951–52	V8	AC-46-5	.030	.016	26–33	18736542(F)	E	Negative	425	350(G)	60–70

A—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is as shown.
B—IGN mark on flywheel.
C—TDC mark on flywheel.
D—Steel ball in flywheel.
E—Between two steel balls on crankshaft pulley.
F—As viewed from rear of engine, odd numbers left bank, even numbers right bank.
G—In Drive Range.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance H-Hot C-Cold Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing (Note A) Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935	Six	.008H	.010H	.0125	30	5	5	43@2 9/32	.001–.003	.002 –.004	.3420	.3410
	Eight	.008H	.010H	.0125	30	B	10	43@2 9/32	.001–.003	.002 –.004	.3420	.3410
1936–37	Six	.008H	.011H	.0125	C	5	5	46@2 9/32	.001–.003	.002 –.004	.3420	.3410
	Eight	.008H	.011H	.0125	C	B	10	46@2 9/32	.001–.003	.002 –.004	.3420	.3410
1938–48	Six	.008H	.011H	.0125	C	5	5	55@2 1/4	.002–.004	.0025–.004	.3420	.3414
	Eight	.008H	.011H	.0125	C	B	10	55@2 1/4	.002–.004	.0025–.004	.3420	.3414
1949–50	Six	.008H	.011H	.0125	C	5	5	55@2 1/4	.002–.004	.0025–.004	.3420	.3414
	Eight	Zero	Zero	Zero	45	13 1/2	14 1/2	65@1 3/4	.002–.004	.0025–.0045	.3420	.3414
1951	All	Zero	Zero	Zero	45	13 1/2	14 1/2	65@1 3/4	.002–.004	.0025–.0045	.3421	.3934
1952	All	Zero	Zero	Zero	45	13 1/2	14 1/2	90@1 13/16	.002–.004	.0025–.0045	.3421	.3934

A—BTDC means before top dead center; ATDC means after top dead center.
B—Top dead center.
C—Intake 30, exhaust 45.

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935-36	All	B	.002	4 to 11	.007	.007	.0015-.003	.001-.0025	C	D
1937-41	All	Above	.002	4 to 11	.009	.009	.001-.003	.001-.0025	C	D
1942	Six	Above	.0015	7 to 20	.008	.007	.001-.003	.001-.0025	C	E
	Eight	Above	.0015	7 to 20	.009	.009	.001-.0025	.001-.0025	C	E
1946-50	L-Head	Above	.002	4 to 11	.009	.009	.001-.003	.001-.0025	C	D
1949-52	V8	Above	.0015	10 to 18	.010	.010	.001-.003	.0018-.0033	F	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Above on sixes, below on eights.
C—Locked in piston.
D—Thumb push fit in piston and rod but with piston heated.
E—Tight hand push fit in rod and piston with parts at 70° (normal room temperature). If considerable hand pressure is required, pin may be tapped in place with a hammer and brass drift.
F—Press fit in rod and piston.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil			Capacity, Pounds or Pints	Grade of Oil		Capacity, Pounds or Pints	Grade of Oil	
					Above +32°F.	Above +10°F.	Above −10°F.		Summer	Winter		Summer	Winter
1935	Six	13	18	6	20	20W	10W	2	140	90	2½	140EP	90EP
	Eight	16	18	7	20	20W	10W	2	140	90	2½	140EP	90EP
1936	Six	12½	18	6	20	20W	10W	2	140	90	2½	140EP	90EP
	Eight	16	18	7	20	20W	10W	2	140	90	2½	140EP	90EP
1937	Six	16	18	6	20	20W	10W	2	140	90	2½	90H	90H
	Eight	20	18	7	20	20W	10W	2	140	90	2½	90H	90H
1938	Six	17	18	6	20	20W	10W	2 (B)	140 (B)	90 (B)	2½	90H	90H
	Eight	21	18	7	20	20W	10W	2 (B)	140 (B)	90 (B)	2½	90H	90H
1939	Six	17	17	5	20	20W	10W	2 (B)	90 (B)	90 (B)	2½	90H	90H
	Eight	24	17	6	20	20W	10W	2 (B)	90 (B)	90 (B)	2½	90H	90H
1940	Six	18	17	5	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
	Eight	11	17	6	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
1941	Six	17¾	19	5	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
	Eight	21½	19	6	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
1942-46	Six	18½	19	5	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
	Eight	20½	19	6	20	20W	10W	2 (A)	90 (A)	90 (A)	2½	90H	90H
1947-48	Six	18½	19	5	20	20W	10W	2 (A)	90 (A)	90 (A)	3¾	90H	90H
	Eight	20½	19	6	20	20W	10W	2 (A)	90 (A)	90 (A)	3¾	90H	90H
1949	Six	18½	18	5	20	20W	10W	2 (A)	90 (A)	90 (A)	3¾	90H	90H
	Eight	21½	18	5	20	20W	10W	A	A	A	3¾	90H	90H
1950	Six	18½	18	5	20	20W	10W	2 (A)	90 (A)	90 (A)	3¾	90H	90H
	Eight	21½	18	5	20	20W	10W	3 (A)	90 (A)	90 (A)	3¾	90H	90H
1951	All	21½	18	5	20	20W	10W	3(A)	90(A)	90(A)	3¾	90H	90H
1952	All	21½	18	5	20	20W	10W	2(A)	80(A)	80(A)	3¾	90H	90H

A—Approximately 11 quarts for Hydra-Matic. Use only Hydra-matic fluid.
B—For automatic trans., use 3½ quarts of same oil used in engine.
EP—Extreme pressure (mild) lubricant.
H—Hypoid gear lubricant.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note N	Main Bolt Tension, Lbs. Ft.
1935	Six	J	.002–.004	1.998–1.999	.001–.003	.005–.010	50–55	B	.001–.003	.004–.007	120
	Eight	J	.002–.004	2.248–2.249	.001–.003	.005–.010	50–55	C	.001–.003	.004–.007	120
1936	Six	J	.002–.004	1.998–1.999	.001–.003	.005–.010	50–55	B	.001–.003	.004–.008	120
	Eight	J	.002–.004	2.248–2.249	.001–.003	.005–.010	50–55	C	.001–.003	.004–.008	120
1937	Six	J	.002–.004	2.123–2.124	.001–.003	.005–.010	50–55	E	.001–.003	.004–.008	120
	Eight	J	.002–.004	2.123–2.124	.001–.003	.005–.010	50–55	F	.001–.003	.004–.008	120
1938	Six	J	.002–.004	2.123–2.124	.0005–.0025	.005–.010	50–55	E	.0005–.002	.004–.008	120
	Eight	J	.002–.004	2.123–2.124	.0005–.0025	.005–.010	50–55	F	.0005–.002	.004–.008	120
1939	Six	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	E	D	.004–.008	120
	Eight	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	F	D	.004–.008	120
1940	Six	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	E	D	.004–.008	130
	Eight	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	F	D	.004–.008	130
1941	Six	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	E	D	.004–.008	H
	Eight	J	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	F	D	.004–.008	H
1942-48	Six	G	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	E	D	.004–.008	H
	Eight	G	.0015–.0035	2.123–2.124	.0005–.0025	.005–.010	50–55	F	D	.004–.008	H
1949-50	Six	G	.0015–.0035	2.353–2.354	.0005–.0025	.005–.010	45–50	E	D	.004–.008	H
1949-52	Eight	K	.0014–.0036	2.2488–2.2498	.0009–.0029	.002–.011	45–50	A	M	.004–.008	L

A—Nos. 1, 2, 3, 4—2.498–2.499"; No. 5—2.623–2.624"

B—Front, 2.478 to 2.479
No. 2, 2.5405 to 2.5415
No. 3, 2.6655 to 2.6665
No. 4, 2.728 to 2.729

C—Front, 2.373 to 2.374
No. 2, 2.5605 to 2.5615
No. 3, 2.623 to 2.624
No. 4, 2.6855 to 2.6865
No. 5, 2.748 to 2.749

E—Front, 2.478 to 2.479
No. 2, 2.5405 to 2.5415
No. 3, 2.6655 to 2.6665
No. 4, 2.6855 to 2.6865

F—Front, 2.478 to 2.489
No. 2, 2.5405 to 2.5415
No. 3, 2.603 to 2.604
No. 4, 2.6655 to 2.6665
No. 5, 2.6855 to 2.6865

D—For rear main .0005 to .0025". Others .001 to .003".

G—Forward thrust is taken by a semi-circular flange in the front engine plate, while the cylinder block takes the backward thrust.

H—Nos. 1, 2, 3 (6 and 8 cyl.), No. 4 (8 cyl.) 100 lbs. ft. No. 4 (6 cyl.) and No. 5 (8 cyl.) 140 lbs. ft.

J—Controlled by spring and plunger at the front.

K—Controlled by thrust plate at front.

L—Rear 140; others 100.

M—For rear main .002-.0035; others .0005-.003.

N—End thrust on all 1935–48 models and 1949–50 sixes is controlled by thrust plate at front bearing. On 1949–52 eights, thrust is taken by rear bearing.

FIRST SERIAL NUMBER

LOCATION—1935-40: On frame left side rail under hood. 1941-48: On upper left front face of dash. 1949-52: On left body pillar post.

Year	Model	Serial Number
1935	F35	103001
	L35	44001
1936	F36	200001
	L36	100001
1937	F37	CF-353001
		LF-540001
		F-372001
	L37	CL-140001
		LL-195001
		L-146001
1938	F38	CF-504001
		LF-545001
		F-600001
	L38	CL-187001
		LL-197001
		L-212001
1939	F39	CF-511001
		LF-551301
		F-663001
	G39	CG-10001
		LG-100001
		G-300001
	L39	CL-189001
		LL-199001
		L-228201
1940	F40	CF-515001
		LF-556001
		F-703001
	G40	CG-16001
		LG-108001
		G-355001
	L40	CL-190501
		LL-202001
		L-242001
1941	F41	66C-1001
		66L-1001
		66-1001
	G41	76C-1001
		76L-1001
		76-1001
	H41	96C-1001
		96L-1001
		96-1001
1941	E41	68C-1001
		68L-1001
		68-1001
	J41	78C-1001
		78L-1001
		78-1001
	L41	98C-1001
		98L-1001
		98-1001
1942	F42	66C-9001
		66L-12001
		66-86001
	G42	76C-7001
		76L-11001
		76-75001
	E42	68C-3001
		68L-3001
		68-9001
	J42	78C-4001
		78L-4001
		78-26001
	L42	98C-4001
		98L-6001
		98-25001
1946	66	66L-14001
		66-112001
		66C-12001
		66K-1001
	76	76L-13001
		76-92001
		76C-9001
		76K-1001
	78	78L-5001
		78-33001
		78C-5001
		78K-1001
	98	98L-7001
		98-32001
		98C-5001
		98K-1001
1947	66	66A-1001
		66L-19001
		66-132001
		66C-15001
		66W-1001
		66K-3001
	76	76A-1001
		76L-20001
		76-134001
		76C-13001
		76W-1001
		76K-4001
	68	68A-1001
		68L-4001
		68-13001
		68C-4001
		68W-1001
		68K-1001
	78	78A-1001
		78L-8001
		78-50001
		78C-7001
		78W-1001
		78K-3001
	98	98L-10001
		98-43001
		98C-7001
		98K-2001
1948	66	66A-2001
		66L-31001
		66-16501
		66C-21001
		66W-3001
		66B-1001
		66K-9001
	76	76A-2001
		76L-31001
		76-164001
		76C-18001
		76W-3001
		76B-1001
		76K-9001
1948	68	68A-2001
		68L-8001
		68-25001
		68C-6001
		68W-2001
		68B-1001
		68K-3001
	78	78A-2001
		78L-6001
		78-72001
		78C-11001
		78W-2001
		78B-1001
		78K-7001
	98	98A-65001
		98L-20001
		98-65001
		98C-11001
		98W-1001
		98B-1001
		98K-6001
1949	76	496-1001
	88	498-1001
	98	499-1001
1950	76	506-1001
	88	508-1001
	98	509-1001
1951	88	517-1001
	98	519-1001
1952	88	528-1001
	98	592-1001

Note—Letters in serial numbers denote point of origin of car:
CF, CL, CG or C—Southgate, Cal.
LL, LF, LG or L—Linden, N. J.
F, L, G, M or number only—Lansing, Mich.
K—Kansas City, Mo.
A—Atlanta, Ga.
W—Wilmington, Del.
B—Framingham, Mass.

FIRST ENGINE NUMBER

LOCATION—1935-48 & 1949-50 Six: On upper left corner of cylinder block. 1949-52 Eight: On left hand bank of cylinder block.

Year	Model	Engine Number
1935	F35	405001
	L35	45001
1936	F36	506001
	L36	202001
1937	F37	670001
	L37	250001
1938	F38	828001
	L38	296001
1939	F39	F-905001
	G39	G-10001
	L39	L-316001
1940	Six	G-79001
	Eight	L-334001
1941	Six	G-225001
1941	Eight	L-379001
1942	Six	G-424001
	Eight	L-450001
1946	Six	6-1001
	Eight	8-1001
1947	Six	6-83001
	Eight	8-37001
1948	66, 76	6-188021
	68, 78	8-127001
	98	9-1001
1949	Six	6A-1001 (Std)
	Six	6A-1002 (Hyd)
	Eight	8A-1001
	Eight	8A-194001
1950	Six	6A-97001
	Eight	8A-194001
1951	All	8C-1001
1952	All	R-1001

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	All	+1 7/8	+ 7/16	5/32	5
1936	All	+1 7/8	+ 7/16	5/32	5 5/6
1937	All	+ 5/8	+ 7/16	5/32	4 5/6
1938–39	All	− 3/8	+ 7/16	5/32	4 5/6
1940–48	All	− 3/8	+ 1/4	3/32	4 5/6
1949–51	All	− 3/8	Zero	3/32	4 1/2
1952	All	− 3/8	+ 1/2	3/32	5

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-46	All	.004–.008	Shims	None	.000–.008
1947-48	All	.003–.012	Shims	Nut	.000–.008
1949-52	All	.004–.008	Shims	Nut	.000–.008

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935-36	Six	A	23.7	2	3/16	1/4
	Eight	A	25.9	2	3/16	1/4
1937-38	Six	A	21 5/16	1 3/4	3/16	1/4
	Eight	A	23 3/64	1 3/4	3/16	1/4
1939	Six	Molded	21 5/16	1 3/4	3/16	1/16(D)
	Eight	A	(B)21 51/64 (C)23 3/64	1 3/4	3/16	1/16(D)
1940	Six	Molded	21 9/32	1 3/4	3/16	3/16(D)
	Eight	A	21 9/32	2	3/16	3/16(D)
1941	119" W.B.	Molded	21 5/16	1 3/4	3/16	3/16(D)
	125" W.B.	Molded	21 5/16	2	3/16	3/16(D)
1942	66, 68, 76	Molded	21 5/16	(B)2 (C)1 3/4	3/16	3/16(D)
	78, 98	Molded	21 5/16	(B)2 1/4 (C)2	3/16	3/16(D)
1946-48	Six	Molded	21 5/16	(B)2 (C)1 3/4	3/16	3/16(D)
	Eight	Molded	21 5/16	(B)2 1/4 (C)2	3/16	3/16(D)
1949-50	Six	Molded	(B)21 5/16 (C)24	(B)2 (C)1 3/4	3/16	3/16(D)
1949-52	Eight	Molded	21 5/16	(B)2 1/2 (C)2	3/16	3/16(D)

A—Primary shoe, molded. Secondary, woven.
B—Front wheel.
C—Rear wheel.
D—Adjust pedal so rubber pad under toe board is compressed the dimension given.

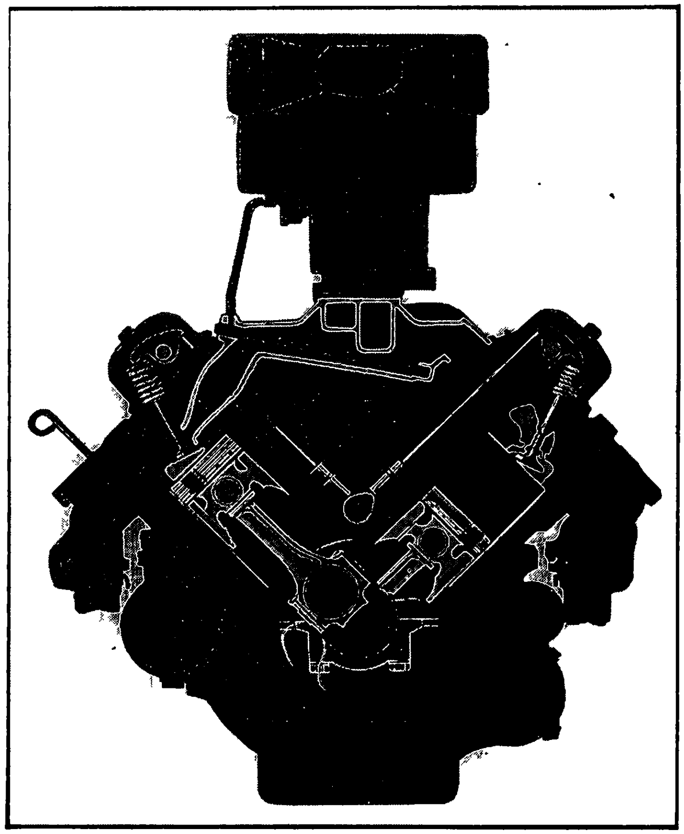


Fig. A 1952 Rocket engine

ENGINE

ENGINE REMOVAL

1935-41—Take off the radiator and front fenders as a unit. Then after disconnecting fuel and oil lines, carburetor linkage, wiring and necessary accessories. unfasten the engine and transmission from their mountings and hoist the engine out of the chassis.

1942-52—After disconnecting fuel and oil lines, carburetor linkage and removing necessary wiring and accessories, remove the radiator core, unfasten the engine and transmission from their mounting and hoist the engine out of the chassis.

CYLINDER HEAD

1935-50 Except V8—The head nuts should be tightened in the order shown in Figs. 2 and 3, drawing all nuts down evenly and then repeating the operation until all are normally tight. After the engine has been run sufficiently long to bring all parts to normal operating temperature, a final tightening should be made with a torque wrench to the torque values given in the *Tune Up* table. Use the high torque value for threads that are clean and dry and the lower value for threads that are clean and oiled.

1949-52 Rocket — To remove either or both cylinder heads, proceed as follows:

1. Drain cooling system and disconnect upper radiator hose from water outlet.
2. Remove air cleaner and generator.

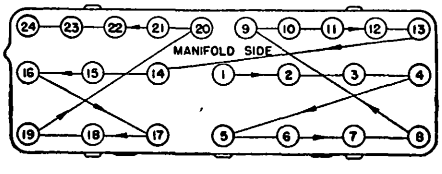


Fig. 2 Head tightening. 1935-50 six-cylinder

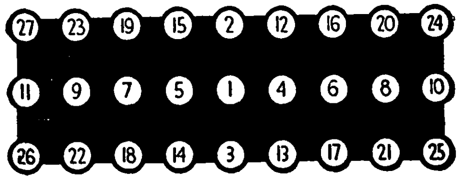


Fig. 3 Head tightening. 1935-48 Eights

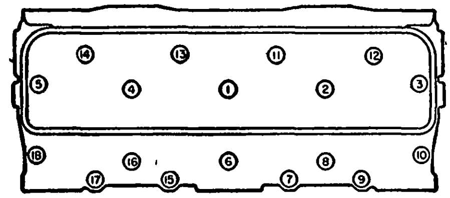


Fig. 4 Head tight ning. 1949-52 Rock t ngin s

3. Remove spark plug wires and retainers.
4. Disconnect throttle linkage.
5. Disconnect spark plug wire and air cleaner supports from cylinder heads.
6. Remove distributor cap and lift cap and high tension wire assembly with supports from engine.
7. Remove fuel pump-to-carburetor fuel line and two vacuum lines from carburetor to fuel pump and distributor.
8. Remove external water by-pass tube.
9. Remove valve covers.
10. Remove intake manifold with coil and carburetor attached.
11. Disconnect exhaust pipe from exhaust manifold.
12. Remove rocker arm shaft with rocker arms and brackets.
13. Remove push rods.
14. Remove cylinder head with exhaust manifold attached.

Installation Notes—Coat a new gasket on both sides with No. 3 gasket sealer and install the gasket with the crimped side up.

After cylinder heads have been placed in position, the push rods and rocker arm assemblies should be installed and care taken to see that the push rods are properly seated in the rocker arms and valve lifters.

Cylinder head bolts should be tightened in the sequence shown in Fig. 4 and to 65 to 70 lbs. ft. torque.

Valve cover gaskets should be cemented to the valve cover by coating the valve cover on one side with high compression gasket cement or gasket shellac.

New intake manifold gaskets coated on both sides with No. 3 sealer must always be used when intake manifold is replaced. Threads of the manifold bolts should be dipped in No. 3 sealer before installing. Manifold attaching bolts and nuts should then be tightened in a criss-cross fashion to 22-26 lbs. ft. torque. It is very important that the intake manifold be properly centered between cylinder heads before bolts are tightened.

After cylinder head and intake manifold installation has been completed, the throttle linkage should be adjusted as outlined in the Hydra-Matic section of this chapter.

VALVE SERVICE, ROCKET ENGINES

Hydraulic Valve Lifters—These valve lifters maintain zero valve lash or tappet clearance. Any lash which results in the system is instantaneously taken up by the hydraulic action. For details on how these lifters function and how they are serviced, see the *Hydraulic Valve Lifters* chapter.

After the engine has been standing for a considerable period of time, a certain amount of valve lifter noise will occur when the engine is first started due to the fact that the oil escapes from those lifters which are holding valves open against spring pressure at the time the engine was stopped. Oil pressure will refill these lifters after a few seconds of engine operation, at which time the noise will disappear. Such starting noise should not be considered as excessive valve noise.

To remove valve lifters, take off successively the intake manifold, engine push rod cover, valve cover, rocker arm shaft assembly, push rods and remove valve lifters, Fig. 5.

Valve lifter and push rods should be placed in a numbered rack in their proper sequence so they can be reinstalled in their same position in the cylinder block.

Valve lifters in production engines may be one of four sizes: standard, .001, .002 or .003 in. oversize. It is important when replacing one or more lifters that the proper size lifter be ordered. An identification numeral is etched on all lifter bodies except standard. The cylinder block is marked for lifter size on the rail under the push rod cover. Valve lifters .005 in. oversize are available for service replacement.

Valve Linkage—Rocker arms are identical except that the intake arms may be identified by a brass pin which blocks the upper end of the drilled passage leading to the push rod oil hole. The oil passage provides lubrication between the push rod and its seat in the rocker arm.

The rocker shafts are supported by four brackets on each cylinder head,

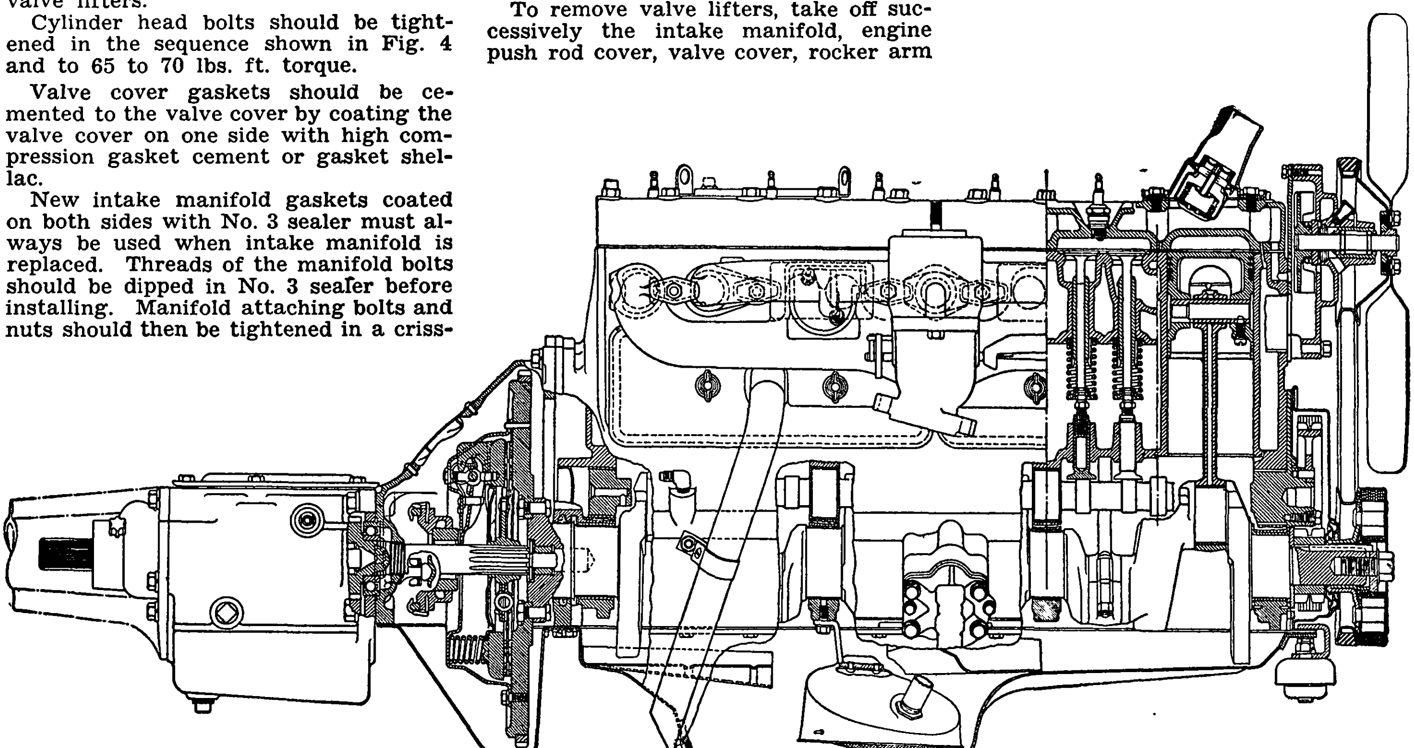


Fig. 1 Engin and clutch. Typical f all 1935-50 Sixes

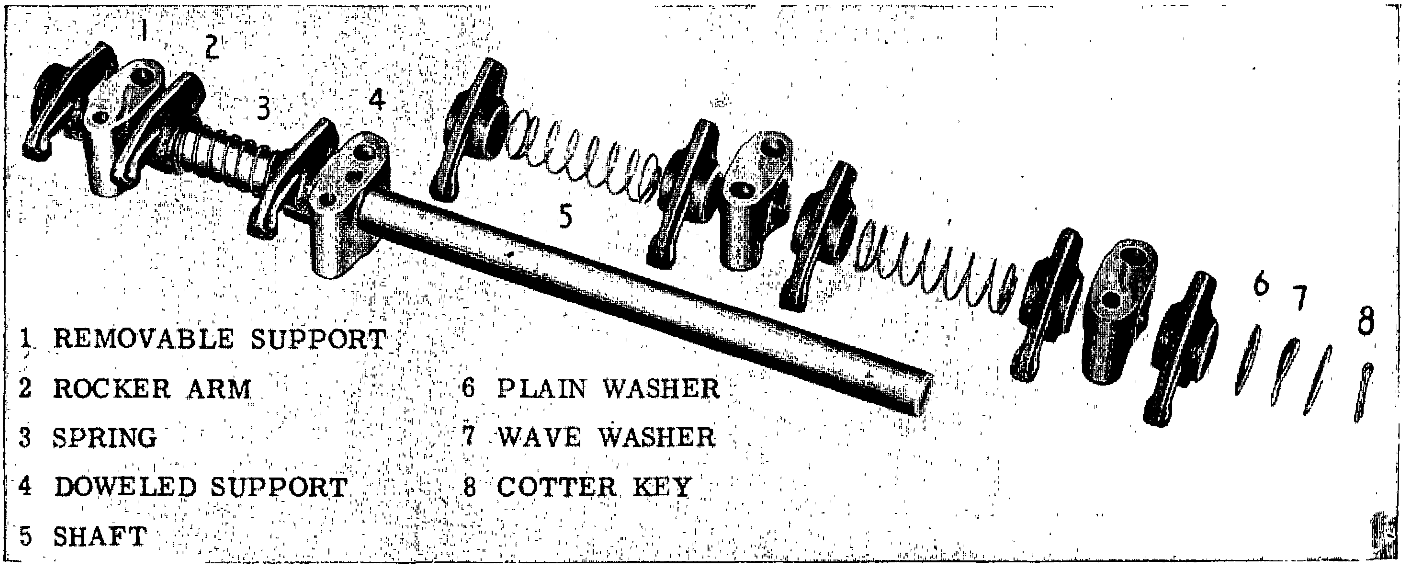


Fig. 6 R cker arm assembly n 1949-52 Rocket

three of which are identical. The remaining bracket on each head has an oil hole drilled through the bottom which indexes with the oil line in the cylinder head originating at the No. 2 camshaft bearing for the left side and No. 4 camshaft bearing on the right side. These two brackets can be identified by their dowel pins which position the rocker arm shaft with respect to the oil passages.

Three rocker shaft springs are used to keep the center rocker arms in proper position against the brackets, whereas both end rocker arms are positioned by a flat washer, wave washer and a cotter pin, Fig. 6.

When necessary to disassemble the rocker arm shaft assembly, remove the cotter pin, wave washer and flat washer. Remove rocker arms, supports and springs from shaft. Note that one support is doweled to each shaft and should not be removed when disassembling the shaft assembly.

When assembling rocker arms and supports to shaft, be sure the supports are installed correctly on the shaft in relation to the doweled support. Be sure also that the rocker arm (push rod end) is on the same side as the large cylinder head bolt hole in each support.

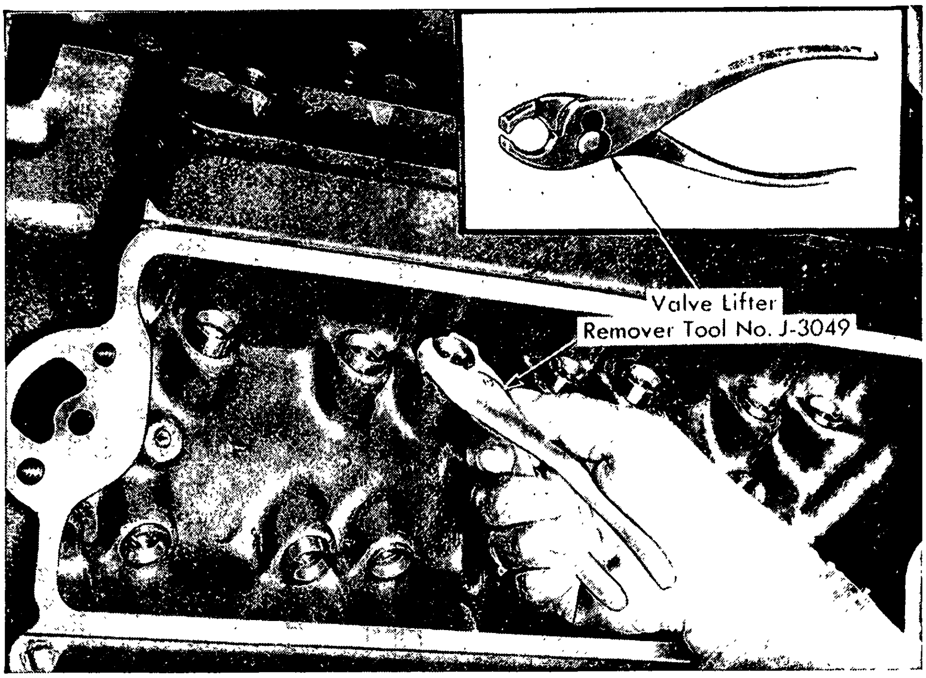


Fig. 5 Removing stuck valve lifters from 1949-52 Rocket

Valves, Springs & Dampers—Rubber seals are installed on the second groove from the end on intake valves, Fig. 7. These seals must be carefully positioned when reinstalled to prevent damage to them.

Intake and exhaust valve springs are identical. To eliminate inherent vibration in valve springs at certain engine speeds and to increase spring life, a damper is used inside the bottom coils seating against the cylinder head.

Exhaust valve stems are $\frac{1}{16}$ in. larger in diameter than that of the intake valve to provide better cooling of the valve head.

To remove valve springs and dampers, take off the cylinder head as outlined previously. Then, using a suitable valve spring compressor, like the one shown in Fig. 8, compress the valve springs until valve stem locks can be removed. Remove spring retainer, spring and dampers.

Valve Guides—The overall length of the intake and exhaust valve guides is the same. But the intake guide has a smaller bore than the exhaust guide and is also beveled at the bottom.

Both intake and exhaust valve guides extend $\frac{21}{32}$ in. above the face of the valve spring seat. It is important when installing a valve guide that the distance from the top of the guide to the cylinder head be held to the above specifications. Therefore, tool BT-13 is available to make this installation properly. With this tool or its equivalent, drive the new guide in from the top of the

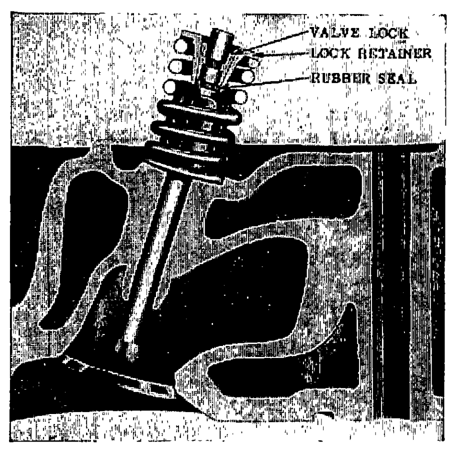


Fig. 7 D tail f intak valve. 1949-52 V8

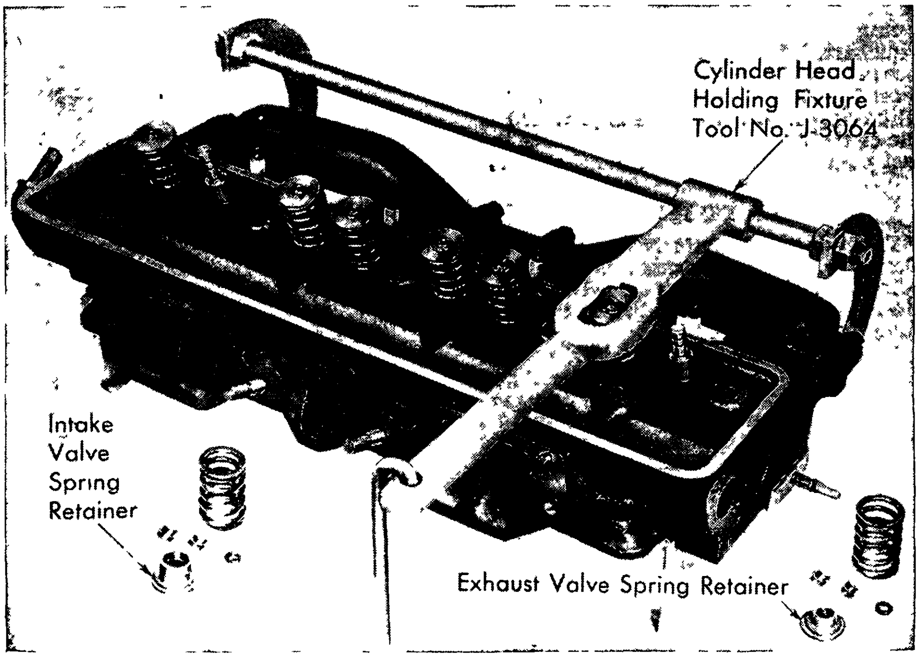


Fig. 8 Showing tool to remove and replace valves and springs on 1949-52 V8

cylinder head until the tool seats on the valve spring seat.

VALVE SERVICE, L-HEAD ENGINES, 1935-50

Valve Adjustment—In order to obtain the correct valve running clearance, valves should be adjusted with the engine warm and running. However, if the working space available makes this method inconvenient, the following procedure may be used.

1. Allow the engine to run until warm and then shut it off.
2. Install a timing light and turn on ignition.
3. Bring No. 1 cylinder up on firing stroke until light just lights. Both valves in No. 1 cylinder are now on the low point of the cam (valves closed).
4. Adjust lash on these valves to the clearance given in the *Valve Data* chart.
5. Proceed as above with the timing light for each cylinder in the firing order.

Valves & Springs—To remove the valves and springs, take off the cylinder head and valve compartment covers. With a suitable valve spring compressor, compress the valve spring, and remove valve locks. Take out the valve and then remove the spring and damper.

To reinstall, reverse the foregoing operations, being sure that the valve spring damper is in place at the upper end of the spring before the spring is installed.

Valve Guides—The same guides are used for both intake and exhaust valves. When installed, the distance from the top of each guide to the top of the block should be 11/16 in. on 1935-36; 5/8 in. on 1937-38, and 7/8 in. on all 1939-50 models.

Special valve guide drivers are available to install guides, one of which is shown in Fig. 9.

Valve Lifters—If valve lifter guides are excessively worn, the lifters may be removed, the guides reamed and oversize lifters installed. Lifters are furnished in oversizes of .002" and .005" on 1935-36 Sixes, and for all 1937-50 models, oversizes of .001", .002", .005" and .010" are available. Oversize valve lifters are not furnished for 1935-36 Eights as the lifter brackets are removable and standard size may be replaced.

On 1937-50 models, the lifters are of the mushroom type, operating in guides which are cast integral with the crankcase, therefore making it necessary to remove the camshaft before the lifters can be taken out. On these models, follow the instructions for removing the camshaft as described under that heading, then remove the oil pan and take the lifters out through the bottom of the engine.

On 1935-36 Sixes, the lifters are of the barrel type and can be removed up through the valve compartment after first taking out the valves.

On 1935-36 Eights, the lifters are also of the mushroom type but they operate in removable guides bolted to the crankcase.

NOTE—On all models, the lifters should be marked to assure getting them back into the original guide hole, otherwise lifter noise or binding will result. When reaming the lifter guides on all models except 1935-36 Eights, it is necessary to remove the valves and guides so that the reamer pilot can be inserted through the valve stem guide hole.

NOTE — On 1939-50 engines, the valve lifter guide holes are *"Bearing-ized"* after being reamed. This process permits greater accuracy in finishing and provides a mirror-like burnished surface. Due to this bearing surface, be sure to check the lifter size and, if possible, use the proper oversize lifter without reaming out the lifter hole, otherwise the *"Bearing-ized"* surface would be destroyed.

CAUTION—When reaming the guide holes on 1935-36 Sixes, cover the entire camshaft at the section being worked on with a clean rag covered with grease to prevent filings from falling on the camshaft. Also on these and all other models, make sure that all iron dust and filings are wiped out of the guide holes before rebuilding the engine.

TIMING CASE COVER

1935-50 L-Head Engines — The timing case cover contains an oil seal at the front end of the crankshaft to prevent a leak at this point. On 1936-50 models, the seal consists of a felt packing, Fig. 10, held in place by a retainer ring spot welded to the cover. This provides effective sealing at the machined hub surface of the fan drive pulley. A groove at the rear side of the fan drive pulley is provided for draining back the oil.

In addition, an oil slinger between the fan drive pulley hub and the crankshaft sprocket prevents the major portion of the oil from reaching the seal proper.

1949-52 Rocket Engines—To remove the cover, drain the cooling system and disconnect lower radiator hose. Disconnect external water by-pass at the intake

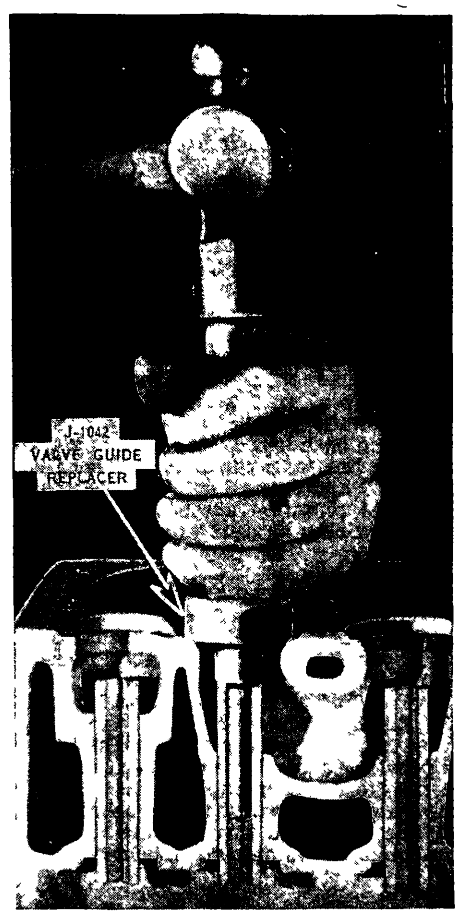


Fig. 9 Installing valv guides, 1935-50 L-Head

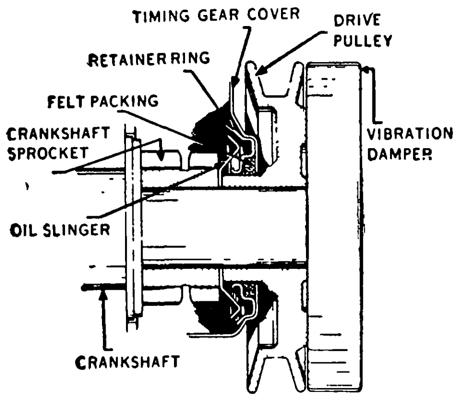


Fig. 10 Crankshaft fr nt nd s al, 1936-50 L-Head

manifold. Drop the oil pan. Remove front engine mounting bolts. Jack up front of engine to clear frame front cross member. Take off radiator core, shroud, fan blades, pulleys, vibration damper and fuel pump. Unfasten the cover from the block and lift it off.

TIMING CHAIN & SPROCKETS

1935-50 L-Head Engines — The timing chain has no adjustment for wear. To remove the chain or sprockets, pull off the vibration damper and fan pulley, support the engine under the front end, unfasten the engine bracket and remove the cover,

To assemble, place the chain over the sprockets so that when the camshaft sprocket is bolted to its hub, the timing marks on both sprockets are opposite each other and in line with the center of both the camshaft and crankshaft.

1949-52 Rocket Engines — Remove the chain cover as outlined previously and take off the chain and sprockets as follows: Slide the oil slinger off the front end of the crankshaft. Remove the fuel pump eccentric from the front of the camshaft sprocket. Take off the chain and sprockets.

To assemble, place the chain over the sprockets so that when the camshaft sprocket and fuel pump eccentric are bolted to the camshaft hub, the timing marks on both sprockets are facing each other in line with the center of both the camshaft and crankshaft. The fuel pump eccentric must be assembled with the machined step against the sprocket.

CAMSHAFT END THRUST

1935-50 L Head Engines — On 1935-40 models, camshaft end thrust is controlled by a springloaded hardened steel plunger in the front end of the camshaft, running against a hardened steel plate in the timing chain cover.

On 1941-50 cars, a semi-circular flange is provided around the camshaft opening in the front engine support plate to take the forward thrust of the camshaft, Fig. 11, the backward thrust being taken at the front of the cylinder block.

1949-52 Rocket Engines—On early 1949 engines, camshaft end thrust is controlled by a thrust plate fastened to the front end of the camshaft. On late 1949 and later engines a thrust plunger and spring is used to control end play of the camshaft. The plunger contacts a pad located on the engine front cover. Two threaded plugs are also added to seal the oil passages. A small hole is provided in one of the threaded plugs to lubricate the fuel pump eccentric and timing chain.

CAMSHAFT BEARINGS

1935-52—All camshaft bearings are replaceable, and if clearance is excessive, new bearings may be pressed in place after the camshaft and old bearings have been removed.

Before installing new bearings, see that the oil feed holes are clean and free from sludge and other foreign particles; and when replacing bearings, be sure to line up the holes in the bearings with those of the crankcase to assure adequate lubrication.

CAMSHAFT REMOVAL

1935-50 L Head Engines — On 1935-39 models the front fenders and radiator must be removed as a unit. On 1940 and later models, leave the fenders in place but remove the radiator and grille. Then, on all models, proceed as follows:

1. Except 1935-36 Eights, take off the cylinder head. On 1935-36 Eights this is not necessary as the valve lifters are carried in removable guides bolted to the cylinder block—which can be removed together with the lifters.
2. On all models, remove oil pan, fuel pump and timing case cover.
3. Remove distributor.
4. Except on 1935-36 Eights, use "U" clips made of ½ in. copper tubing, 2 in. long, bent so as to fit under the valve heads to hold them open.
5. Tie up valve lifters with soft wire to hold them in raised position to clear cams and camshaft bearing journals.
6. Mark valve lifters so they may be reassembled in their respective positions in the cylinder block. This is to avoid lifter noise or binding which would very likely result if installed otherwise.
7. Remove timing chain and sprockets and withdraw camshaft.
8. To replace, reverse operations and set ignition timing.

1949-52 Rocket Engines—To remove the camshaft from these engines, proceed successively as follows:

1. Remove radiator and heater hoses.
2. Remove air cleaner.
3. Remove fuel and vacuum lines.
4. Remove distributor.
5. Remove throttle linkage from carburetor.
6. Remove fan, pulleys and belts.
7. Remove generator, belt & brackets.
8. Remove spark plug wire support.
9. Remove external water by-pass tube.
10. Remove push rod covers, rocker arm assembly and push rods.
11. Remove intake manifold.
12. Remove cylinder block cover.
13. Remove valve lifters and place in numbered rack to keep them clean and so they can be replaced in the same location as removed.
14. Remove upper radiator baffle support.
15. Remove radiator core.

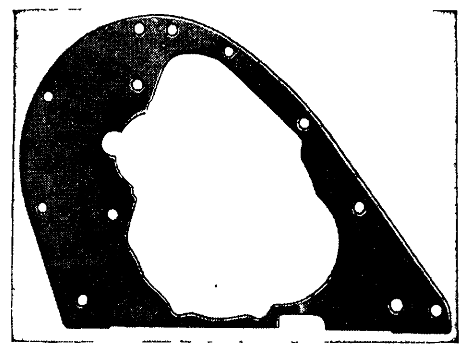


Fig. 11 Front engine supp rt plate showing camshaft thrust flange, 1941-50 L-H ad

16. Remove vibration damper.
17. Remove fuel pump.
18. Remove exhaust cross-over pipe.
19. Remove steering idler arm.
20. Remove oil pan.
21. Remove front engine mounting.
22. Remove timing chain cover.
23. Remove fuel pump eccentric, timing chain and sprocket.
24. Remove camshaft thrust plate and withdraw camshaft.
25. To replace, reverse sequence of operations, set valve timing and adjust carburetor idle.

PISTONS & RODS

1935-50 L-Head Engines — When correctly assembled the oil spray hole in the upper half of the connecting rod bearing must be on the camshaft side of the engine with the T-slot side of the piston opposite to the camshaft side.

Oldsmobile pistons are marked on top with the letters "V-S" which, when installed, should be toward the valve side of the engine.

1949-52 Rocket Engines—After removing the connecting rod cap, push the rod and piston out through the cylinder bore, being careful to keep the rod in alignment to clear the crankshaft. The internal crankcase clearances are very limited and extreme care must be taken not to damage parts. After removing the piston assembly, reinstall the bearing cap. Remove seven other pistons in the same manner.

NOTE — On 1, 3, 5, 7 pistons, assemble the connecting rod with the machined surface of the bearing face on the same side as the "F" marks, Fig. 12. On 2, 4, 6, 8 pistons, assemble rods with machined surface having two bosses placed on same side as letter "F."

PISTONS

1935-52—On 1935 models, pistons are available in standard as well as .010″ and .030″ oversizes. On 1936-51 models oversizes of .003″, .005″, .010″, .015″ and .030″ are obtainable. For checking sizes of stock pistons, measurements should be taken with micrometer calipers across the high point of the piston skirt contour, which is across the piston pin support ribs on the piston skirt.

Before any attempt is made to fit new pistons, cylinder bores should be care-

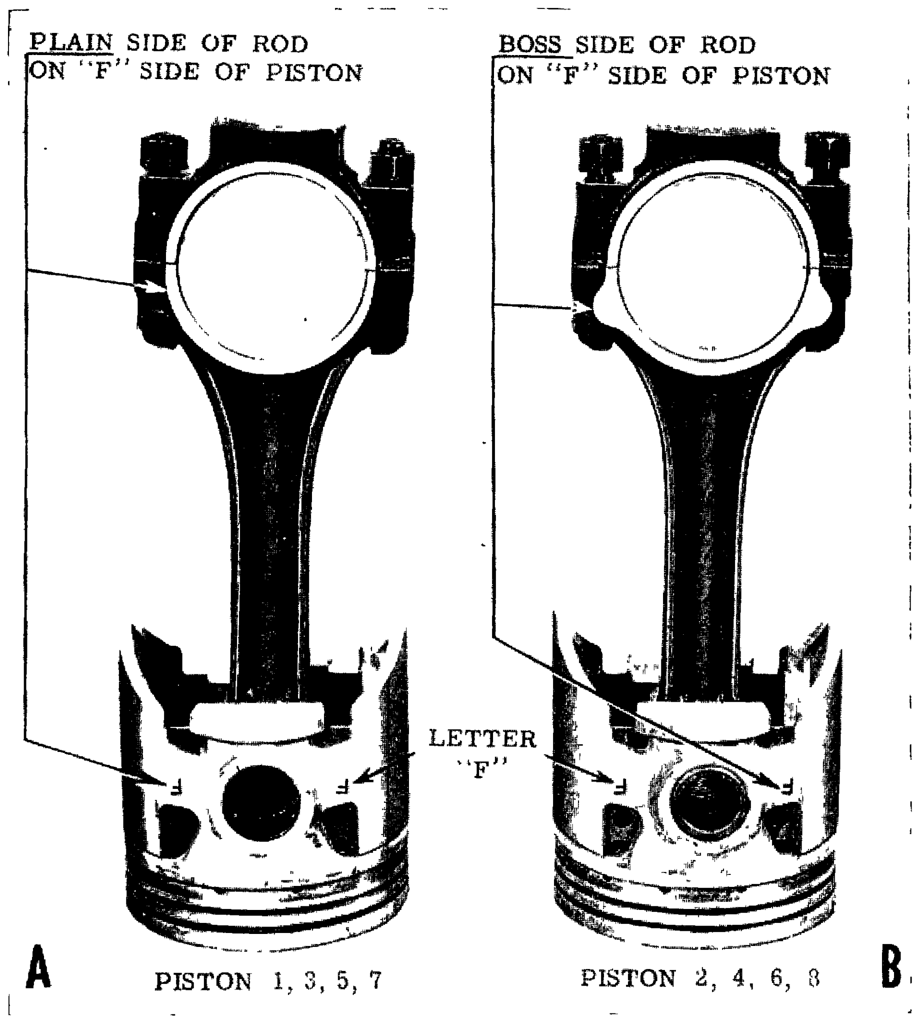


Fig. 12 Correct assembly of pistons and rods on 1949-52 Rocket engines

fully measured, and refinished. Cylinders that are not badly scored but need a "cleaning up" to bring them within satisfactory working limits may be reconditioned with a hone.

A good job should show measurements of not more than .0005″ out-of-round or taper. If cylinders are scored badly or out-of-round excessively, they should be bored first with a reliable boring tool and then polished with a hone.

When fitting pistons, use feeler stock of the thickness given in the *Piston & Ring* table. The feeler should be about ½″ wide and long enough to extend down into the bore for the full length of the piston. Insert the piston into the bore upside down and place the feeler stock between the piston and the cylinder wall on the high point of the piston contour. Hook the feeler to a spring scale and withdraw the feeler by pulling it out of the cylinder with the scale. The piston is fitted properly if the amount of pounds pull registered on the scale comes within the limits given in the *Piston & Ring* table.

PISTON RINGS

1935-52—Piston rings are available in standard sizes and the following inch oversizes: .010, .020 and .030.

When installing a new set of rings without reconditioning the cylinder bores, always remove the top ridge of the bore with a reliable ridge reamer. Care must be taken not to cut below the top of the upper ring position in the bore. Always cut the ridge before removing the piston assemblies, keeping the tops of the pistons covered to prevent cuttings from reaching bearings, crankshaft, timing case, etc.

New rings must be fitted with end gaps and groove clearances according to the specifications given in the *Piston & Ring* table. Ring grooves must be clean and free from carbon and must show no perceptible wear.

Install rings according to the instructions which are usually contained in the ring package. When assembled on the pistons, the gaps should be staggered around the circumference of the piston but with no gaps over the piston pin.

PISTON PINS

1935—Coat inside of the piston pin boss with graphite grease and assemble pin with split end entry through lock pin boss. Using a special tool, the pressure required to press pin in place is 200 to 250 lbs. in the first boss and 300 to 350 lbs. in second. Hole and piston pin must be lined up with lock screw hole in boss, otherwise piston may be forced out-of-round. Check piston for roundness after assembly. Piston should be round within .0005″.

Pins are available in standard and .003″ oversize.

1936-50 L Head Engines (Except 1942)—To remove or install pin, heat piston and pin assembly in boiling water which causes the piston pin bosses to expand and allow the pin to be easily removed or installed. To remove piston pin and assembled connecting rod, remove lock screw, place piston in boiling water for one minute, place in holder and push out pin toward plain boss side.

To assemble, heat piston and pin in boiling water for one minute, dip pin in hot light engine oil, start pin through plain boss and connecting rod and make sure that lock screw hole in pin and boss will align. With piston replacing tool, lightly push pin through until lock screw holding pin and boss are aligned. Slight misalignment may be corrected by inserting punch through holes and prying into place. If heavy pressure is required, reheat piston and pin in boiling water. Do not force pin. Apply graphite grease to lock screw and insert in place. After completing assembly, check for alignment before installation in the engine.

The piston pin bosses have a hard, electrolited surface and should not be reamed. Therefore only standard size wristpins should be used.

1942—Piston pins are available in standard as well as .001″ and .003″ oversizes, all being machined to the high limit. There may be cases where the standard size pin will provide a satisfactory fit and if a careful reaming job is done, finish honing of the piston pin hole should not be necessary.

The piston fit is satisfactory when it is a "very tight wring fit" in each piston pin hole. This fit can be described as one in which the pin can be twisted in each pin hole with the aid of a 6″ drift in the piston pin lock screw hole, with the pin and hole completely free of oil. Since this is a dry metal-to-metal fit, some squeak will be apparent as the pin is twisted in the piston. The fit must be made with the solid part of the pin in the boss with the split part entirely through the boss.

When removing the pin from the piston, hold the assembly in the hand and tap out the pin with a suitable tool from the split end. Do not support the piston rigidly on a bench during removal of the pin as this may destroy the roundness of the piston.

1949-52 Rocket Engines—Piston pins are available in standard, .001″ and .003″ oversizes. If necessary, reaming and honing of the piston pin hole for the installation of oversize pins are satisfactory. The fit of the pin in the piston should be a tight hand push. If considerable hand pressure is required, the pin may be tapped in place with a hammer and brass drift.

It is very important that both the pin and piston pin hole be clean and free from oil. When assembling the rods to

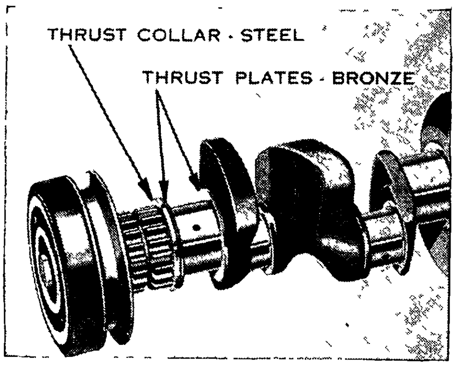


Fig. 13 Crankshaft end play adjustment, 1935-50 L-Head

the pistons, follow directions shown in Fig. 12.

PISTON PIN BUSHINGS

1935-52—The fit of the piston pin in the connecting rod bushing should be such that the piston pin will not drop through the bushing by its own weight, but will need to be pushed through with a slight pressure of the thumb.

The oil hole in the bushing must line up exactly with the hole in the connecting rod, otherwise scoring of the piston pin may result from insufficient lubrication.

CONNECTING ROD BEARINGS

1935-50 L-Head Engines — Connecting rods have thin wall, steel-backed babbitlined bearings, held in place with extensions stamped in the edge of the bearing shells and located in machined notches in the cap and rod. They can be replaced simply by removing the caps and replacing the upper and lower shells.

1949-52 Rocket Engines—The bearing inserts are assembled with a slight projection above the rod and cap faces to insure positive contact. Always use new bearings for wear adjustments. If metal is removed from either the cap or face, it will be impossible to use the rod again with a new bearing shell.

A small groove is forged in both the rod and cap at the attaching bolt boss. When the rod and cap are assembled, the two grooves should be on the same side. This side may also be used for stamping the cylinder number on the rod and cap.

CRANKSHAFT & MAIN BEARINGS

1935-50 L Head Engines—The crankshaft is supported by shell type main bearings, held in place with small extensions on the edge of the bearing shell, which are located in machined notches in the block and cap. No attempt should be made to shim, file or otherwise take up worn bearings.

To install new bearings, remove the cap and take out the worn lower shell. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.

Place a new upper shell on the crankshaft journal with the locating notch in the correct position, and rotate the shaft to turn the shell in place. Install the lower shell in the cap and install the cap.

1949-52 Rocket Engines—The main bearing caps are numbered consecutively (one to four) with number one at the front. The rear main bearing (5) is not numbered. Bearing adjusting shims are not used, nor are they recommended. Whenever a bearing failure occurs, a new bearing insert should be installed.

Bearing inserts for the first four bearings are furnished in one size only. The rear main bearing inserts are furnished in three sizes and are marked "M" for medium, "T" for thin, and "H" for heavy. These letters are marked on the tang of the bearing.

The lower flywheel housing must be removed in order to remove the rear main bearing cap. Main bearing caps are installed with the number toward the right side bank of cylinders.

CRANKSHAFT END THRUST

1935-50 L-Head Engines — Crankshaft end thrust is controlled by a steel thrust collar and two bronze thrust plates at the front main bearing, Fig. 13. Through normal wear, this clearance will seldom become excessive but whenever new bearings are fitted, check the end play by forcing the crankshaft backward to the limit of its travel, insert a shim between the rear bronze thrust plate and the adjacent crankshaft flange, noting the thickness of shim required to take up all play.

The permissible end play is given in the *Engine Bearing* table, with the minimum figure desired. The bronze thrust plates are furnished in various thicknesses to establish the correct end play.

NOTE—The steel thrust collar used on Hydra-Matic equipped cars has a more highly polished finish and may be identified by the Part No. 414229 etched on the collar. This collar may be used on cars equipped with synchromesh transmissions *but not vice versa.* The bronze thrust plates used on synchromesh transmission equipped cars are both the same except for thickness which is selective. On Hydra-Matic equipped cars, one of the bronze thrust plates is plain while the other has eight grooves in the surface of the plate. The grooved plate should be installed next to the steel thrust collar with the grooves toward the collar.

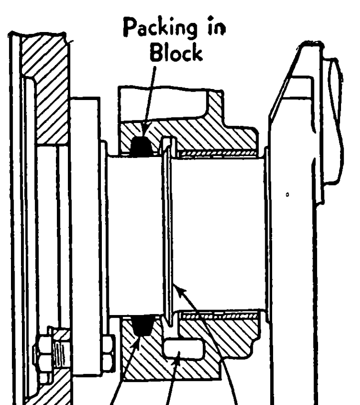


Fig. 14 R ar main b aring il seal, 1937-50 L-Head

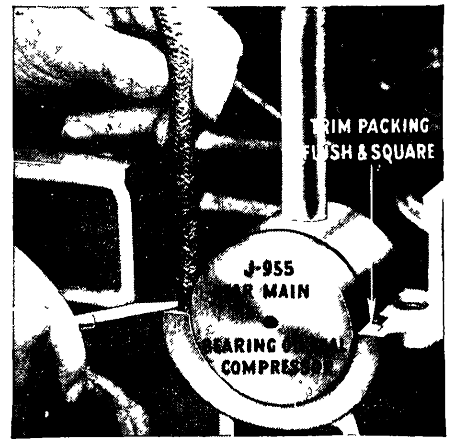


Fig. 15 Installing r ar main bearing oil seal, 1937-52

1949-52 Rocket Engines—Crankshaft end thrust is taken on the flanges of the rear main bearing shells. If end play is in excess of the limits given in the *Engine Bearing Data* table, replace the rear main bearing shells.

CRANKSHAFT REAR OIL SEAL

1935-36 — Oil sealing at the rear main bearing is controlled by an oil slinger, integral with the crankshaft, running in a groove which has a hole leading into the oil sump. The back spiral groove on the crankshaft returns any surplus oil to the sump through the oil return hole. In addition, a cork gasket is used at the vertical joint between the bearing cap and the crankcase.

1937-52—Oil sealing at the rear main bearing is controlled by a wick-type seal contacting the machined surface of the crankshaft, Fig. 14. In conjunction with the wiper, a slinger on the crankshaft, ahead of the seal, deflects oil into the oil drain, from which it is returned to the oil pan. The vertical joints between the bearing cap and cylinder block are sealed with cork strips.

If necessary to replace the packing in the upper half of the rear main bearing, follow the instructions given below for installing the packing in the lower half of the bearing.

To install, insert the packing in the groove in the bearing cap and use a smooth, rounded tool, Fig. 15, to work the packing from end to end toward the center of the cap, to force and shape the packing in the groove. Then cut off the over-lapping ends of the packing *flush* with the surface of the cap. Make sure that the packing is not pulled out of the groove when cutting off the ends.

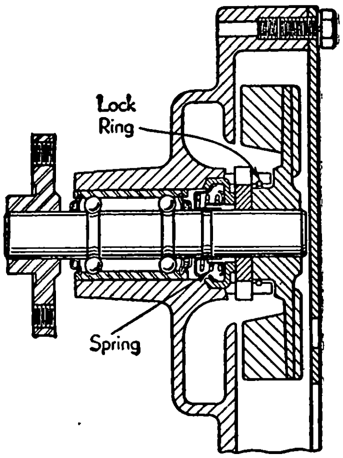


Fig. 16 Water pump, 1937-40 Sixes

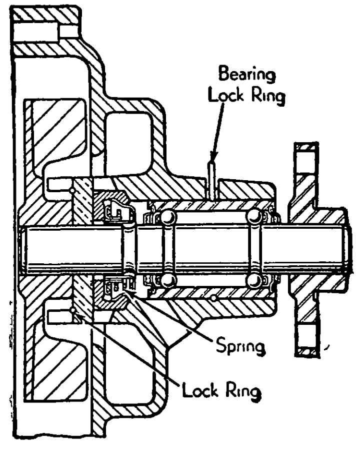


Fig. 17 Water pump, 1937-40 Eights

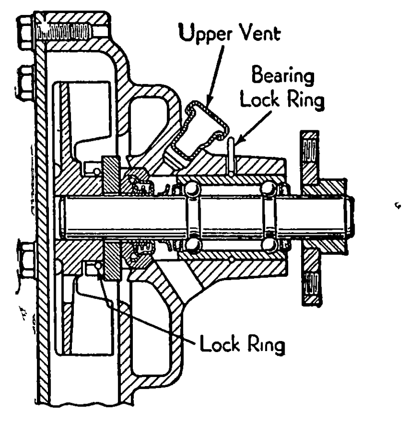


Fig. 18 Water pump, 1941-50 L-H ad

ENGINE OILING

OIL PAN REMOVAL

1936-38—To remove the pan, drain the engine oil and, as soon as the pan is empty, replace the drain plug and tighten it securely. Take out the oil level indicator and, after removing the oil pan cap screws, drop the pan on the tie rod. Lift up the oil strainer so it clears the baffle inside the pan, slide the pan toward the rear and lower it to the floor.

1939—To remove the pan, drop the steering relay rod out of position by disconnecting the pitman arm from the steering gear, and the steering idler arm support from the frame.

NOTE—The front cross member as well as the removable cross member on the Eights is provided with openings to remove some of the cap screws at the front end of the oil pan. The five cap screws ahead of the front cross member, however, may be more easily removed from the top by raising the hood and using a box socket wrench.

1940—To remove the pan, drop the steering relay rod out of position by disconnecting the pitman arm from the steering gear, and the steering idler arm support from the frame.

NOTE—The frame cross member on the Eights is provided with openings to remove some of the cap screws at the front end of the oil pan. The attaching cap screws at the extreme front end of the pan can more easily be removed if the front end of the engine is raised slightly. To do this, remove two engine mounting cap screws, engine side filler plates, and disconnect the flexible main fuel line at the fuel pump so it will not be broken or damaged.

1941 — To remove the pan, drop the steering relay rod on one side by disconnecting the idler arm support from the frame. On the Eights, remove the flywheel lower pan. On all models, the bolts around the front end of the oil pan, where not directly accessible, can be reached through openings provided in the front cross member and by unhooking the fasteners of the splash guard between the front cross member and the radiator lower baffle.

Rotate the crankshaft, either by the flywheel or starter, so that the counterweights are up out of the way. It may be necessary to remove one or the other of the engine filler plates.

1942-48 — Procedure for removing the pan on these models is the same as for 1941 except that the left engine filler plate should be loosened and the right filler plate should be removed. Moreover, the third bolt from the front on each side of the pan must be removed with an open end wrench due to interference by the front suspension cross member.

1949-50 Six Cylinder—

1. Drop steering relay rod on one side by disconnecting idler arm from frame.
2. Drain radiator and disconnect hoses.
3. Remove engine mounting bolts from front frame cross member and raise engine about ¾" to permit removal of oil pan.
4. The bolts around front end of oil pan, where not accessible directly, may be reached through openings provided in the front cross member and by unhooking the fastenings of the splash guard between cross member and radiator lower baffle. The No. 1 bolts (from the front) on each side of pan must be removed with an end wrench due to interference by front cross member.
5. Rotate crankshaft so that counterweights are up out of the way.

1949-52 Rocket Engine—To remove the pan, take off the starting motor and exhaust crossover pipe. Drop the steering relay rod by disconnecting the idler arm from the frame. Unfasten and remove pan.

OIL PUMP

1935-50 L-Head Engines—The oil pump on all engines is of the positive gear type and can be removed without disturbing any of the driving mechanism. On all models except 1935-36 Eights, the pump is located on the outside of the right-hand side of the engine. On 1935-36 Eights, the pump is located at the bottom of the oil pan and submerged in oil.

To disassemble the oil pump, press the drive gear from upper end of the pump shaft, remove pump housing cover and oil pump gears and shaft. In assembling the pump, the shaft is pressed into pump gear flush with outer end of gear on all Sixes, and within ¼" of the outer end of the gear on 1937-50 Eights. Place idler gear on stub shaft in pump body and slide pump shaft and gear assembly into place in pump housing. Put woodruff key in place on upper end of pump shaft and press pump drive gear onto shaft between inner face of gear hub and pump body. Assemble piston, relief spring and nut into place and pump cover and bolt cover to pump body, using new gaskets between pump cover and body.

It is advisable to use special tools, J-954, oil pump gear assembly plate for locating the shaft in the gear, and feeler gauge J-954 for measuring between inner face of gear hub and pump body, to obtain proper end play.

1949-52 Rocket Engines — The positive gear type oil pump is attached to the rear main bearing cap by three bolts and can be removed without disturbing any of the drive mechanism.

To disassemble the pump, release lock wire and remove screen. Take off the oil screen shroud and remove the snap ring from the extension shaft coupling. Remove the oil pump cover and take out the gears. Remove oil pressure regulator nut. spring and valve.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-36 and 1938—Remove the hood and disconnect the upper and lower hose. Unfasten the radiator brace rods; and on 1935 and 1938 cars, take off the water pump. On all models, detach the core from the support and lift it out.

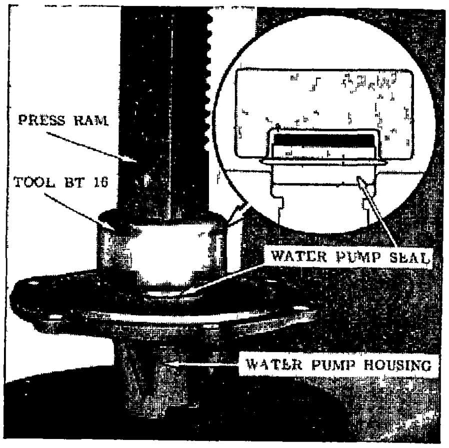


Fig. 19 Installing seal in water pump housing n 1949-52 Rocket

1937—Remove the hood and side panels. Disconnect the upper and lower hose and the headlamp wiring at the junction block Unfasten the upper shell from the core support and lift out the core.

1939 SIX—Raise the hood and disconnect the right headlamp wiring from the junction block Remove the wiring harness from the top of the core Disconnect the upper and lower hose Lift the core out from the top, turning the fan as necessary to prevent interference

1939 EIGHT—To remove the core on these models, it is necessary to lift off the radiator and front fender unit, after which remove the core from the assembly

1940-41—Raise the hood and disconnect the upper and lower hose Unclip the wiring harness from the core Disconnect the hood latch operating cable from the latch and pull the cable back through the core suport flange Remove the radiator drain cock, disconnect the core from the support and lift it out through the top

1942-50 L-Head Engines — After disconnecting the upper and lower hose, unfasten the core from the support, turn the fan as necessary to prevent interference and lift out the core

1949-52 Rocket Engines—To remove the radiator core and shroud, drain cooling system and remove upper and lower radiator hose Remove radiator upper baffle and shroud Unfasten radiator core from its support and lift it out

WATER PUMP, REMOVE

1935-50 L-Head — Remove the fan belt from the crankshaft pulley by first relieving the tension on the belt at the generator pulley Loosen and remove the cap screws which attach the pump to the cylinder block, loosen the radiator hose and take off the pump assembly.

1949-52 Rocket Engines — Remove fan and two fan pulleys Remove six water pump attaching bolts and lift off pump

When reinstalling the pump, one side of the pump bearing housing gasket should be coated with gasket cement The four bearing housing bolt threads should be dipped in a suitable sealer.

WATER PUMP, OVERHAUL

1935-36—For removal and replacement of either or both pump shaft bushings, remove the fan and press the impeller from the shaft, after which press the bushings from the pump housing Either bushing may be removed separately without disturbing the other

To assemble, press the rear bushing in first with the packing gland nut over the end of the pilot on the inserting tool (J-830) The shoulder on this tool burnishes the rear bushing to size while it is being pressed in place Screw the packing gland nut up against the pump body to prevent the bushing from backing out, then push the tool back out of the bushing Using the same tool, press the front bushing into the pump housing, using the spacer (supplied with tool) to locate the bushing properly Press the impeller on the pump shaft until the shaft is slightly more than flush with the impeller hub Assemble the pump cover and check the shaft end play by mounting a dial indicator on the housing with the indicator contacting the end of the shaft If the end play is less than 008" or more than 014', remove the cover and change the position of the impeller on the shaft until the desired clearance is obtained Install the fan and assemble the pump to the cylinder block

1937-50 L-Head — To disassemble the pump, take off the back cover plate, the pulley and the bearing lock ring from the outside of the bearing at the housing Support the outer end of the body in a press and remove the shaft and bearing assembly through the impeller

If the graphite washer and bearing seal is to be replaced, release the snap ring which retains these parts, noting the relative position of the parts when removing (see Figs 16, 17 and 18)

When assembling, the slinger should be replaced To make the installation, stand the bearing and shaft assembly upright in a press and start the brass slinger onto the end of the shaft, with the flared end of the slinger toward the bearing Using a suitable tool, press the slinger down on the shaft until there is a clearance of 025' between the slinger and the end of the bearing

Before completing the assembly of the pump, make sure that the chamfered

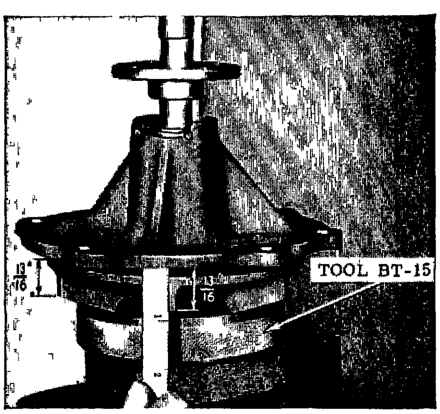


Fig. 20 Installing impeller n 1949-52 R ck t water pump

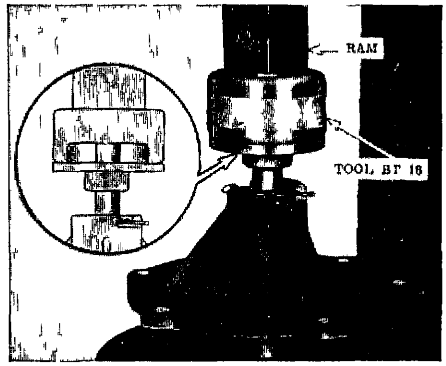


Fig. 21 Installing fan hub n 1949-52 Rocket water pump

seat for the rubber seal is not scored, and see that the seat in clean so that the seal will seat properly When installing the seal, apply a wet soap solution to the hole in the casting to facilitate assembly

When installing the shaft and bearing into the pump body, press the assembly down until the bearing lock ring snaps into position in the outer bearing race Install the impeller in position so as to obtain a clearance of 1/32" between the impeller and the end of the pump housing

1949-52 Rocket—The water pump double row bearing has one large groove in the center and two smaller grooves toward one end The end with the two smaller grooves must always be assembled into the pump housing first This end of the bearing shaft will then be at the impeller end of the pump

To assemble the pump, press the seal into the housing, Fig 19 Press the bearing into the housing until the bearing seats on shoulder in housing Install the bearing retainer spring at the front end of the housing Using the tool shown in Fig 20 to support the impeller, press the bearing shaft through the impeller until the bottom edge of the vanes are 13/16 from the machined face at edge of housing If the fan hub was removed, press the hub on the shaft, Fig 21, until the shaft bottoms in the tool shown.

ELECTRIC SYSTEM

IGNITION TIMING

1935-39 SIX; ALL 1940-50 L-Head—With the breaker gap set to the clearance given in the *Tune Up Chart,* crank the engine to bring No 1 piston up on its compression stroke and stop when the steel ball in the flywheel (IGN mark on 1935) is opposite the pointed screw at the timing hole

Locate No 1 spark plug wire on the distributor cap, place the cap in position on the distributor and mark the housing opposite No 1 terminal so that its relative position will be known when the cap is removed

With the octane selector set midway between advance and retard, loosen the distributor body clamp and rotate the

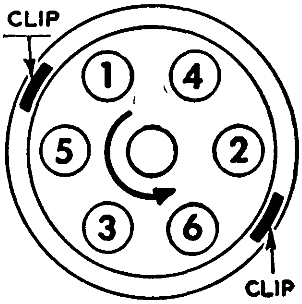


Fig. 22 1940-50 six-cylinder distribut r cap diagram

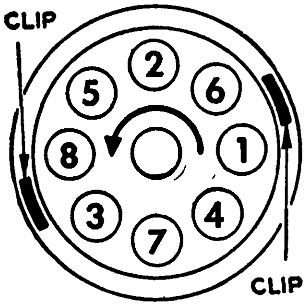


Fig. 23 1940-48 eight-cylinder distributor cap diagram

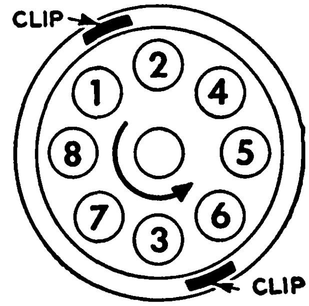


Fig. 23A 1949-52 Rocket engine distributor cap diagram

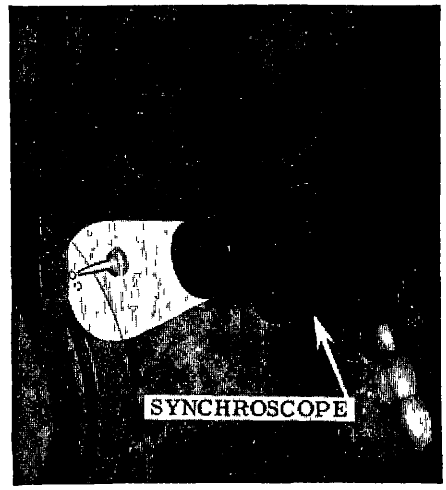


Fig. 25 Ignition timing n 1949-52 R cket

distributor until the points close. Then rotate the distributor in the opposite direction until the points just begin to open, after which tighten the clamp bolt.

NOTE—For best results, use a Neon timing light or a suitable test lamp to check the timing. Advance or retard the octane selector to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

1935 Eight—Cylinders 3, 4, 5 and 6 are fired from the stationary points and therefore, these points should open when No. 6 piston is coming up on its compression stroke and the line marked IGN-6 on the flywheel registers with the pointed screw at the timing peep hole. The adjustable points open when the line marked IGN-1 on the flywheel, a quarter revolution from the IGN-6 mark, registers with the pointed screw.

1936-39 EIGHT—Timing instructions on these models are the same as described for the Sixes except that the steel ball in the flywheel indicates the point at which No. 6 cylinder fires. Measured in piston travel, this mark is .002" before No. 6 piston reaches TDC of its compression stroke. There is no indication on the flywheel when No 1 cylinder fires.

1949-52 Rocket—When setting ignition timing, make sure that the arrow point on the distributor is in the center of the "O" position on the octane selector, Fig. 24.

Ignition timing is set by means of two brass pins, Fig. 25, in the vibration damper and a pointer in the front cover. For best results use a timing light. With the light connected to No. 1 cylinder and with engine idling, the distributor must be set so the pointer appears between the two brass pins.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-52—To adjust the free travel of the clutch pedal, loosen the lock nut on the adjustable rod and turn the link in the desired direction to obtain from 1 to 1½ inches free travel.

CLUTCH REMOVAL

1935-49 — Remove the transmission as

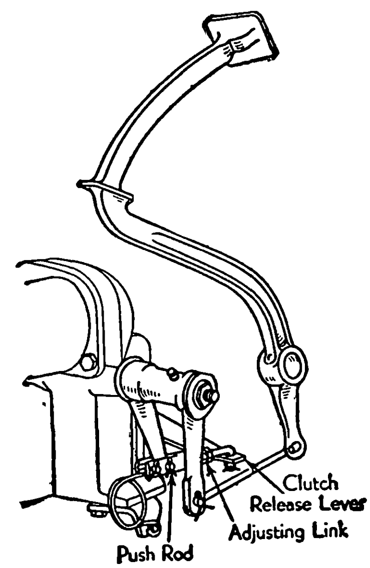


Fig. 26 Clutch pedal adjustm nt, 1937-38

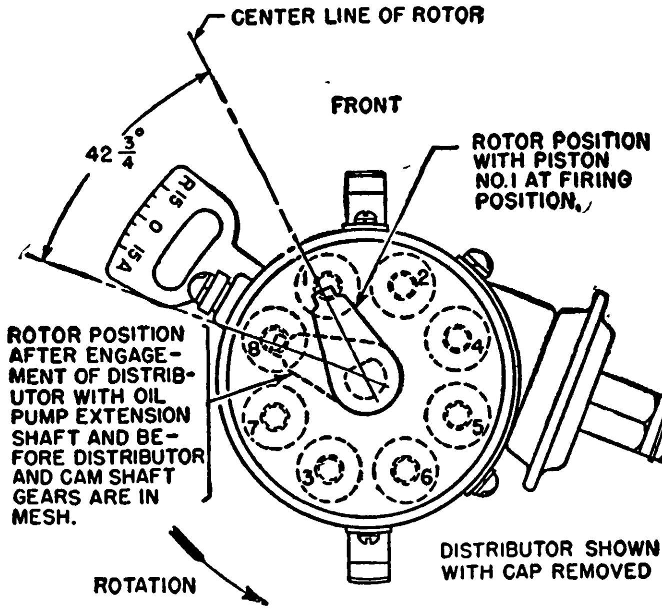


Fig. 24 Distributor detail n 1949-52 Rocket

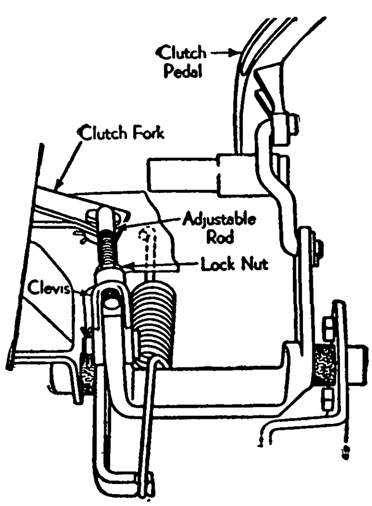


Fig. 27 Clutch pedal adjustment, 1939-52

described under that heading. Remove the clutch housing pan and mark the clutch cover and flywheel so that the clutch may be installed in the same relative position.

Loosen the clutch cover bolts gradually and evenly until the clutch spring pressure is entirely relieved. Remove the bolts and the clutch assembly may be taken out from below.

Before installing, pack grease into the crankshaft pilot bearing and clean the flywheel and pressure plate surfaces thoroughly.

Assemble the clutch to the flywheel loosely, being sure that the disc is in place with the side marked *"Flywheel Side"* toward the flywheel, and also, that the mating marks on the flywheel and clutch cover match.

The second threaded hole in the flywheel, on each side of the locating dowel, has a deeper counterbore than the others, and the cap screws having the longer shank must be installed in these holes, otherwise the clutch cannot be fastened securely to the flywheel.

Tighten the bolts gradually and evenly until all are tight. Install the transmission, and after the assembly is completed, adjust the clutch pedal free travel.

1950-52—After raising the car, proceed as follows:

1. Drain transmission and disconnect manual control rods and speedometer cable at transmission.
2. Remove clutch return spring and disconnect clutch linkage at yoke connecting link.
3. Detach drive shaft at rear universal joint and slide shaft from transmission.
4. Remove bolts holding transmission to clutch housing and remove transmission.
5. Remove right and left splash pans, engine breather pipe, and right and left rear lower flywheel housing bolts. These bolts are removed in order that the bolt holes can be used to pilot the engine support bar is one is to be utilized.
6. Install engine support bar if one is available. If not, support rear of engine with a suitable jack.
7. Remove engine rear mounting bolts at clutch housing.
8. Remove frame cross member by removing three bolts at each end.
9. Remove eight bolts which fasten clutch housing to flywheel housing and remove clutch housing.
10. Unfasten clutch from flywheel and remove clutch.
11. To install, reverse sequence of foregoing operations, lubricating clutch shaft pilot bearing with front wheel bearing lubricant and bearing surface of release levers with lubriplate.
12. Adjust clutch pedal lash and transmission shift linkage.

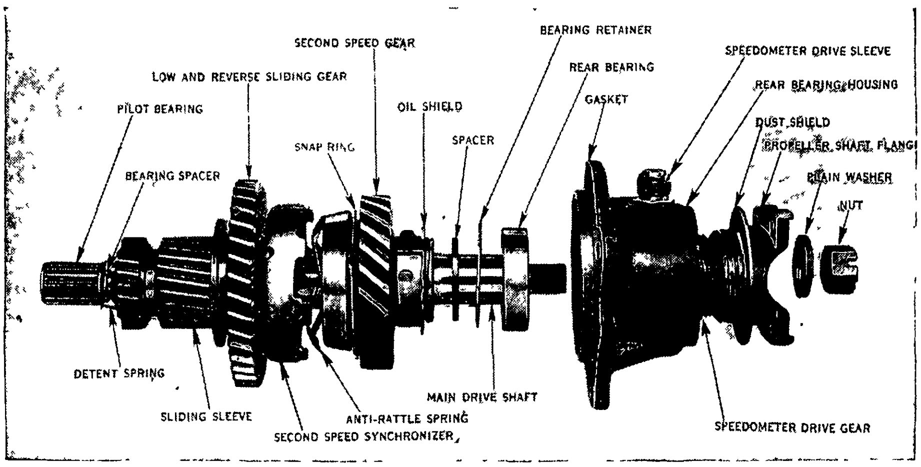


Fig. 28 Transmission mainshaft parts, 1935-38

SYNCHROMESH TRANSMISSION

TRANSMISSION REMOVAL

1935-49 SYNCHROMESH—Take out the floor board on 1935-36 cars, or the transmission floor cover on 1937-49 models. Detach the speedometer cable and remove the propeller shaft. On 1937-38 cars, unfasten the intermediate bearing support and remove, or push aside, the front propeller shaft.

On 1939 models, disconnect the shift controls as follows, removing the parts in the sequence given to prevent damage to the selector cable: Disconnect the control rod from the lever at the transmission; the selector cable from the cable anchor bracket; unscrew the cable from the end of the selector shaft, and remove the selector shaft lever and helper springs.

On 1940-49 cars, disconnect the shift control rods from the levers at the transmission.

On all models, continue the operation by removing the bolts which attach the transmission to the clutch housing and install guide studs in the top holes. Slide the transmission straight back on these guide studs until the clutch shaft is free of the clutch disc hub. Remove the assembly by lifting it out through the opening in the floor.

NOTE—Reverse the order of the above procedure to install the transmission, being sure to use the guide studs so that the assembly can be guided safely into position without damaging or bending the clutch disc. See the *Gearshift* section for the procedure for adjusting this linkage.

1950-52—After raising the car, drain the transmission and disconnect the manual control rods and speedometer cable at transmission. Detach drive shaft at rear universal joint and slide shaft from transmission. Remove bolts holding transmission to the clutch housing and slide transmission out.

TRANSMISSION, OVERHAUL

1935-38—After removing the transmission as already described, proceed as follows: Remove cover and disassemble. Place transmission in two gears to lock the mainshaft. Remove rear bearing retainer housing. Rotate housing clockwise to uncover lock for countershaft.

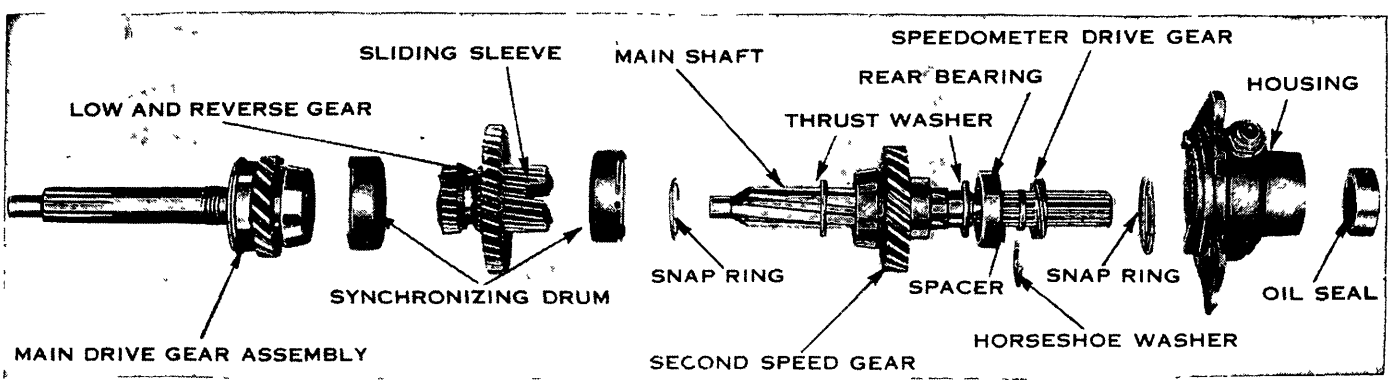


Fig. 29 Synchr mesh transmissi n main driv lin . All 1939-48 m d ls and 1949-50 Six s.

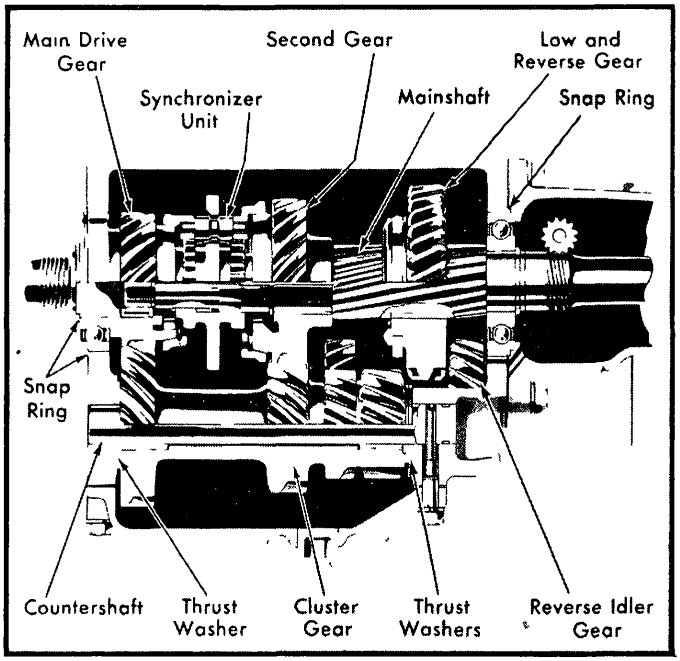


Fig. 29A 1950 V8 synchromesh transmission

Drive countershaft out rearward. Hold the low and reverse gear and draw the mainshaft assembly through rear of case. On 1935 units, pinch the prongs of the main drive gear bearing snap ring, and at the same time, tap the assembly out rearward. On other models, the snap ring has no prongs and should be removed. Lift out countershaft cluster and thrust washers. Remove idler gear and shaft. Note that the large washer on the gear is toward the front.

To disassemble the mainshaft, Fig. 28, remove the sliding sleeve and detent springs. Take out second speed synchronizing drum by releasing its snap ring. Remove transmission companion flange and bump the rear end of the mainshaft on a block of wood to loosen the rear bearing housing. Remove second speed oil sleeve and rear bearing retainer snap ring to remove the rear bearing.

To disassemble the main drive gear assembly, remove the high speed synchronizing drum snap ring, and the snap ring and spring washer which retains the main drive gear bearing. Bump the end of the shaft on a block of wood to remove the bearing.

ASSEMBLY DETAILS — Reverse the above procedure to assemble but care must be exercised to prevent scoring or bruising of any parts. The teeth of all gears should show no nicks or pitting. Bearings must turn freely and must be free from any score marks on either the races or rollers. The main drive gear should turn freely while holding the mainshaft.

Nicks in the synchronizing cones will prevent proper synchronization. If the steel cones show scoring or cutting, the synchronizing will be too severe. To prevent "lock out" when shifting gears, smooth up the steel cones with fine emery cloth, and finish with a polishing cloth, being careful not to change the cone angle. Never polish or change the angle of the bronze cones. Care must be taken to use the recommended lubricant to prevent improper synchronization from this cause. Make sure the oil grooves are clean. The bronze cones should show the heaviest contact on their large diameters for best results in synchronization. Make sure the sliding sleeve is a free fit on the mainshaft. See that the flat detent springs are not bent or broken and that they are properly positioned.

TRANSMISSION, OVERHAUL

ALL 1939-48 & 1949-50 SIXES—Fig. 29.

1. Remove transmission cover.
2. Remove helper spring and transmission shift lever bolt from left end of selector shaft.
3. Remove stamped shift lever.
4. Remove selector rod lever from left side of case.
5. Remove speedometer driven gear.
6. Remove transmission rear bearing housing and mainshaft assembly which is fastened to the transmission case by four capscrews.
7. Remove the four set screws from shifter forks and selector shaft cams.
8. Drive selector shaft through right side of transmission case, using a soft hammer. Removal of the selector shaft will push out the welch plug at the right side of the case. Do not let shifting cams drop into case.
9. Remove shift rails and forks. NOTE: it is not necessary to completely remove the shift rails to remove the shift forks. The shift rails may be pushed toward the back of the case sufficiently to allow removal of the forks and yet not require removal of the rail and poppet springs which are underneath the shift rails. The second and high speed shift rail is shorter than the low and reverse rail, and the second and high speed shifting cam is shorter than the low and reverse cam.
10. Remove low and reverse gear and sliding sleeve.
11. Remove countershaft by pushing shaft to rear of transmission, using a suitable tool to hold the needle bearings in position. Allow countershaft gear to drop to bottom of case.
12. Remove main drive gear snap ring and remove gear through rear of case.
13. Lift out countershaft gear and related parts.
14. Remove idler shaft lock pin by driving pin into idler gear. Then remove gear and shaft.
15. Remove the selector shaft oil seal only if necessary. If removed, a new one must be installed to provide an effective seal.

ASSEMBLY NOTES—Be sure that the helper spring installation is made correctly.

If removed, be sure to use new welch plugs at front end of second and high shift rail and at end of selector shaft.

When assembling transmission, fill the extension housing with a ½ pint of transmission lubricant after transmission has been assembled in car and pro-

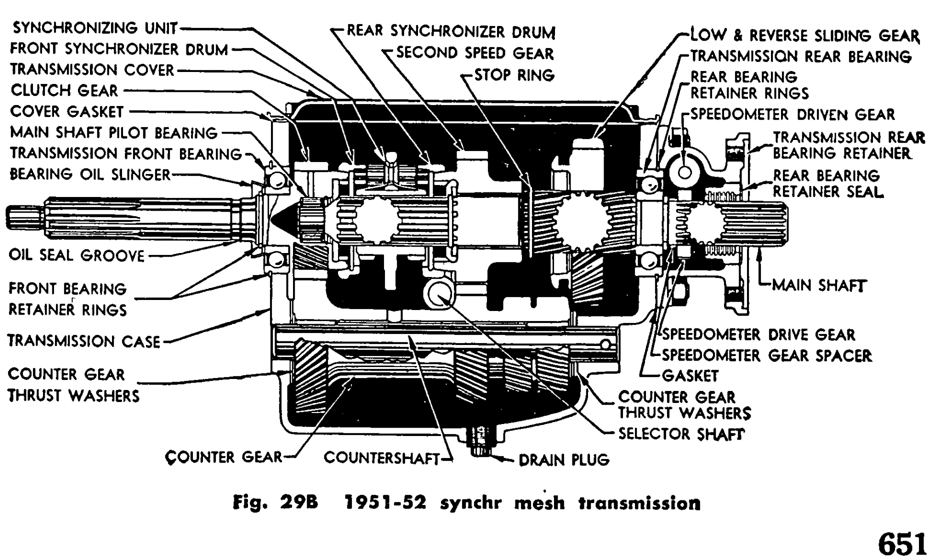


Fig. 29B 1951-52 synchr mesh transmission

peller shaft in place. This is in addition to the normal amount added to the transmission.

Hold transmission shift lever in neutral when assembling shift lever bolt in place; otherwise damage to shifting cams may result.

When assembling the idler shaft lock pin, drive it into the case until the outer end of the pin is ¾" inside the case.

TRANSMISSION, OVERHAUL

1950 V8—Fig. 29A

1. Remove transmission cover.
2. Remove speedometer driven gear and sleeve assembly.
3. Unfasten and slide rear bearing retainer from mainshaft.
4. Push countershaft from case, using a suitable tool to hold needle bearings in place while the cluster gear, washers and bearings are lifted out.
5. Pull mainshaft to rear of transmission case and place low and reverse shifter lever in reverse (by pushing lever forward) so that mainshaft can be pulled back as far as possible.
6. Remove Phillips head screw and snap ring which secure and position clutch shaft bearing to front of transmission case.
7. Pull end of mainshaft to one side and slightly upward (with transmission upside down) in order to make room for the clutch shaft to be removed through the case. NOTE: In removing and replacing clutch shaft, special care should be exercised to avoid damage to the pilot on the front of the mainshaft which acts as the inner race of the bearing between clutch shaft and mainshaft.
8. Slide synchronizer drum from mainshaft after disengaging second and third (front) shift fork.
9. Push mainshaft back into place with bearing in case so that snap ring holding second speed gear to mainshaft can be removed.
10. Pull mainshaft from case, sliding second speed gear and low and reverse gear from shaft.
11. Remove second speed gear from case.
12. Place low and reverse shift lever in neutral, disengage shift fork from low and reverse gear, remove shift fork from lever and lift gear from case.
12. Start removal of idler shaft by pushing it from the case with a suitable drift, then finish removal by pulling shaft from case.
13. Lift idler gear and two washers from case.
14. Flatten lock plates and loosen bolts holding the two shift levers to the case. Remove levers and shift fork shafts.
15. Remove shift fork shaft seals.

ASSEMBLY NOTES—Reverse the sequence of the foregoing procedure to assemble the transmission, and observe the following:

Be sure shift levers do not bind in transmission case when installed.

The reverse idler gear must be installed with the chamfered teeth toward the rear. Be sure a thrust washer is located at each end of gear.

Install a new snap ring on mainshaft to hold second speed gear in place.

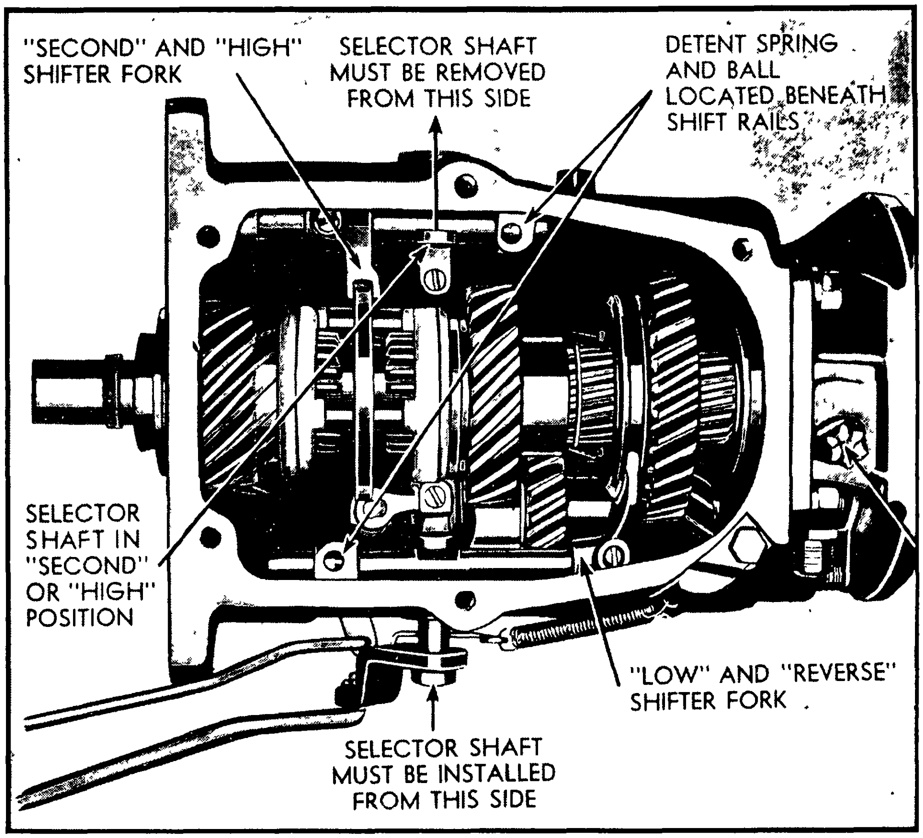


Fig. 29C 1951-52 synchromesh transmission

A bronze and steel washer are used at the rear of the cluster gear and a bronze washer only is used at the front. The two bronze washers may be identified by the fact that the front washer has a lip which fits into a groove in the transmission case.

The two lower rear bearing retainer bolts (with transmission case right side up) must be sealed with Permatex to avoid leakage at this point.

When installing the cover, the two longer bolts which secure the idler and cluster gear shafts must be sealed with Permatex.

TRANSMISSION, OVERHAUL

1951-52—Figs. 29B and 29C.

1. Thoroughly clean all dirt from exterior of transmission to avoid getting dirt into bearings when transmission is opened.
2. Remove transmission cover and gasket, toggle spring, spring clip and spring extension.
3. Remove speedometer driven gear, then remove rear bearing retainer and gasket.
4. Place transmission in second gear, move mainshaft back until rear bearing is clear of case, and disengage shift yoke from synchronizer. Then lift front end of mainshaft enough to remove synchronizer from shaft. Note that the counterbored end of the synchronizer must face the second speed gear when replaced.
5. Remove snap ring holding second speed gear to mainshaft. Remove thrust washer after lining up small wire spacer ring installed in bottom of snap ring groove with thrust washer key, then remove second speed gear from mainshaft.
6. Remove snap ring holding low and reverse gear to mainshaft.
7. Slide low and reverse gear off mainshaft while pulling shaft out through rear of transmission case.
8. Place transmission levers in neutral and remove set screws holding shifter yokes and levers to their respective shafts. NOTE: Each yoke shaft is in neutral position when the notch for the shifter lever is directly above the selector shaft.
9. Slide shift lever and interlock away from second and high yoke shaft, then remove interlock retainer from groove in right end of selector shaft.
10. Remove outer shift lever and lock washer from left end of selector shaft and, after making sure transmission is still in neutral, depress inner selector lever and drive the shaft out through the right side of the transmission, using a soft hammer. NOTE: The welch plug in right side of case will be driven out by the shaft. Do not allow shift levers and interlock to drop into case.
11. Push second and high speed yoke shaft out through front of case, taking care to prevent poppet ball and spring from flying out. Remove shift yoke, ball and spring.
12. Taking care to prevent poppet ball and spring from flying out, push low and reverse yoke shaft out through rear of case. Remove poppet ball, spring and low and reverse interlock pin.
13. Drive countershaft lock pin into the shaft, then drive shaft out

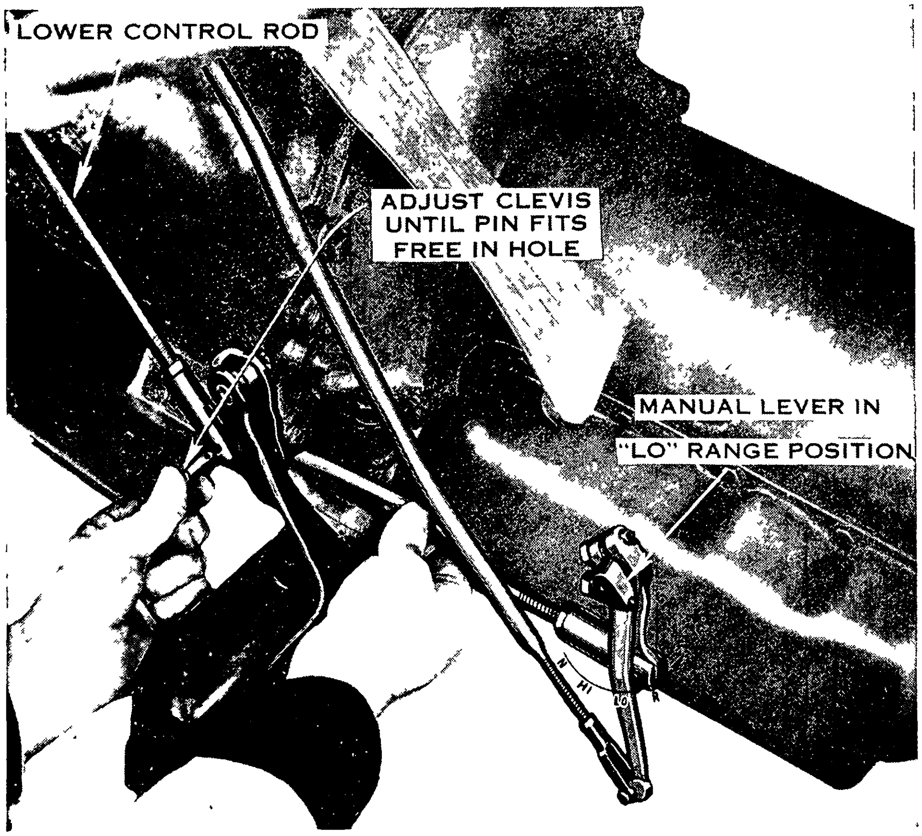


Fig. 31 Adjusting Manual control rod, 1940-52 Hydra-Matic

through rear end of case, using a suitable tool to hold needle bearings and washers in place. Allow cluster gear to rest on bottom of case.

14. Remove snap ring from main drive gear bearing and tap drive gear and bearing toward rear of transmission to remove.
15. Carefully raise cluster gear out of case so that related parts remain in gear.
16. Remove transmission outer selector lever, lock washer and nut; then remove inner lever and shaft, spring washer, flat washer, and oil seal from case.
17. Drive reverse idler gear shaft lock pin into the shaft, then remove shaft, gear and thrust washers.

ASSEMBLY NOTES—Reverse the order of the foregoing procedure to assemble the transmission, observing the following:

Install the reverse idler gear so that the chamfered teeth is at the rear of the case The idler gear shaft is ground slightly larger at one end in order to form a positive seal at the rear end of the transmission case. Make sure that this end of the shaft is at the rear when replaced and that the small hole in the opposite end lines up with the lock pin hole in the case. Install a new lock pin coated with white lead or other sealing compound to prevent leaks. Drive lock pin 1" below surface of boss on case.

When installing the cluster gear and related parts, note that a small diameter bronze washer and a steel washer are used at the rear of the gear (bronze washer next to gear) and a larger bronze washer (only) is used at the front. When countershaft is installed, install a new lock pin coated with white lead or other suitable sealing compound to prevent leaks. Drive pin flush with surface of transmission case.

After shift yoke shafts are installed, install a new welch plug coated with white lead or other sealing compound in right side of transmission case.

After installing second speed gear on mainshaft and, after lining up the small wire spacer ring in bottom of mainshaft snap ring groove with spline which is machined *part way* onto the ground second speed gear bearing surface, install second speed gear thrust washer and snap ring. Note that one spline is machined the entire length of the second speed gear bearing surface on the mainshaft. This full spline is for lubrication purposes and should not be obstructed by the thrust washer key.

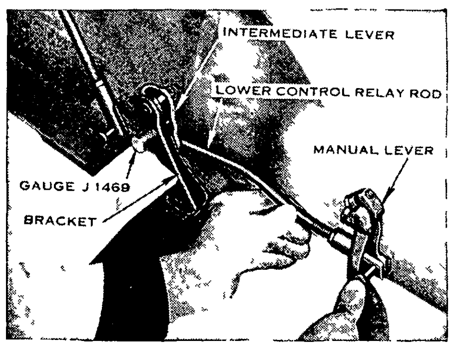


Fig. 30 Adjusting manual control relay rod, 1946-52 Hydra-Matic

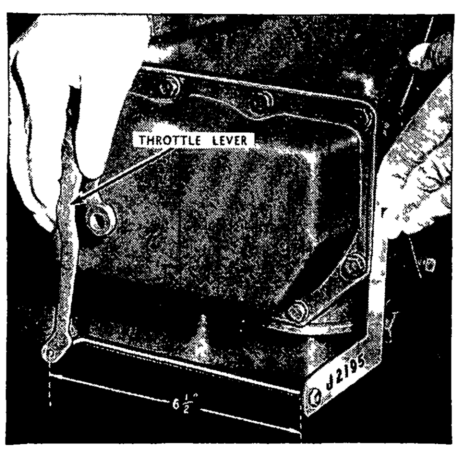


Fig. 32 Checking transmissi n thr ttle l ver, 1941-52 Hydra-Matic

HYDRA-MATIC DRIVE

1940-52—A step-by-step pictorial procedure for servicing the Hydra-Matic Drive is given in a special chapter elsewhere in this book The following material covers external adjustments.

MANUAL CONTROL ADJUSTMENT

1940-52—See Figs. 30 and 31 and proceed as follows:

1. Loosen the two clevis lock nuts on the lower control relay rod and take out the two clevis pins and spring washers.
2. Move transmission manual control lever all the way back into reverse position. To insure lever being in extreme reverse position, rotate propeller shaft by hand until engagement of anchor is felt and lever is against stop.
3. Move intermediate lever, Fig. 30, until gauging hole is in line with hole in bracket. Insert the proper aligning tool through gauging hole in lever and bracket.
4. With transmission manual lever held all the way back, adjust clevis so pin just slips freely through clevis and lever.
5. Assemble pin, spring washer and cotter pin and tighten check nut. Remove gauging tool.
6. Now move the manual lever on the transmission, Fig. 31, into the "LO" range position. To find the "LO" range position, move the lever all the way forward to the neutral position. Then move the lever back again to the second detent.
7. Place upper (selector) lever against stop by pulling down on the lower control rod until the stop is felt.
8. With the levers in the above positions, adjust the clevis of the lower control rod so that the clevis pin slips in freely, Fig. 31.
9. Remove the clevis pin and lengthen the rod one full turn of the clevis from this position. Assemble clevis pin, spring washer, cotter pin and tighten lock nut.

THROTTLE CONTROL ADJUSTMENT

1941-48 — Place the gauge, Fig. 32,

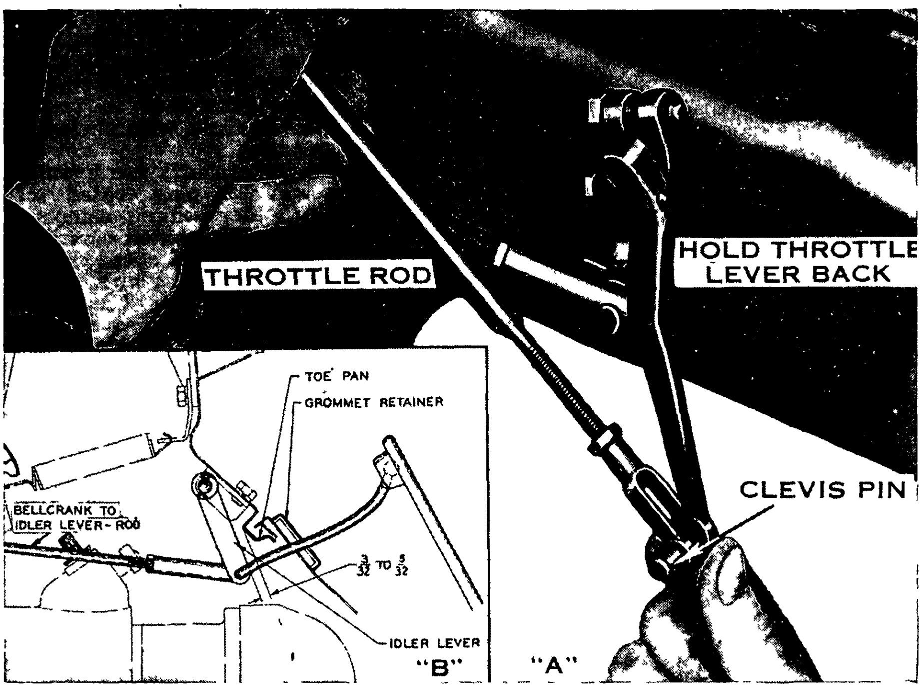


Fig. 33 Adjusting throttle rod, 1941-48 Hydra-Matic

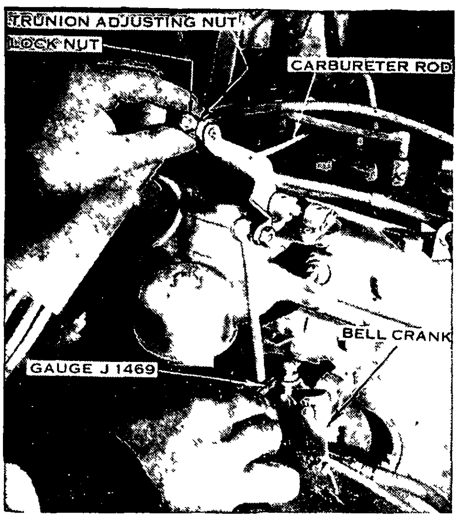


Fig. 34 Adjusting carburetor rod, 1941-48 Hydra-Matic

against the machined surface at the back of the transmission and position the gauge rod so that its tip enters the hole in the throttle lever while the lever is held against the stop in the transmission. If the rod will not enter the hole, remove the lever and bend the required amount. Replace the lever, tighten the clamp bolt and again check for the correct position of the hole.

NOTE—Always remove the lever when bending. This will prevent possible damage to the valve body or mispositioning of the inner throttle lever.

To adjust the throttle control, first be sure the engine idles at 375 RPM. Then with the transmission in neutral, remove the spring lock from the trunnion, Fig. 33, and loosen trunnion lock nut. Adjust the length of the carburetor rod by means of the trunnion adjusting nut until the pin gauge (J-1469) slips freely through the holes in the bell crank and indexing plate, Fig. 34. Tighten the trunnion check nut. Tightening the check nut may change the alignment of the gauging holes. Therefore, with the check nut tight, if the gauging pin cannot enter the holes freely, loosen the check nut and lengthen the rod one-half turn. Tighten the nut and recheck the alignment of the holes.

Check the carburetor rod for free movement both in the idle and full throttle positions. Replace the trunnion spring lock.

Disconnect the throttle rod from the throttle lever at the transmission, Fig. 33, and hold the throttle lever all the way back against the stop. With the carburetor held on slow idle, adjust the clevis until the pin slides freely through the holes in the clevis and throttle lever. Then shorten the throttle rod by one full turn and connect it to the throttle lever.

Adjust the accelerator pedal rod so that the idler lever will have from $\frac{3}{32}$ to $\frac{5}{32}$ inch clearance between the idler lever and the rib in the body toe pan (inset Fig. 33). This clearance will permit proper position of the accelerator pedal for foot comfort and will correct the clearance so the carburetor can return to slow idle.

THROTTLE CONTROL ADJUSTMENT

1940—This adjustment should be made with the engine running at 375 RPM. To make the adjustment, disconnect all the throttle rods at the adjustable ends: namely, carburetor-to-bell crank rod, bell crank-to-cross shaft rod and cross shaft-to-transmission rod. The carburetor must be held in the slow idle position while adjusting the rods. This can be done with a heavy rubber band, permitting both hands to be free.

Using gauge J1468 as shown in Fig. 35, the trunnion on the carburetor rod must be adjusted and, when held fully in position in the carburetor, the lever must just touch the carburetor-to-bell crank rod at points "A" and "B" in the illustration. When correct, remove the gauge, tighten the trunnion check nut, assemble the spring over the rod and replace the cotter key.

Now place gauge No. J-1470 on the lever at the right side of the throttle cross shaft. Note that the gauge is marked "6" and "8," and when an adjustment is made on either of these models, be sure to use the proper section of the gauge. The clearance between the toe pan and the lever is ⅜″ on the "90" series and $\frac{5}{16}$″ on the "60" and "70" series. Hold the bell crank-to-cross shaft lever all the way back to be sure the gauge is touching the toe pan. Hold the carburetor in the slow idle position and adjust the trunnion on the bell crank-to-cross shaft rod so it enters freely. When correct, tighten the check nut, install the cotter key and remove the gauge.

Now rotate the throttle cracker lever on the left-hand end of the cross shaft upward to obtain wide-open throttle and full over-travel of the throttle cross shaft. Then adjust the wide open stop screw so it just contacts the stop on the cross shaft bracket, after which tighten the lock nut.

Allow the cross shaft to return to slow idle position, being sure the carburetor is again held in the slow idle position. Then hold the throttle lever on the side of the transmission against the idle stop (all the way back) in the transmission and adjust the cross shaft-to-transmission rod so that the clevis pin slips freely through the clevis and lever; shorten the rod by one full turn of the clevis from this position, after which install the clevis pin, tighten the check nut and slip in a cotter pin. Finally, run the engine and check for free throttle control and positive return to slow idle.

THROTTLE CONTROL ADJUSTMENT

1949 Six (First Type)—With engine idle set as 375 RPM, see Fig. 36 and proceed as follows:

1. Remove clevis pin and clevis from throttle lever (A) at side of transmission. Bend lever as required so small end of tool (see Fig. 32) will just enter hole in lever while flat of tool is held against rear face of transmission and throttle lever held back against its stop. Do not assemble clevis and pin.

2. With carburetor at slow idle position, bend throttle rod (B) so that gauge holes in bell crank (C) and indexing plate (D) are aligned and gauge rod enters holes freely. Remove gauging rod.

3. With carburetor at slow idle position, hold throttle lever (A) against stop. Adjust clevis so clevis pin slides freely through clevis and lever (A). Shorten rod by one full turn of clevis. Replace pin and tighten jam nut.

4. Remove accelerator spring and clevis pin from rod (E) so that gauge rod enters holes freely in cross shaft bracket (F). Replace clevis pin and tighten jam nut. Remove gauging rod.

5. Remove clevis pin from rod (G).

Advance carburetor to wide open position and hold down on accelerator rod (G) lightly so that accelerator pedal stop touches floor mat. Be sure floor mat is flat against floor cover. Adjust rod (G) so clevis pin enters holes in clevis and lever (F). Shorten clevis by six full turns. This will provide about ¼″ clearance between stop on pedal and floor mat when carburetor is in wide open position. Install clevis pin and spring.

6. Adjust throttle cracker screw (H)

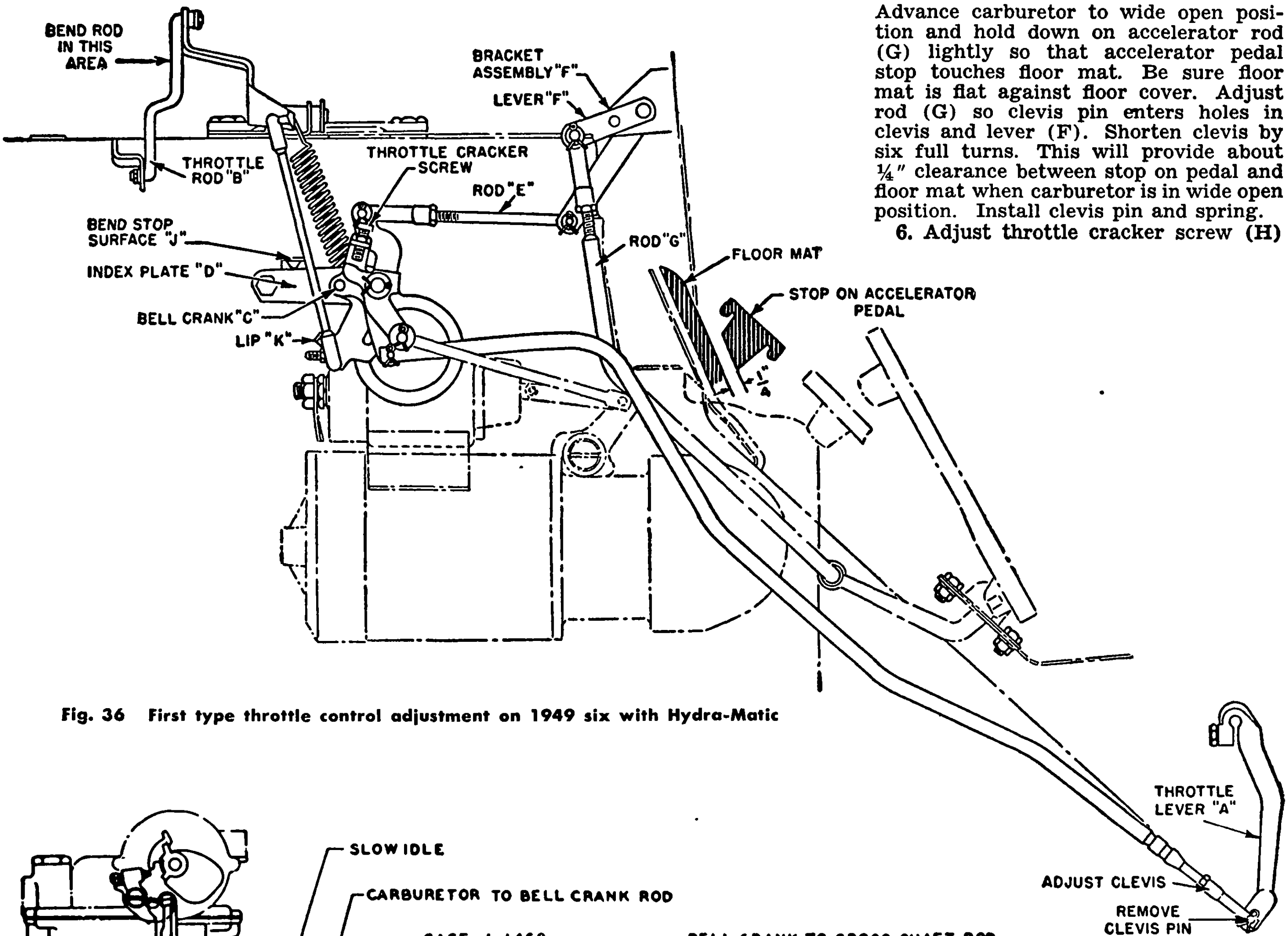


Fig. 36 First type throttle control adjustment on 1949 six with Hydra-Matic

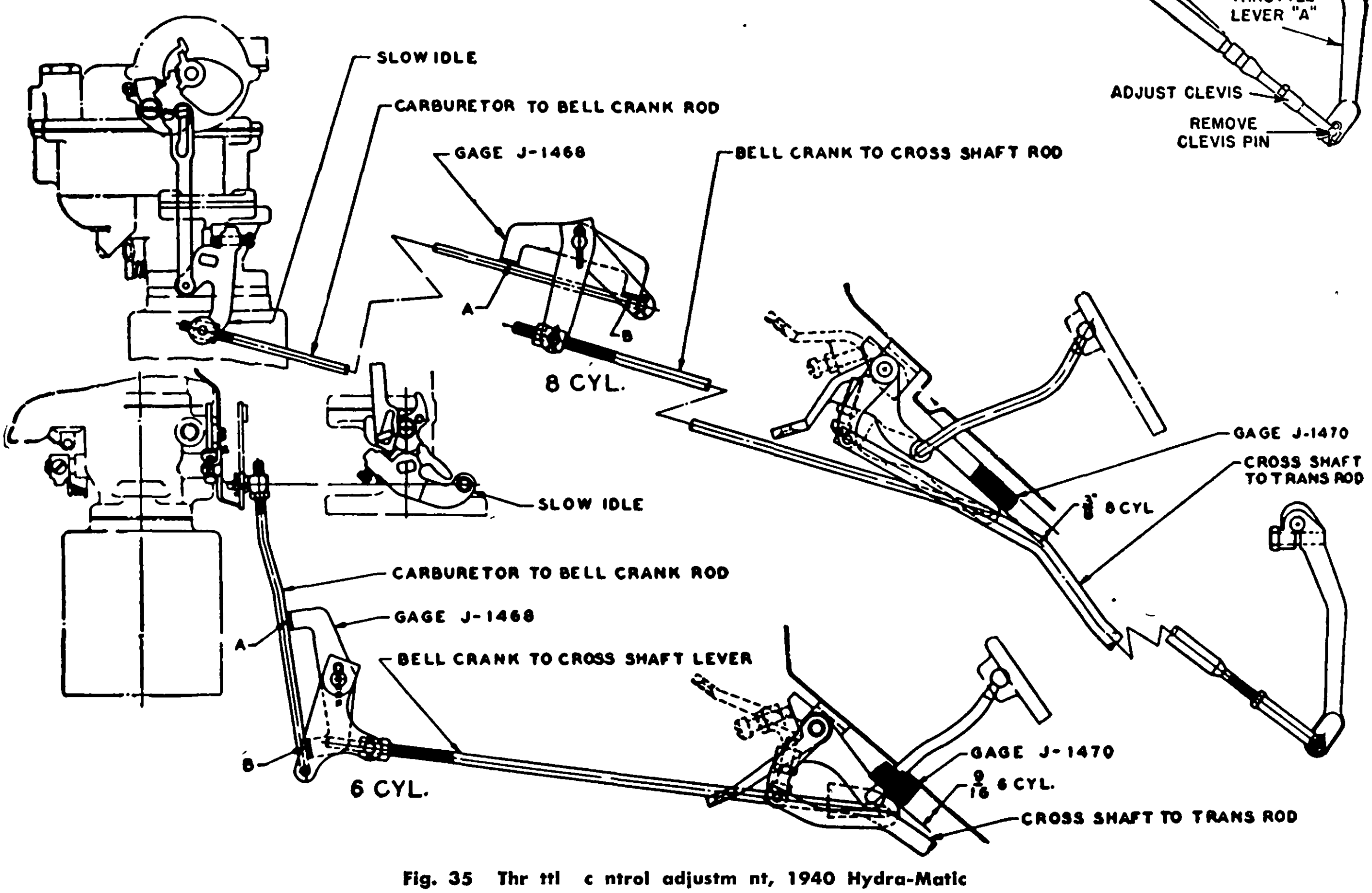


Fig. 35 Thr ttl c ntrol adjustm nt, 1940 Hydra-Matic

to obtain .062" to .085" clearance between idle adjusting screw and high step of fast idle cam when starting motor is fully engaged. Disconnect coil to distributor wire when making this adjustment.

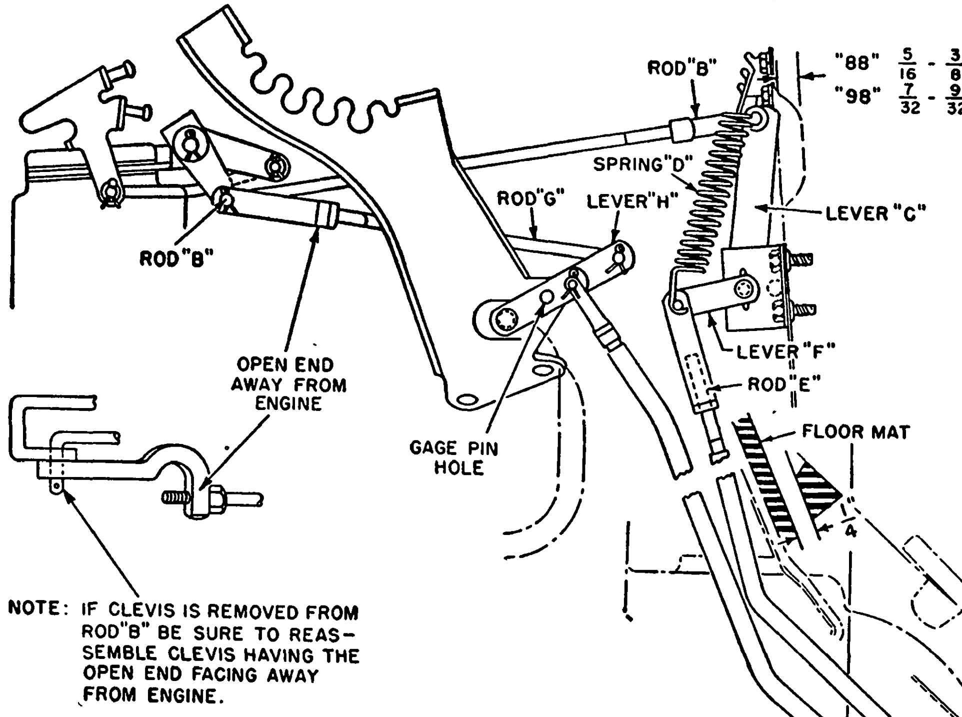
7. Bend stop surface (J) on indexing plate to obtain $\frac{1}{32}$" to $\frac{1}{16}$" clearance between stop plate and lip on bell crank (K), when bell crank is stopped by transmission throttle lever at its full open position.

1949 V8 (First Type)—With engine adjusted to 375 RPM, see Fig. 37 and proceed as follows:

1. Remove clevis pin and clevis from throttle lever (A) at side of transmission. Bend lever as required so small end of tool (see Fig. 32) will just enter hole in lever while flat of tool is held against rear face of transmission and throttle lever held back against its stop. Do not assemble clevis and pin.

2. Remove clevis pin from rod (B). With carburetor at slow idle position, adjust rod (B) to obtain $\frac{5}{16}$" to $\frac{3}{8}$" clearance on "88," or $\frac{7}{32}$" to $\frac{9}{32}$" on "98" model, between dash depression and right hand lever (C). Reassemble clevis to lever.

3. Remove spring (D) and clevis of rod (E) from pin in lever (F). Hold carburetor wide open. Hold accelerator down on floor mat lightly. Do not push down on rod. Be sure floor mat is flat against floor cover. Then adjust clevis so it just slides over pin welded in lever (F), then shorten clevis by six full turns. This will provide approximately ¼" clearance between stop on pedal and floor mat when carburetor is in wide open position. Install clevis and spring. When final adjustment is made, be sure to assemble clevis with open end facing toward center of engine.



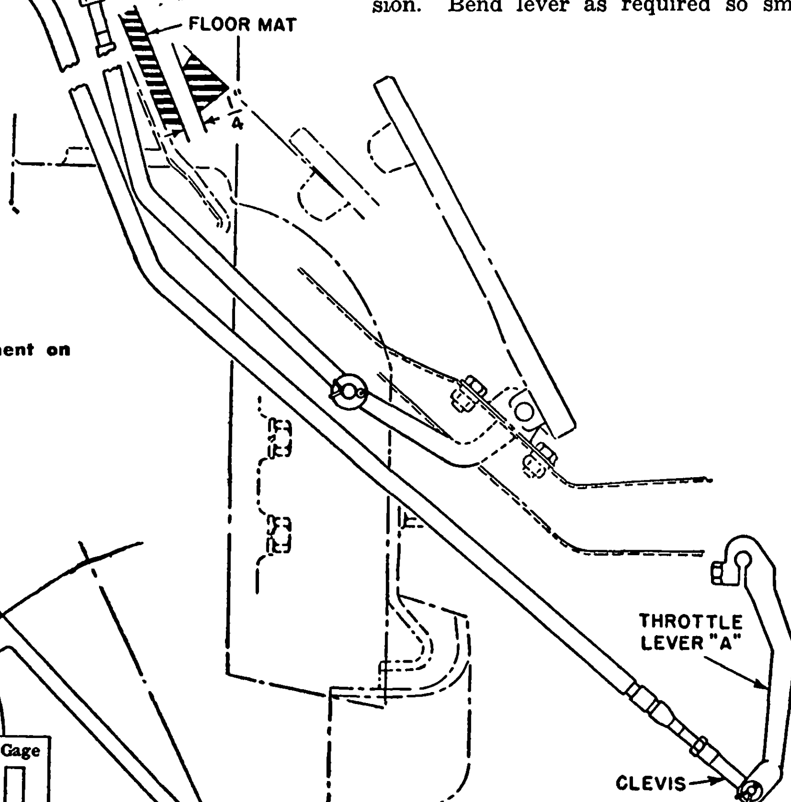


Fig. 37 First type throttle control adjustment on 1949 V8 with Hydra-Matic

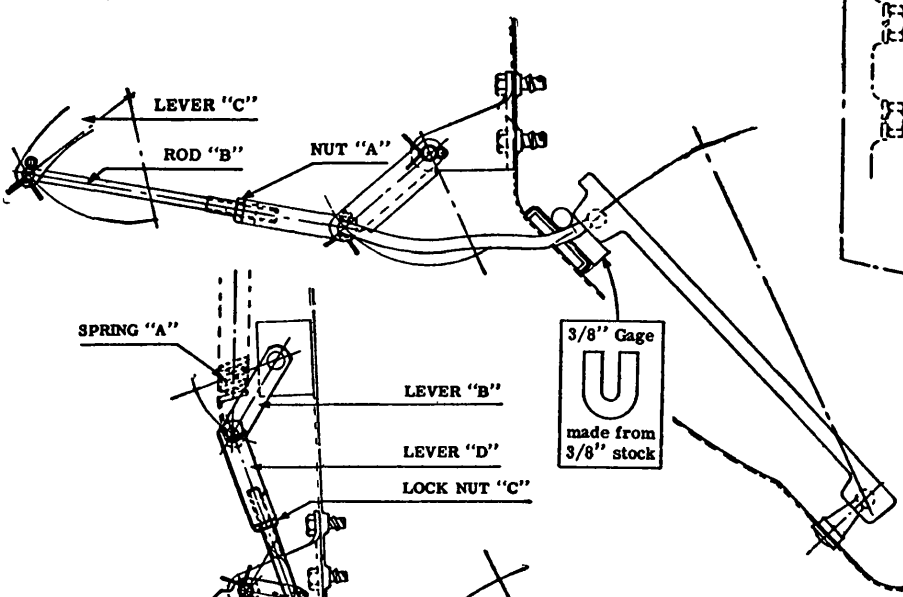


Fig. 37A Second type throttle control adjustment. 1949 Six-cylinder Hydra-Matic models

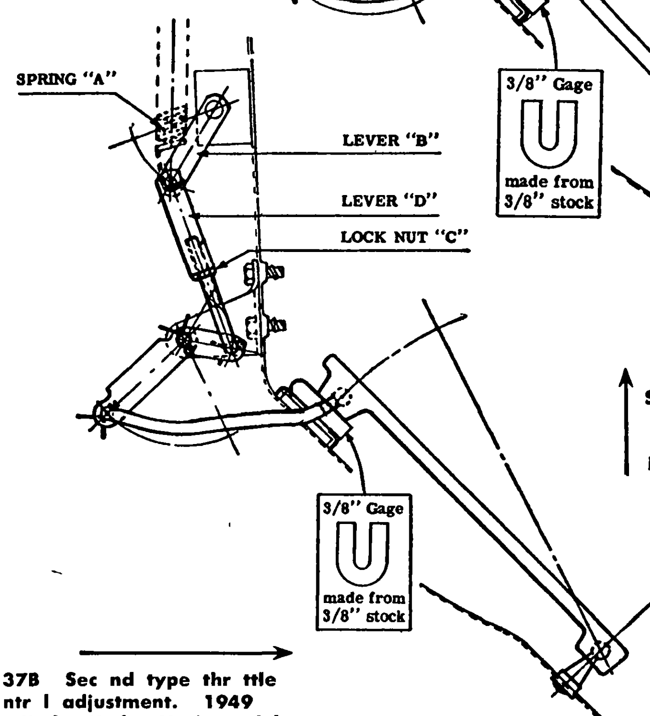


Fig. 37B Sec nd type thr ttle c ntr l adjustment. 1949 Eight-cylinder Hydra-Matic m d ls

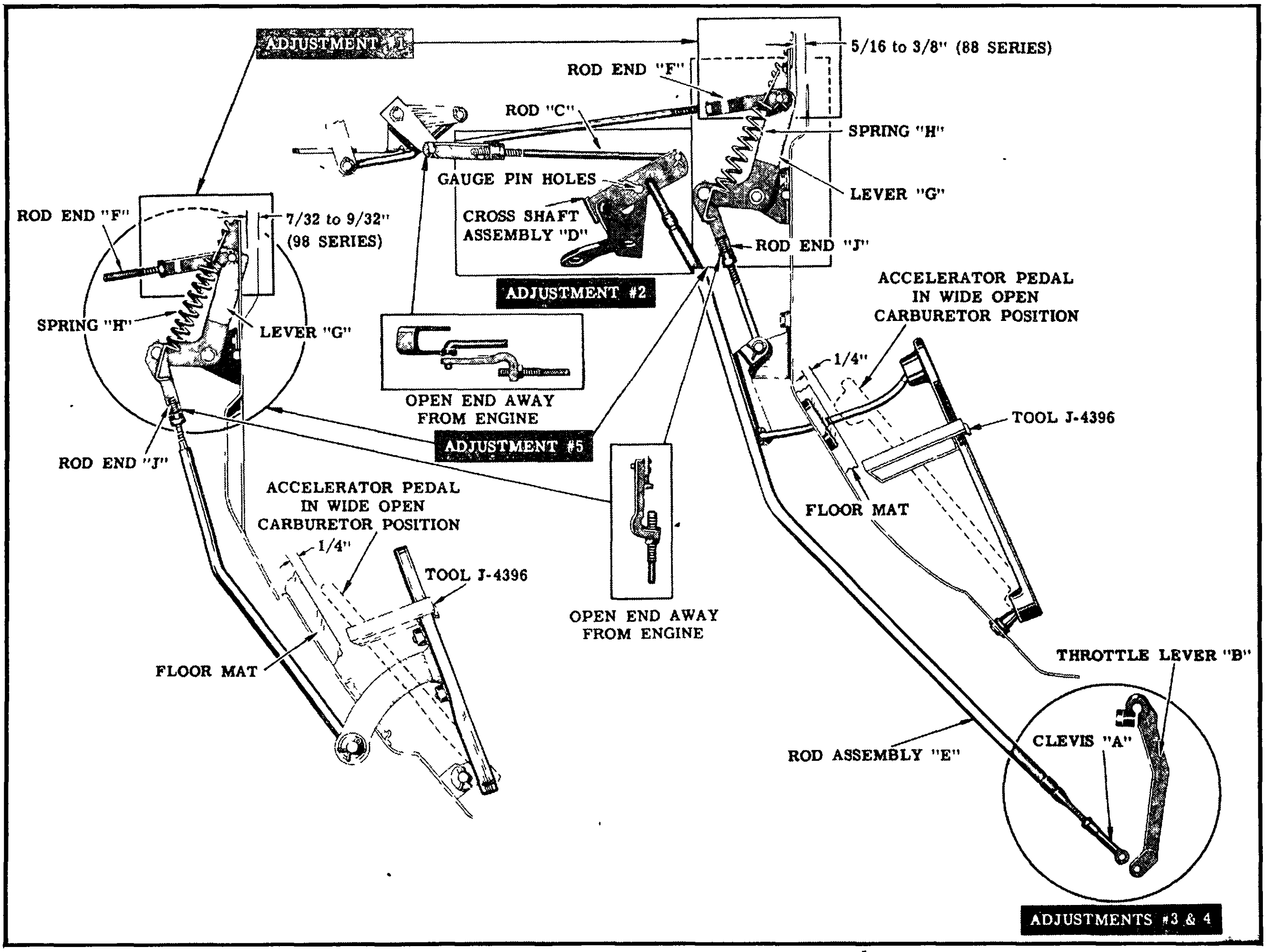


Fig. 37D 1950-52 V8 Hydra-Matic throttle control adjustment

4. Remove rod (G) from lever (H). Install a gauging rod through hole in lever (H) and bracket. Adjust rod (G) so it enters lever (H) freely while carburetor is held in slow idle position. Install rod and tighten jam nut. Remove gauging rod. If clevis is removed from rod (B) be sure to assemble clevis having the open end facing away from engine.

5. With carburetor at slow idle position, hold lever (A) against stop. Adjust clevis so pin slides freely through clevis and lever (A). Shorten clevis by one full turn. Replace clevis pin and tighten jam nut.

NOTE—To start V8 engines when cold, press accelerator to floor *once* and release in order to set the fast idle, then turn on ignition and press starter button. To start these engines when hot, press the accelerator about ⅓ open and hold in this position, then turn on ignition and press starter button.

THROTTLE CONTROL ADJUSTMENT

1949 Second Type — A new throttle control that incorporates a stud design mounting for the accelerator pedal went into production about September 1, 1949. The new throttle control changes the accelerator rod adjustment slightly over the first type.

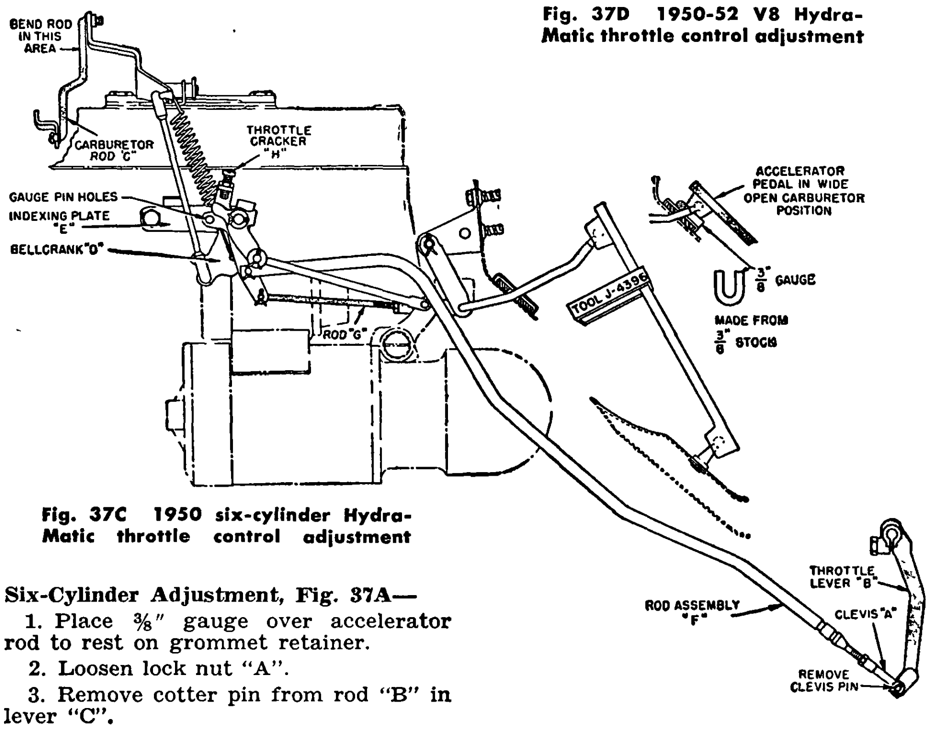


Fig. 37C 1950 six-cylinder Hydra-Matic throttle control adjustment

Six-Cylinder Adjustment, Fig. 37A—

1. Place ⅜" gauge over accelerator rod to rest on grommet retainer.
2. Loosen lock nut "A".
3. Remove cotter pin from rod "B" in lever "C".

4 Remove rod from lever
5 Hold carburetor wide open
6 Pull rod "B" forward until pad on accelerator rests on gauge
7 While holding rod and lever out in this position, adjust rod so it just enters hole in lever
8 Install cotter pin, tighten lock nut and remove gauge

Eight-Cylinder Adjustment, Fig. 37B—
1 Place ⅜" gauge over accelerator rod to rest on grommet retainer
2 Remove spring "A" from pin in lever "B"
3 Loosen lock nut "C".
4 Lift lever "D" from pin
5 Hold carburetor wide open
6 Hold rod end down until accelerator pad rests on gauge
7 While holding rod and lever in this position, adjust rod end so it slides over pin in lever
8 Reinstall spring over pin, tighten lock nut and remove gauge

THROTTLE CONTROL ADJUSTMENT

1950 SIX—Before throttle adjustments are made, engine idle must be set as follows (a) Position safety lock tool (J-4396) on accelerator pedal to prevent accidentally racing engine (b) Apply hand brake firmly (c) Start engine and allow it to warm up until carburetor returns to slow idle position (d) Place selector lever in "DR" position (e) Adjust engine idle to 350 rpm (f) Return selector lever to "N" position Then make the adjustments as follows and in the order given, referring to Fig 37C

Adjustment No. 1—Remove clevis pin and clevis "A" from transmission throttle lever "B" With use of Tool J-2029 bend lever so that small end of Tool J-2195 (Fig 32) will just enter hole in lever while flat face of tool is held at rear face of transmission case and lever is back against its stop

Adjustment No. 2—With carburetor at slow idle position, bend carburetor rod "C" with bending Tool GA-38 so that gauge holes in bellcrank "D" and indexing plate "E" are aligned and gauge pin enters holes freely

Adjustment No. 3—Hold transmission throttle lever "B" in its rear position against stop and adjust clevis "A" so that holes in clevis and lever are aligned and the clevis pin enters holes freely Then remove clevis pin and shorten rod assembly "F" by one full turn of the clevis Replace clevis pin and cotter pin, and tighten clevis jam nut

Adjustment No. 4—Remove cotter pin from rod "G". Hold carburetor wide open Pull rod "G" forward until accelerator pad rests on gauge Adjust rod "G" so it enters hole in lever Floor mat must be away from grommet retainer when the adjustment is made

Adjustment No. 5—Adjust throttle cracker screw "H" to give 062" to 085" clearance between idle adjusting screw and high step on fast idle cam when starting motor is fully engaged Disconnect lead from coil to distributor while making this adjustment.

THROTTLE CONTROL ADJUSTMENT

1950-52 V8—Before making the adjustments, set engine idle in the same manner outlined for 1950 Six-Cylinder models Then refer to Fig 37D and proceed as follows.

Adjustment No. 1—Adjust rod "F" to give $\frac{7}{32}$" to $\frac{9}{32}$" clearance on "98" models and $\frac{5}{16}$" to ⅜" clearance on "88" models between dash depression and lever "G" when lever and rod end are assembled and carburetor is at slow idle

Adjustment No. 2—With carburetor at slow idle, adjust rod "C" so that the two gauge holes in cross shaft "D" are aligned and gauge pin BT-25 enters holes freely Assemble cotter pin and tighten jam nut NOTE· Rod "E" must be disconnected at transmission when this adjustment is made Clevis on rod "C" should be assembled with open end facing away from engine

Adjustment No. 3—With clevis pin removed from throttle lever "B" at side of transmission, use Tool J-2029 to bend lever so that the small end of Tool J-2195 (Fig 32) will just enter hole in lever while flat face of tool is held at rear face of transmission case and lever is back against its stop

Adjustment No. 4—With carburetor on slow idle, hold transmission throttle lever "B" in its rear position against stop and adjust clevis "A" so that holes in clevis and lever are aligned and clevis pin enters holes freely Then remove clevis pin and shorten rod "E" by one full turn of the clevis Replace clevis pin and cotter pin, and tighten clevis jam nut

Adjustment No. 5 — Remove return spring 'H and adjust rod end "J" to give ¼' clearance between floor mat and pedal when throttle linkage is assembled and pedal is depressed to wide open carburetor position NOTE Be sure to assemble clevis on rod end "J" with open end facing toward center of engine when final adjustment is made

GEARSHIFT

SHIFT SELECTOR, ADJUST

1939—Fig 38. The selector cable adjusting nuts (at the cable anchor bracket, steering column end) determines the vertical distance between the hand control lever and the steering wheel With the transmission in neutral, this dimension should be from $2\frac{7}{16}$' to $2\frac{9}{16}$", Fig 39, and is obtained by turning the two adjusting nuts to lengthen or shorten the control shaft and cable

1940-48—Before making the adjustment, the selector rod must be assembled in place between the lower control lever and the transmission, and with the gears in neutral

To make the adjustment, Fig 40, remove the clevis pin from the lever at the lower end of the control shaft at the steering column Turn the selector rod adjusting screw until the vertical distance between the hand control lever and the rim of the steering wheel is from $2\frac{11}{16}$" to $2\frac{13}{16}$ Fig 41 Turning the screw up reduces the clearance.

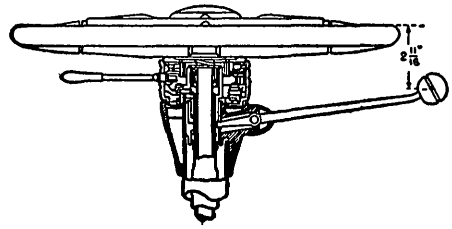


Fig. 44 Vertical adjustment of shift lever 1949-50 Six with syncromesh transmission

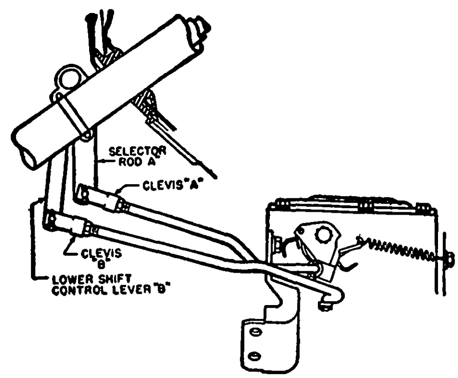


Fig. 45 Shift control rod adjustment. 1949-50 Six with syncromesh transmission

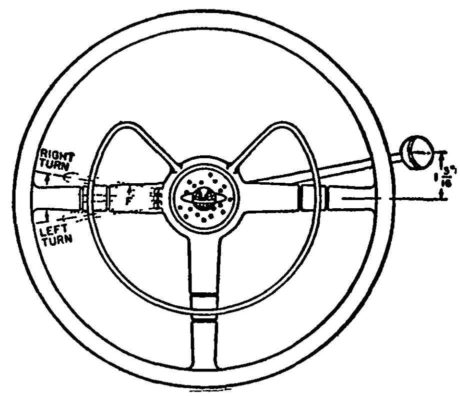


Fig. 46 Horizontal position of shift lever. 1949-50 Six with syncromesh transmission

SHIFT CONTROL ROD, ADJUST

1939-48—With the transmission in neutral, the hand control lever should be approximately 1½" above the horizontal position

For 1939 cars, disconnect the lower control rod from the selector shaft lever at the transmission Place special gauge No J-1082 in position on the steering column cable anchor bracket, Fig 42, with the upper end of the lower control rod in the slotted opening in the gauge Then adjust the clevis on the lower end of the lower control rod (at transmission) until the pin enters the clevis and selector shaft freely.

NOTE—For 1940-48 models, the adjustment is made in the same manner except that special gauge No J-1445 is used for 1940, and No J-1609 for 1941-48 cars (see Fig. 43).

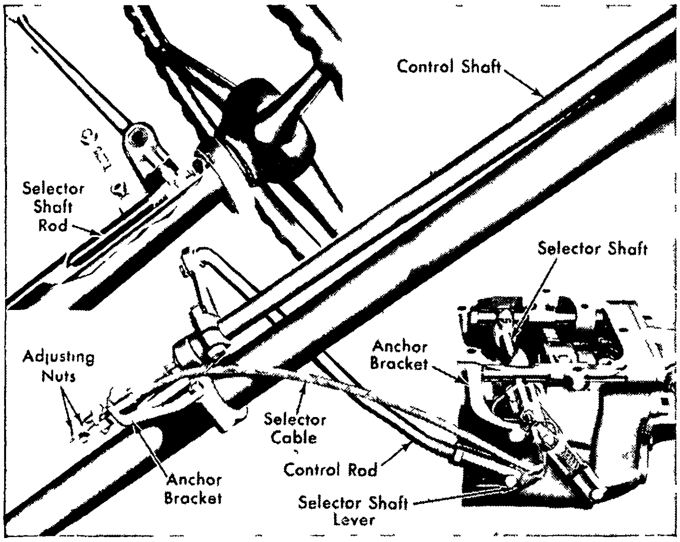


Fig. 38 Gearshift controls, 1939

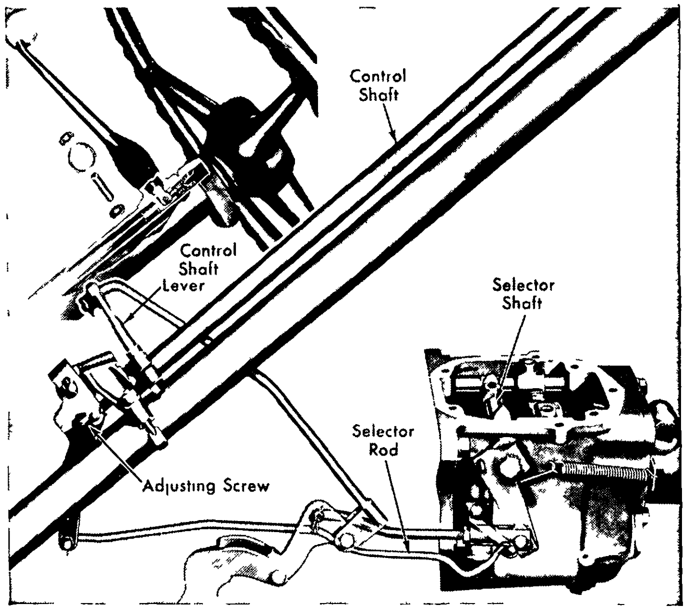


Fig. 40 Gearshift contr ls, 1940-48 with synchromesh transmissi n

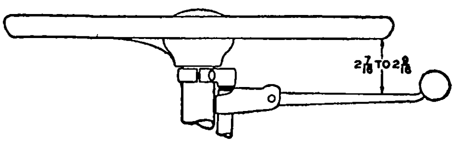


Fig. 39 Gearshift selector cable adjustment, 1939

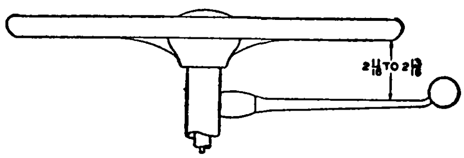


Fig. 41 Gearshift selector rod adjustment, 1940-48

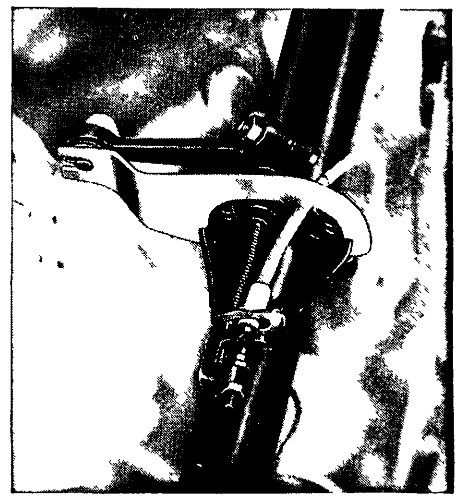


Fig. 42 Gearshift c ntr l r d adjusting gauge, 1939 with synchromesh transmissi n

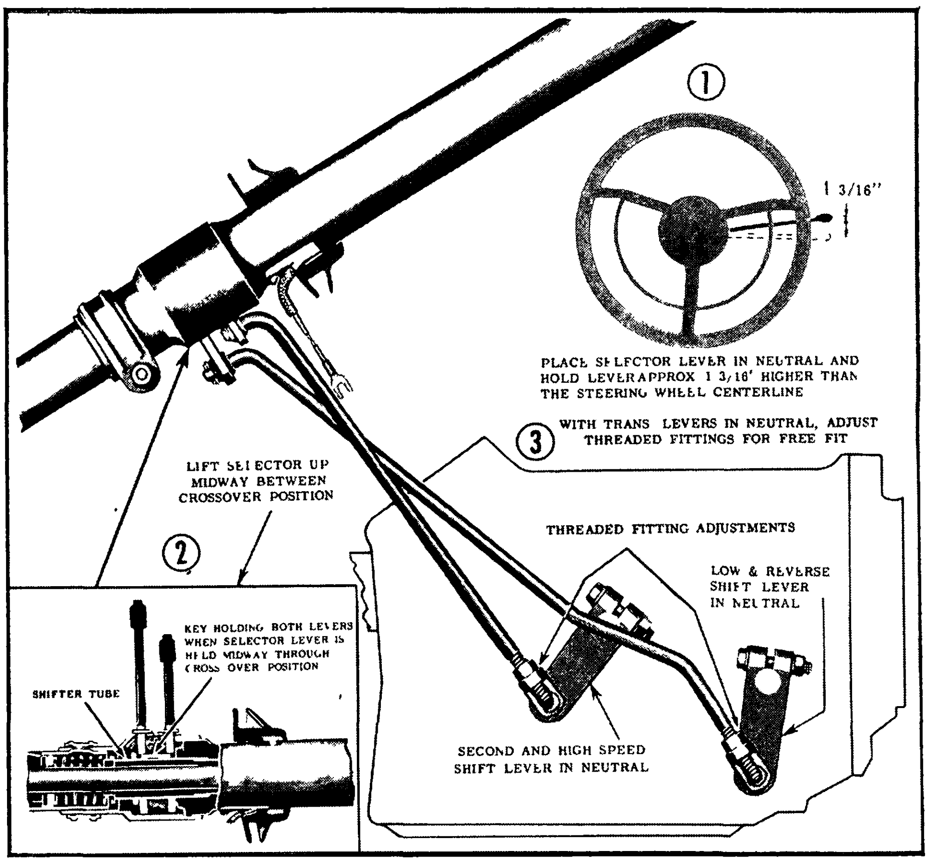


Fig. 46A Shift lever adjustment f r 1950 V8 with synchromesh transmissi n

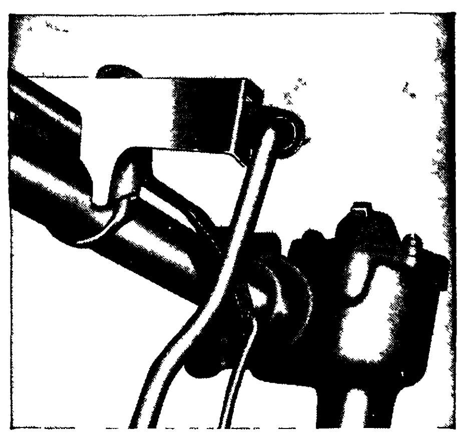


Fig. 43 G arshift c ntr l r d adjusting gauge, 1940-48 with synchrom sh transmission

1949-50 SIX—To adjust the shift control levers, see Fig. 45 and proceed as follows:

1. Place hand control lever and transmission in neutral.

2. Remove selector rod clevis pin (A) and adjust clevis to obtain a vertical distance of $2\frac{11}{16}''$ between the top of the steering wheel rim and the center of the shift control knob, Fig. 44, when clevis pin slides freely through hole.

3. With the hand control lever and transmission in neutral, remove the lower shift control rod clevis pin (B), Fig. 45, and adjust the clevis to obtain a dimension of $1\frac{1}{16}''$ from the center line of the steering wheel to the center of the shift control lever knob, Fig. 46, when clevis pin just slides freely through hole.

1950 V8—Three adjustments are provided for positioning the gearshift lever on these models. A horizontal adjustment is required only if the shift rods (below floorboard) have been removed. The crossover adjustment should be checked and, if necessary, readjusted after the horizontal adjustment has been completed or whenever the crossover through neutral is found to be rough.

If the shift bowl has been removed for any reason, the vertical distance between the steering wheel to the knob must be adjusted before the main horizontal adjustment can be properly made.

Horizontal Adjustment — Place the manual lever in neutral position. Lift the manual lever up midway through the crossover position, wedging it with a screwdriver between the shift lever and pivot pin retainer. The centerline of the shift lever knob should be held approximately $1\frac{3}{16}''$ higher than the steering wheel horizontal centerline when in neutral, Fig. 46A. Place transmission shift levers in neutral position. Adjust link at lower end of each shifter rod so that the link pins fit into their respective transmission levers without interference. Remove screwdriver from manual lever and check crossover "feel" in neutral. If the crossover is not smooth and clean and without interference, make the crossover adjustment.

Crossover Adjustment—Adjust either shifter rod approximately 1 to 4 turns in the direction required to give clean crossover in neutral. Be sure lock nuts are both tightened against their respective links after adjustment has been completed.

Vertical Adjustment—Disconnect the linkage between the transmission and shifter levers and allow the lower (low and reverse) lever to swing to its maximum counterclockwise position. Remove the horn button, steering wheel and turn signal switch assembly) or the spacer between shifter bowl and steering wheel). Move the shift tube assembly down until the key on the tube touches the lower shift lever. The shift tube can be moved downward by lifting up on the shift lever knob while keeping it in neutral position. While holding shift lever knob "up", turn adjusting screw assembly down tight against the shift lever, then back off ½ turn and stake securely. This adjustment will result in a vertical distance of approximately $2\frac{31}{32}''$ from the top edge of the steering wheel to the top of the shift lever knob when the lever is allowed to come to rest in the neutral position.

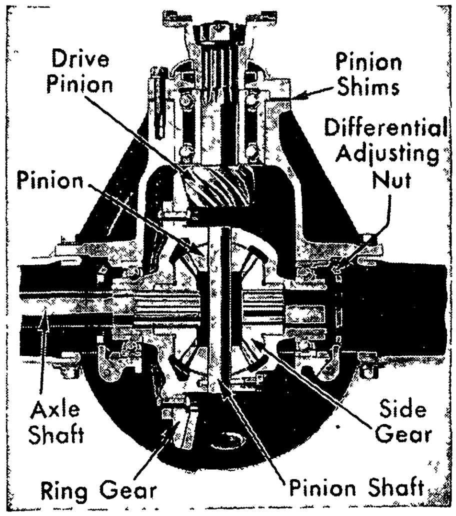


Fig. 47 Rear axle, 1935-36

1951-52—Two shift linkage adjustments are required to properly position the hand control lever with respect to the steering wheel. The procedure is as follows:

Set the transmission outer shift lever in neutral. Adjust the clevis to obtain a dimension of $1\frac{1}{4}''$ (horizontal) from the steering wheel centerline to the centerline of the shift lever knob. With transmission outer selector lever against rear stop, and hand control lever knob resting in neutral position, adjust the clevis on this rod so that the clevis pin will easily enter the hole in the lever.

Remove the clevis pin connecting the outer selector lever to the cross shift lever, lengthen the clevis by three full turns and replace the pin. This gives the proper vertical adjustment between steering wheel and shift lever knob.

REAR AXLE

REAR AXLE SERVICE

1935-46—Fig. 47 pictures the rear axle used on 1935-36 models, while Figs. 48 and 49 is the type employed on 1937-46 cars.

In Fig. 47, the pinion is adjusted by split shims located betweeen the pinion bearing flange and the differential carrier. In this design, the drive pinion and bearings may be taken out of the differential carrier without disturbing the differential unit.

In Fig. 48, the pinion is adjusted by shims between the shoulder on the pinion shaft and the inner race of the double-row ball bearing.

In both types, the double-row ball bearing is built with no looseness or end play, nor is it adjustable for end play. If there is any looseness between the race and cone, it was probably caused by abrasive matter in the lubricant which wore down the balls.

In Fig. 47, the differential bearings are of the ball type. These bearings are built with as much as .020 inch end play and are loose until pulled in position by the adjusting nuts. They should not be rejected unless the bearing shows chipped balls or races, or has more than .030 inch end play. In Fig. 48, the differential bearings are of the taper roller type.

In both designs, the threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle Chapter*.

PINIONS & BEARINGS, REPLACE—Fig. 47. The pinion bearing is a press fit on the pinion shaft and a slip fit in the differential carrier. If either the drive pinion oil seal or bearing is to be replaced, the differential unit need not be taken out of the carrier. But if a new drive pinion is to be installed, remove the differential unit in the usual manner because it will have to be dismantled any way in order to replace the matched ring gear.

To remove the drive pinion, unbolt the pinion bearing retaining flange and tap the flange toward the front until the pinion is loose enough to be lifted out by hand. Carefully collect the shims and lay them aside for future use. If the shims are damaged, select new shims of the same thickness so that, upon reassembly, the original pinion adjustment can be obtained without loss of time.

Hold the pinion flange in a vise, remove the retaining nut and pull off the flange. Mount the pinion in an arbor press (gear end down) and, using a piece of standard 3-inch pipe 4¾ inches long, placed so that one end butts against the pinion flange, press the pinion shaft out of the bearing.

To assemble, press the bearing on the pinion shaft by applying pressure to the inner race. Replace the bearing retaining flange and the pinion flange, tightening the latter securely with its nut. Assemble the original shim pack at the front end of the carrier and slide the pinion and bearing assembly in place. Tighten the screws which fasten the retainer to the housing.

If a new drive pinion was installed, its position should be checked with a pinion setting gauge, if available, in the manner described in the *Rear Axle Chapter*. If a correction is necessary, loosen the pinion flange and bearing retainer flange and, if the pinion is to be moved toward the center of the axle, remove shims; if it is to be moved away from the center of the axle, add shims.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact between the ring gear and pinion according to the instructions given in the *Rear Axle Chapter*. When the adjustment is correct, install a new cotter pin.

PINIONS & BEARINGS, REPLACE—Fig. 48. The inner race of the double-row bearing is a press fit on the pinion shaft and the outer race is locked in the differential carrier by three cone-pointed lock screws which bear against a sleeve.

The outer race of the rear roller bearing is pressed into the differential car-

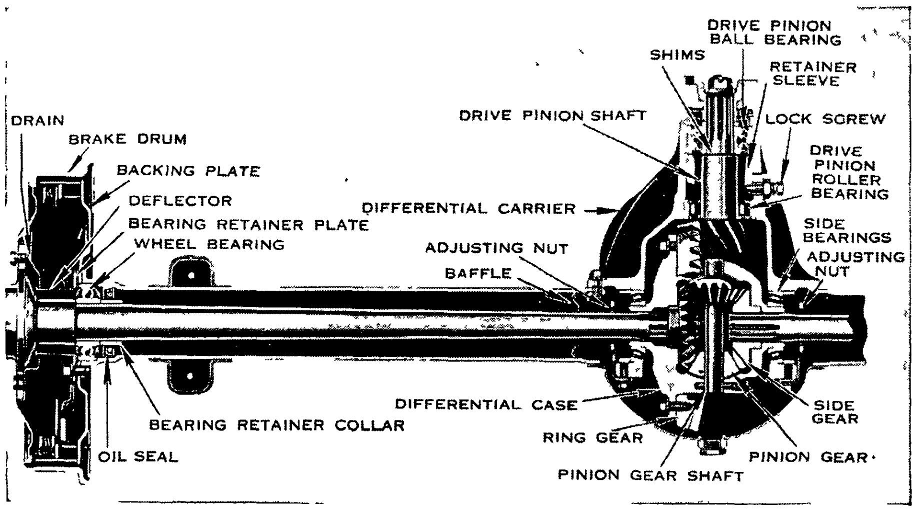


Fig. 48 Rear axle, 1937-46

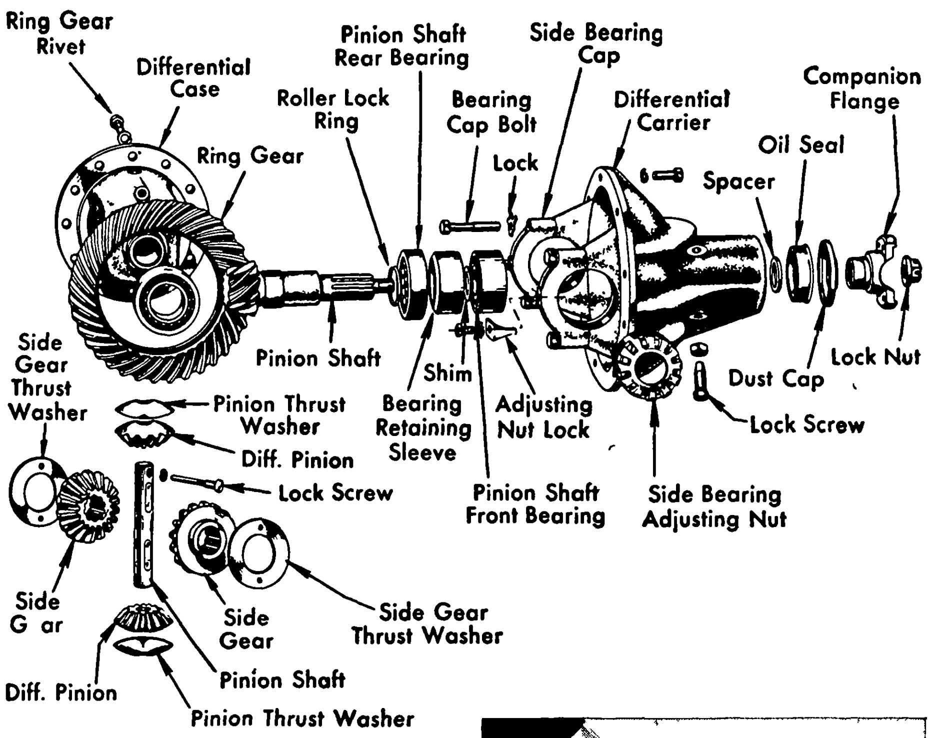


Fig. 49 Rear axle, 1937-46

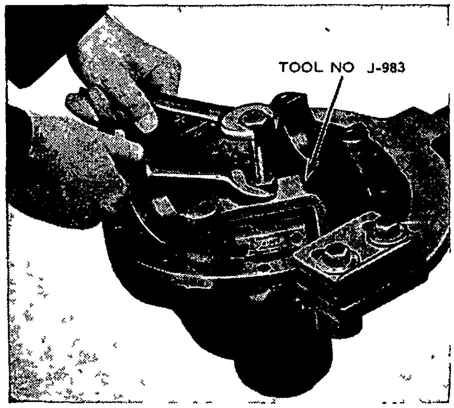


Fig. 50 Rem ving driv pinion bearing ut r rac , 1937-46

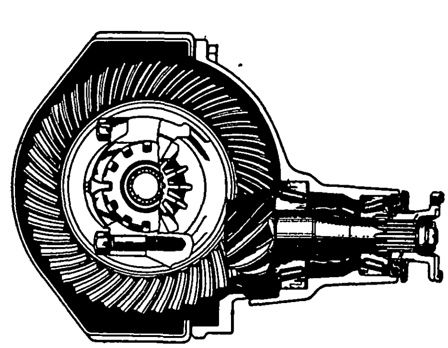


Fig. 51 Rear axl , 1947-52

rier. An inner race is not necessary as the hardened and ground shaft furnishes a race for the rollers.

To remove the drive pinion, unbolt the differential carrier from the axle housing, take out the axle shafts and, after removing the differential bearing caps and adjusting nuts, lift the differential from the carrier.

Fasten the carrier in a vise or fixture and, after removing the pinion flange nut, pull off the flange. Mount the carrier in an arbor press and force the pinion shaft back through the ball bearing inner race. After removing the pinion, make note of the total thickness of shims so that, if necessary, the pinion may be replaced in its original position.

The snap ring, which acts as a spacer between the pinion head and the rear bearing rollers, should *not* be removed from the shaft.

NOTE — After the rear bearing rollers have been running for some time under load, they may be removed singly from the race. When this is possible, the roller bearing race may be removed from the carrier with the tool shown in Fig. 50. But if the rollers cannot be taken out singly, the bearing assembly may be removed after loosening the three cone-pointed screws from the carrier casting. The bearing may then be pressed through the rear of the differential carrier by applying force to the bearing race under an arbor press.

The double-row bearing may be removed by taking out the three lock screws. Then, after removing the lock sleeve, tap the bearing from the housing.

NOTE—The diameter of the roller path in the pinion shaft should be checked with a micrometer. If the micrometer reading shows more than .0007 inch undersize when compared with unused portion of the shaft (just ahead of the roller path) a noisy gear will probably result. If a suitable micrometer is not available, mount the pinion in the carrier with the original shims. If excessive radial clearance is observed in the roller bearing when the pinion is forced up and down by hand, the gears will not run quietly. Excessive radial clearance may be due to undersize rollers or wear on the pinion shaft at the roller path. If the roller path does not show excessive wear, a new bearing may correct the condition. If the excessive clearance is caused by a worn pinion shaft, a new ring gear and pinion must be installed.

To assemble the drive pinion, push the double-row bearing into the housing, tapping lightly on its outer race, if necessary. With the tapered end of the bearing lock sleeve toward the rear, slide the sleeve up against the outer race of the ball bearing and lock in place with the three pointed screws.

Drive the outer race of the rear roller bearing into the housing. Coat the rollers with heavy grease and slip them in the race. Install the original thickness of shims that were removed when the assembly was dismantled. Make sure the shims are flat and not cocked. Shims are available in several thicknesses so that a suitable combination may be selected to replace the original ones if they are damaged, or if another combination is needed to secure proper location of the pinion if a new gear set is installed.

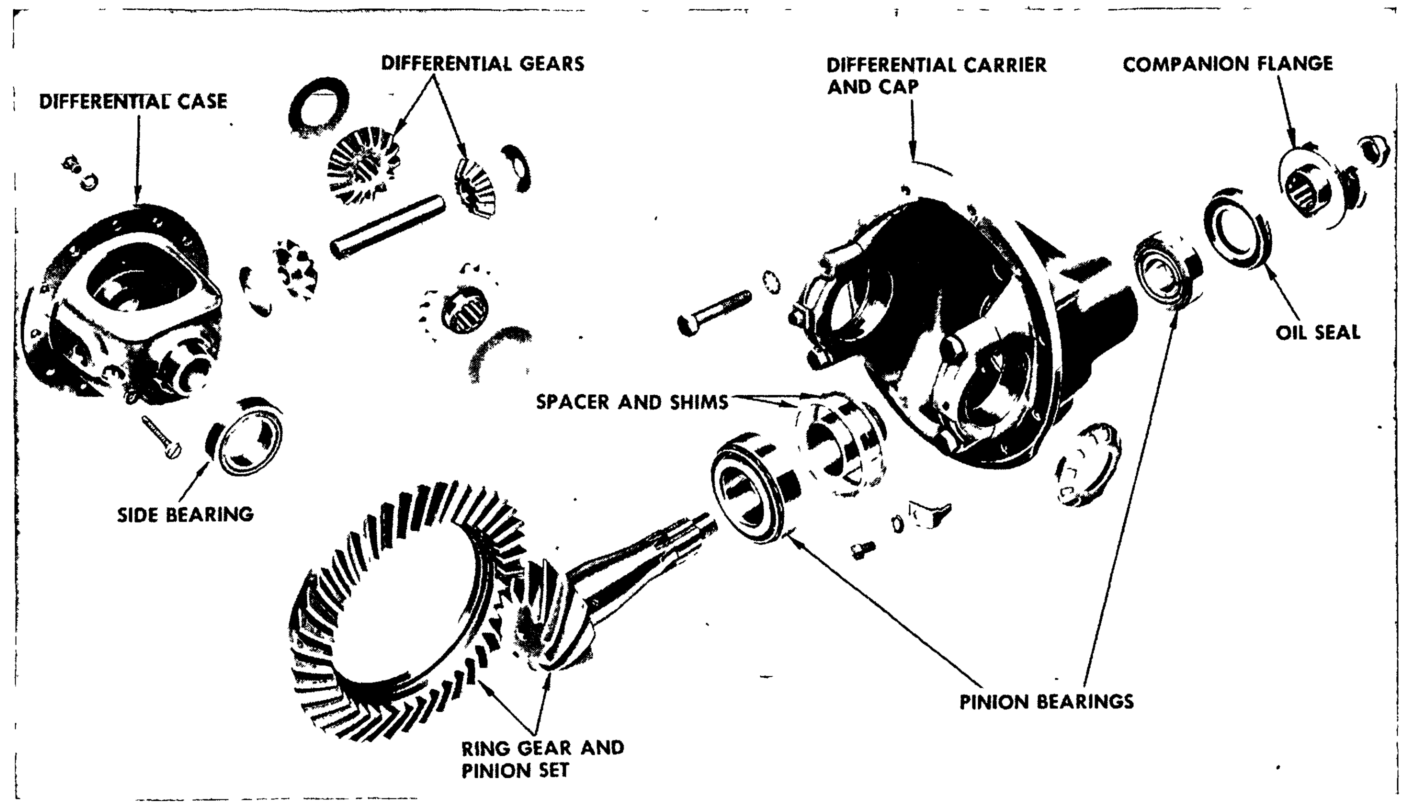


Fig. 52 Rear axle, 1947-52

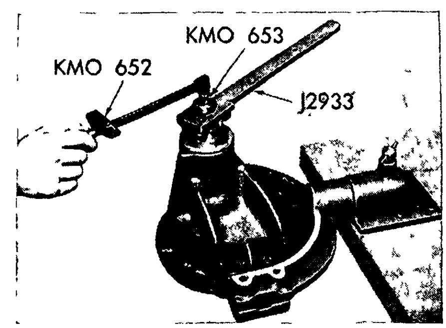


Fig. 53 Measuring pinion bearing preload with a torque wrench, 1947-52

Install the pinion into the carrier, replace the pinion flange and tighten the retaining nut securely. Do not install the oil seal or insert a cotter pin in the flange nut until the drive pinion is located properly.

If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, press out the pinion shaft and, if the pinion is to be moved toward the center of the axle, add shims; if it is to be moved away from the center of the axle, remove shims.

If a pinion setting gauge is not available, assemble the differential unit in the carrier, adjust the bearings and backlash, and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*.

When the adjustment is correct, remove the pinion flange, install the oil seal, replace the flange and tighten the nut securely, locking it with a new cotter pin. Be sure the three pointed screws are tight and their lock nuts secure.

REAR AXLE SERVICE

1947-48—This axle, Figs. 51 and 52, is similar to the 1946 axle except for changes to permit the use of tapered roller pinion bearings.

The splined companion flange is fastened to the pinion stem with a special nut which seats directly on a counterbore in the flange. The nut is retained by staking the end of the pinion stem into two slots milled on top of the nut.

The drive pinion is mounted on preloaded taper roller bearings. Adjustment of the pinion along its axis is obtained by shims placed between the rear bearing outer race and a shoulder in the carrier. Adjustment of preload of the two bearings is obtained by tightening the companion flange nut which compresses a sleeve over the pinion stem between the bearings. Both bearing outer races are pressed into the carrier, the rear race against pinion adjusting shims, the front race against the shoulder in the carrier. The rear bearing inner race is pressed onto the pinion stem to a shoulder at the pinion end. The front bearing is a light press to a close sliding fit on the pinion stem.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash and other differential case operations, is given in the *Rear Axle Chapter*.

PINION & BEARINGS, REPLACE— After removing the differential unit from the carrier, unscrew the pinion flange retaining nut and pull off the flange. Press the pinion out of the front bearing and through the rear end of the carrier. The rear bearing cone and bearing spacer will come out with the pinion. The bearings may then be removed and installed with suitable pulling equipment.

Reverse the operations to assemble and, after pressing on the pinion flange, slip on the washer and nut. Tighten the nut until the bearings have a preload drag of 27 to 30 inch pounds on new bearings or 15 to 20 inch pounds on used bearings to rotate the pinion shaft.

To adjust the preload, draw up the nut until the spacer starts to buckle. Check the pull as shown in Figs. 53 or 54, depending upon the equipment available. This adjustment must be made every time the flange nut is removed or loosened. If the adjustment is to be made with the differential unit in the carrier, the rear wheels must be jacked off the floor.

The pinion can be moved in toward the center of the axle by removing the required thickness of shims from between the spacer and the carrier. If it is to be moved away from the center of the axle, add shims.

NOTE—A new spacer is required between the pinion bearings when a new ring gear and pinion set is installed, either outer or inner members of either pinion bearing is changed, a new carrier casting used, or pinion adjusting shim thickness is increased. When the same pinion flange is removed and reinstalled as when an oil seal is replaced, checking for pinion bearing preload with a torque wrench is not necessary if care is taken to tighten the nut to exactly its previous position. Should a new pinion flange be

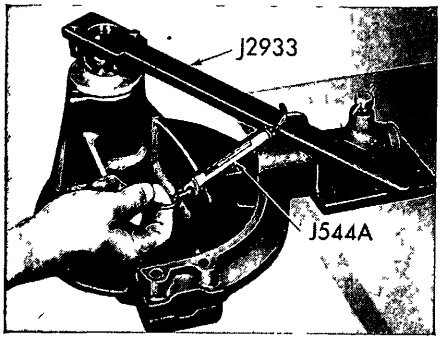


Fig. 54 Measuring pinion bearing preload with a spring scale, 1947-52

required, a torque wrench reading should be taken before loosening the nut and the nut tightened to the same torque wrench reading.

1949-52—These units are fundamentally the same as used in the 1948 models. The side bearing tension and all other adjustments on the Six is adjusted in the same manner as on the 1948 models.

The side bearing adjustment on the Eights is similar to the Six except that the pedestal cap spread must be determined. With the differential case assembled in the carrier, adjusting nuts in place, and pedestal caps tightened just snug, proceed as follows:

1. Back off the right adjusting nut (one opposite ring gear) four turns.
2. Tighten the left hand adjusting nut against the bearing race, removing all lash between the ring gear and pinion. Then back off four notches, leaving slot in adjusting nut in line with lock cap screw hole in bearing cap.
3. Tighten right hand adjusting nut, watching race of bearing. When bearing race starts to turn, continue to tighten two to three notches, align slot in nut with hole in bearing cap.
4. Tighten cap bolts 70 to 75 lbs. ft.
5. Clamp an indicator to differential carrier and check backlash. This should not be less than .004" nor more than .008".
6. If necessary, adjust by turning the nuts in the required direction to obtain the correct lash; always moving both nuts an equal number of notches.
7. Again tighten pedestal caps 70 to 75 lbs. ft. and check lash. After the correct backlash has been obtained, proceed as follows:
8. With the special gauge postioned as shown in Fig. 55, check the clearance between the gauge and the machined surface of the pedestal cap—which should be .005". If the clearance is incorrect, loosen the right hand bearing cap bolts and adjust the nut as required (one notch at a time) to obtain .005" clearance. Be sure bearing cap bolts are tight each time clearance is checked. Do not tighten adjusting nut more than 4 notches nor less than 2 notches.
9. Recheck backlash. If necessary, move adjusting nuts an equal number of notches to obtain. 004" to .008" backlash.

NOTE—On eight-cylinder models, the differential carrier is a press fit in the axle housing. When installing the carrier it must be held so the pedestal caps are in line with the supports in the housing before the assembly can be drawn into the axle housing.

To perform this operation, position the gasket and install 3 special pilot studs into the housing as shown in Fig. 56. Assemble the carrier over the pilot studs. Then temporarily use four 1½" long bolts, two each side as shown, and tighten the bolts evenly to draw the carrier into the housing. Remove the pilot studs and install 6 of the regular carrier bolts in the vacant holes. Remove the four temporary bolts, install the regular ones and tighten all 40 to 45 lbs. ft.

AXLE SHAFT REMOVAL

1935-36—After removing the wheel, pull off the hub and drum. Unfasten the brake support and remove the assembly, which also serves as a bearing retainer. Use a puller to remove the shaft and bearing.

1937-52—These axle shafts are supplied with the wheel studs pressed into the flange. Studs on the left-hand axle have left-hand threads.

To remove a shaft, unfasten the brake drum from the flange and the brake support plate from the axle housing. Pull the bearing retainer plate away from the brake plate, using care not to dislodge the brake plate as the brake line might be damaged. Remove the shaft with a puller.

REAR WHEEL BEARING

1935-36—The non-adjustable annular ball bearing is pressed onto the axle shaft with a force of 3000 pounds.

1937-38—With axle shaft removed, split the bearing retainer collar with a cold chisel, being careful not to damage the axle shaft. Never remove this bearing unless a new one is to be installed. Engage the outer race of the bearing with a block (tool No. J-947-2) used in conjunction with a slit block (tool No. J-947-1), and press the bearing off the shaft. This bearing should not be used again, after once being removed. To install the new bearing on the axle shaft, use an arbor press, making sure that an even pressure is applied to the *inner* bearing race. After bearing is pressed firmly against the shoulder on the shaft, press the retainer collar in place with its tapered end away from the bearing.

Fig. 55 Adjusting differential carri r ped stal spread n 1949-52 V8 m d ls

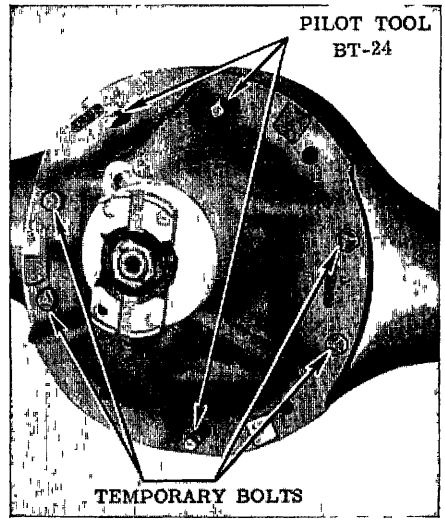


Fig. 56 Installing machin d carrier into axle housing on 1949-52 V8 m d ls

1939-52 — The procedure is practically the same as for 1937-38, except that the retainer which on the 1937-38 must be split with a chisel for removal, has been eliminated.

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1935—Camber is adjusted by inserting washers between the upper and lower knuckle support yokes and the control arms. Inserting washers on the upper knuckle support yoke increases the camber and inserting washers on the lower knuckle support yoke decreases the camber. A 1/16" washer makes a change of 1/3 degree in the camber. Special washers are made for this purpose and care must be used to see that the washers do not bind on the chamfer of the yoke stud. Both sides should check within ¼ degree or if measured in inches, within 1/16".

To adjust caster, jack up the front wheels until the tires clear the floor and loosen the nuts holding the control arms to the upper and lower knuckle support yokes one turn. Loosen the knuckle support clamp bolt on top of the knuckle support and turn the upper support bolt. Looking at the head of the bolt, from the rear, turn it clockwise to increase caster and counter-clockwise to decrease the caster. Every time the bolt makes a ¾ turn, the caster changes ¼ degree. Be sure to tighten the loosened nuts and bolts after the adjustment is made.

1936-52 — To adjust caster, loosen the clamp bolt at the upper end of the steering knuckle support. Remove the lubrication fitting from the front bushing of the eccentric pin at the outer end of the upper control arms. Insert an Allen wrench through the hole from which the lubrication fitting was removed and

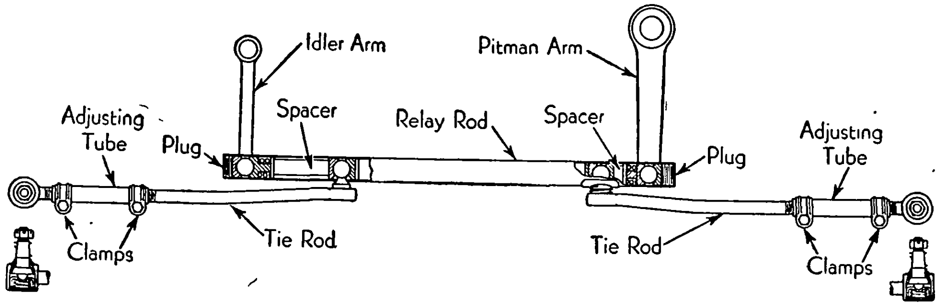


Fig. 57 Steering linkage, 1939-52

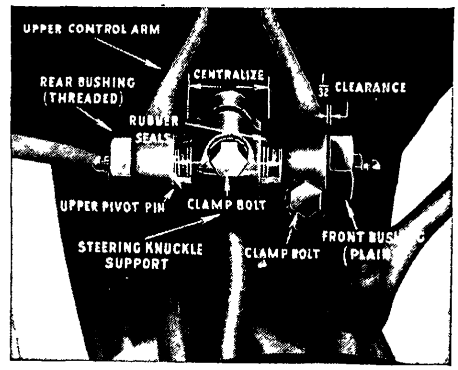


Fig. 59 Upper pivot asembly details, 1937-52

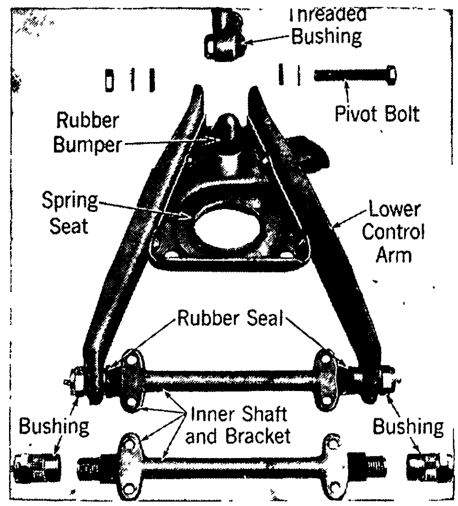


Fig. 60 Lower contr l arm details, 1937-52

turn the threaded eccentric pin until the desired caster angle is obtained. Turn the threaded pin on each side of the car clockwise to increase caster and counterclockwise to decrease caster. Always turn the pin in multiples of one turn so that the camber will not be disturbed. After completing the adjustment, tighten the knuckle support clamp bolts and install the lubrication fittings. This procedure should only be used to change the caster less than 3 degrees.

To adjust camber, insert an Allen wrench as described for making a caster adjustment. The camber angle is controlled by the eccentric action of the threaded pin and a half turn gives the maximum adjustment. Changing the camber will change the caster angle slightly but if the pin is not turned more than a half turn the caster angle will still be within its limits.

TOE-IN, ADJUST

1935-36—Loosen the clamp bolts on both ends of each tie rod and turn both tie rods until the toe-in is correct. If the rods cannot be adjusted so that they are both the same length when the toe-in is correct, the steering knuckle arms should be checked to determine if they are bent. To make this check, the distance between the edge of the brake drum and the pivot ball on the steering knuckle arm should be same within $\frac{1}{8}$".

1939-52—To adjust the toe-in, loosen the clamps at both ends of the adjustable tubes at each tie rod, Fig. 57. Then turn the tubes an equal amount until the toe-in is correct. Turning the tubes in the direction the wheels revolve when the car moves forward decreases the toe-in and vice-versa. When the adjustment is complete, tighten all clamp screws.

FRONT END SERVICE

1935—With any operation involving the disassembly of the front suspension, place jacks under the frame to support the chassis, and another jack under the spring seat, raising it up enough so that the weight of the car is placed on this jack, after which remove the wheel assembly.

KINGPIN SUPPORT—Disconnect brake hose. Remove outer end of tie rod from steering arm by placing a support under the arm and, after, loosening the nut nut with a lead hammer. Remove the cotter pin and nut from the upper control arm yoke, using a socket wrench. Pivoting on the lower control arm, drop the steering spindle and brake assembly to a horizontal position out of the way. Remove cotter pin and nut from lower control arm yoke.

UPPER YOKE PIN—Place a jack under spring seat, raise car and remove wheel. Remove stub of yoke from upper control arm. Do not allow knuckle support to swing out far enough to strain brake hose. Remove upper yoke rear bushing. Loosen clamp on upper control arm yoke and remove bushing. Loosen clamp screw on support arm and insert a $\frac{1}{4}$" Allen wrench in front end of knuckle support bolt and screw out either front or back. When installing, hold control arm yoke straddle of upper end of the support arm so that the drop in the yoke is down from the stub and insert support bolt. Screw the bolt into the control arm until with $\frac{1}{16}$" space between front face of support and inside of yoke, the end of the bolt is just flush with the front face of the yoke. Tighten clamp screw. Screw in front bushing until space between the yoke and support arm has been reduced to $\frac{1}{4}$" so that rear bushing can be readily threaded into place.

KINGPIN BUSHING—Remove the assembly of steering knuckle and support arm and perform following operations on the bench. Remove Welch plugs and locking pin and remove kingpin. Drive out bushing with a driver, press in new bushing and line ream.

LOWER CONTROL ARM YOKE—Place car jack under bottom of spring seat and raise car from floor. Remove front

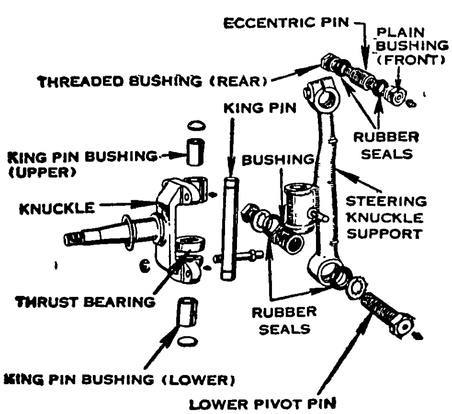


Fig. 58 Upp r and l wer piv t pin d tails, 1937-52

wheel with hub and brake drum attached. Remove the four bolts and nuts holding the brake backing plate to the steering knuckle, allowing the brake hose to remain attached to the frame—the best method being to wire the disc to the frame so that it does not hang by the brake hose. Push the two bottom brake disc bolts completely out of place, allowing enough freedom of movement to permit the following operation:

Remove cotter pin and nut holding lower control arm yoke to control arm and pull the stub of the yoke out of the arm. These yokes are interchangeable between right and left and the drop in the yoke should in either case point up to allow more clearance for the action of the support arm. The clamping bolt will be in alternate position on right and left side. Unscrew and remove the bushing opposite the clamping bolt first. Loosen the clamping bolt and remove the opposite bushing. Drive out the locking pin holding the lower knuckle support pivot and by means of a screwdriver turn out the pivot bolt, which allows the yoke to be removed.

LOWER CONTROL ARM BUSHINGS—Place car jack under bottom of spring seat and raise car from floor. Remove front wheel. Remove cotter pin and nut

from lower control yoke. Support the frame of the car by means of another jack or hoist under upper control arm. Lower jack under spring seat sufficiently to allow stub of the lower yoke to be removed from the control arm, then remove jack. Remove the coil spring together with the retainer and washers.

Remove the four bolts and nuts holding lower control arm shaft to front cross member. Loosen clamp bolt on lower control arm and remove rear bushing (plain). Remove front bushing (threaded).

LOWER CONTROL ARM—When assembling the pivot shaft in the lower control arm, locate it so that there is equal clearance at each end, between the bolt flanges on the pivot shaft and the inner faces of the ends on the control arm. Tighten the lower control arm bushing against the control arm. Install the plain bushing so that the clearance between its hexagon head and the control arm is $\frac{1}{64}$".

FRONT END SERVICE, 1936-52

UPPER PIVOT PIN — Fig. 58. To remove the pin, unscrew the clamp bolt and the two bushings and remove the rubber seals. Loosen the clamp bolt in the knuckle support and unscrew the pivot pin.

To replace, hold the knuckle support in line with the hole through the control arm and screw the pivot pin into the support, having the wrench hole in the pin toward the front of the car. Screw in the pin until it is centralized and tighten the clamp bolt. Assemble the seals over the pin. Centralize the knuckle support in the control arm yoke and start the rear bushing on the pin and into the control arm. Start the front bushing on the pin before locking the rear bushing up tight. After tightening the rear bushing, screw up the front bushing until there is $\frac{1}{32}$ inch clearance between the bushing and arm as shown in Fig. 59. Replace and lock the control arm clamp bolt, and set the caster, camber and toe-in.

LOWER PIVOT PIN—Fig. 60. To remove, unscrew lock nut and remove the pin. To install, centralize the knuckle support between the control arm yoke and screw the pin through the front control arm and into the knuckle support bushing. After screwing the pin into the

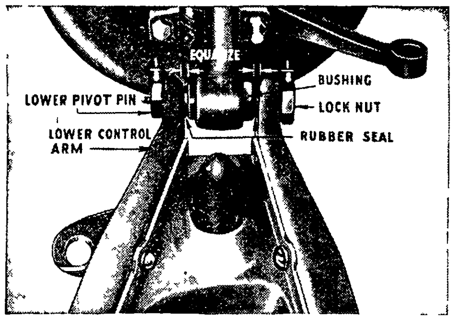


Fig. 61 Lower pivot assembly details, 1937-52

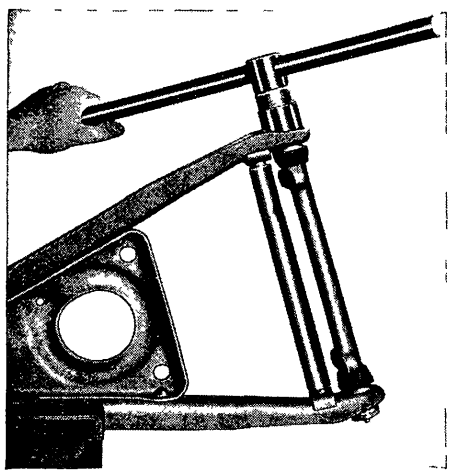


Fig. 62 Using spreader tool to prevent lower control arms from moving inward while installing bushings, 1937-52

rear control arm, install the lock nut and washer and set the camber, caster and toe-in. When properly spaced, there will be about ⅛ inch clearance as shown in Fig. 61.

LOWER CONTROL ARM OR SPRING—Fig. 60. To remove, disconnect the outer end of the tie rod and stabilizer link. Remove the lower pivot pin. Remove the jack from under the spring seat, allowing the lower control arm to drop out of position. Take out the spring. Unfasten the pivot shaft from the frame cross member. Unscrew the bushings and remove the pivot shaft from the lower control arm.

To prevent the arms from moving inward while the bushings are being installed, a special spreader tool, Fig. 62, should be used. To install the shaft and bushings into the lower control arm, place the tool in position and set the shaft in the control arm. Start a bushing on the shaft and into the arm at the same time and tighten the bushing. Center the shaft between the control arms and install the other bushing, being sure the threads index so there is no bind. Remove the tool and check the distance between the center of the pivot shaft bolt holes and the inside face of the arm. The dimension should be the same on both sides. Install the control arm assembly, replace the spring and lower pivot pin. Then set the caster, camber and toe-in.

KINGPINS & BUSHINGS — Fig. 58. After removing the wheel and brake support plate, drive out the kingpin lock and the kingpin. Press out the bushings.

With the oil hole in the new bushings in line with the hole for the oil fitting, press the bushings into the knuckle. Then burnish the bushings in place and line-ream to size. Install the kingpin and complete the assembly in the reverse order of removal.

STEERING GEAR

STEERING GEAR REMOVAL

1935-38 — Remove the horn button and take off the steering wheel nut and use a puller to remove the wheel. Disconnect the clamp which fastens the steering column to the instrument panel. Use a puller to remove the pitman arm. Disconnect the steering gear from the frame and withdraw the gear. Replace in the reverse order.

1939-52—Remove the horn button and unscrew the nut and pull off the wheel. Disconnect the control rod from the lever at the lower end of the steering column, and also the selector cable or rod.

Unfasten the steering column from the instrument panel clamp. Pull off the pitman arm. Disconnect the gear from the frame and withdraw the gear.

Reverse the order of removal to replace the gear and see the *Gearshift* section for adjustment procedure.

PACKARD

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	C mpression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Eight "120"	120	120	In Block	3¼ x 3⅞	257.2	6.50	110 @ 3850		35 @ 25
	Standard 8	1200	127	In Block	3 3/16 x 5	320.0	6.50	130 @ 3200		35 @ 25
		1201	134							
		1202	139							
	Super 8	1203	132	In Block	3½ x 5	384.8	6.30	150 @ 3200		35 @ 25
		1204	139							
		1205	144							
	V12	1207	139	In Block	3 7/16 x 4¼	473.0	6.40	175 @ 3200	..	50 @ 25
		1208	144							
1936	Eight "120"	120B	120	In Block	3¼ x 4¼	282.0	6.50	120 @ 3850		35 @ 25
	Standard 8	1400	127	In Block	3 3/16 x 5	320.0	6.50	130 @ 3200		35 @ 25
		1401	134							
		1402	139							
	Super 8	1403	132	In Block	3½ x 5	384.8	6.30	150 @ 3200		35 @ 25
		1404	139							
		1405	144							
	V12	1407	139	In Block	3 7/16 x 4¼	473.0	6.40	175 @ 3200		50 @ 25
		1408	144							
1937	Six "110"	115C	115	In Block	3 7/16 x 4¼	237.0	6.30	100 @ 3600		35 @ 30
	Eight "120"	120C	120	In Block	3¼ x 4¼	282.0	6.50	120 @ 3800		35 @ 30
	Super 8	1500	127	In Block	3 3/16 x 5	320.0	6.50	130 @ 3200		60 @ 30
		1501	134							
		1502	139							
	V12	1506	132	In Block	3 7/16 x 4¼	473.0	6.40	175 @ 3200		60 @ 30
		1507	139							
		1508	144							
1938	Six "110"	1600	122	In Block	3½ x 4¼	245.3	6.52	100 @ 3600	195 @ 1400	35 @ 30
	Eight "120"	1601	127	In Block	3¼ x 4¼	282.0	6.60	120 @ 3800	225 @ 2000	35 @ 30
		1602	148							
	Super 8	1603	127	In Block	3 3/16 x 5	320.0	6.50	130 @ 3200	260 @ 1600	60 @ 30
		1604	134							
		1605	139							
	V12	1607	134	In Block	3 7/16 x 4¼	473.0	6.40	175 @ 3200	365 @ 1200	60 @ 30
		1608	139							
1939	Six "110"	1700	122	In Block	3½ x 4¼	245.3	6.52	100 @ 3200	195 @ 1500	35 @ 30
	Eight "120"	1701	127	In Block	3¼ x 4¼	282.0	6.41	120 @ 3600	225 @ 1800	35 @ 30
		1702	148							
	Super 8	1703	127	In Block	3 3/16 x 5	320.0	6.45	130 @ 3200	265 @ 1600	60 @ 30
		1705	148							
	V12	1707	134	In Block	3 7/16 x 4¼	473.0	6.30	175 @ 3200	365 @ 1500	60 @ 30
		1708	139							
1940	Six "110"	1800	122	In Block	3½ x 4¼	245 3	6.39	100 @ 3200	195 @ 1500	45 @ 30
	Eight "120"	1801	127	In Block	3¼ x 4¼	282 0	6 41	120 @ 3600	225 @ 1800	45 @ 30
	Super 8 "160"	1803	127	In Block	3½ x 4⅝	356 0	6 45	160 @ 3500	292 @ 1800	50 @ 30
		1804	138							
		1805	148							
	Custom Super 8 "180"	1806	127	In Block	3½ x 4⅝	356 0	6 45	160 @ 3500	292 @ 1800	50 @ 30
		1807	138							
		1808	148							
1941	Six "110"	1900	122	In Block	3½ x 4¼	245 3	6.39	100 @ 3600	195 @ 1500	45 @ 30
	Eight "120"	1901	127	In Block	3¼ x 4¼	282.0	6.41	120 @ 3600	225 @ 1800	45 @ 30
	Clipper 8	1951	127	In Block	3¼ x 4¼	282.0	6.85	125 @ 3600		45 @ 30
	Super 8 "160"	1903	127	In Block	3½ x 4⅝	356.0	6.45	160 @ 3600	292 @ 1800	50 @ 30
		1904	138							
		1905	148							
	Custom Super 8 "180"	1906	127	In Block	3½ x 4⅝	356.0	6.45	160 @ 3600	292 @ 1800	50 @ 30
		1907	138							
		1908	148							
1942	Clipper 6 "110" Special	2000	120	In Block	3½ x 4¼	245 3	6.71	105 @ 3600	192 @ 2000	45 @ 30
	Custom ..	2010	120							
	Convertible Coupe 6 "110"	2020	122	In Block	3½ x 4¼	245.3	6.71	105 @ 3600	192 @ 2000	45 @ 30
	Clipper 8 "120" Special	2001	120	In Block	3¼ x 4¼	282.0	6.85	125 @ 3600	230 @ 2000	45 @ 30
	Custom	2011	120							
	Convertible Coupe 8 "120"	2021	127	In Block	3¼ x 4¼	282.0	6.85	125 @ 3600	230 @ 2000	45 @ 30
	Super Clipper 8 "160"	2003	127	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
	Super 8 "160"	2004	138	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
		2005	148							

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1942	Con. Coupe Sup. 8 "160"	2023	127	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 1800	50 @ 30
	Cust. Clipper Sup. 8 "180"	2006	127	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 1800	50 @ 30
	Custom Super 8 "180"	2007 2008	138 148	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 1800	50 @ 30
1946	Clipper 6	2100	120	In Block	3½ x 4¼	245.3	6.71	105 @ 3600	192 @ 2000	45 @ 30
	Clipper 8	..2101 2111	120	In Block	3¼ x 4¼	282.0	6.85	125 @ 3600	230 @ 2000	45 @ 30
	Super Clipper 8	.2103 2123	127 148	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
	Custom Clipper Super 8...	2106 2126	127 148	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
1947	Clipper 6 . . .	2100	120	In Block	3½ x 4¼	245.3	6.71	105 @ 3600	192 @ 2000	45 @ 30
	De Luxe Clipper 8 .	2111	120	In Block	3¼ x 4¼	282.0	6.85	125 @ 3600	230 @ 2000	45 @ 30
	Super Clipper 8	2103	127	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
	Custom Clipper Super 8	2106 2126	127 148	In Block	3½ x 4⅝	356.0	6.85	165 @ 3600	292 @ 2000	50 @ 30
1948	Standard Eight Deluxe Eight	2201 2211	120	In Block	3½ x 3¾	288	7.00	130 @ 3600	226 @ 2000	40 @ 45
	Super Eight Super Eight Convertible	2202 2232	120	In Block	3½ x 4¼	327	7.00	145 @ 3600	266 @ 2000	40 @ 45
	Custom Eight Custom Eight Convertible	2206 2233	127	In Block	3½ x 4⅝	356	7.00	160 @ 3600	282 @ 2000	50 @ 45
1949–50	Eight	2301	120	In Block	3½ x 3¾	288	7.00	135 @ 3600	226 @ 2000	40 @ 45
	Super Eight Super Eight Convertible	2302 2332	127	In Block	3½ x 4¼	327	7.00	150 @ 3600	266 @ 2000	40 @ 45
	Custom Eight Custom Eight Convertible	2306 2333	127	In Block	3½ x 4⅝	356	7.00	160 @ 3600	282 @ 2000	40 @ 45
1951	200 Eight	2401	122	In Block	3½ x 3¾	288	7.00	135 @ 3600	230 @ 2000	40 @ 30
	250 Eight	2401	122	In Block	3½ x 4¼	327	7.00	150 @ 3600	270 @ 2000	40 @ 30
	300 Eight	2402	127	In Block	3½ x 4¼	327	7.00	150 @ 3600	270 @ 2000	40 @ 30
	400 Patrician Eight	2406	127	In Block	3½ x 4¼	327	7.80	155 @ 3600	275 @ 2000	40 @ 30
1952	200 Eight	2501	122	In Block	3½ x 3¾	288	7.00	135 @ 3600	230 @ 2000	40 @ 30
	250 Eight	2531	122	In Block	3½ x 4¼	327	7.00	150 @ 3600	270 @ 2000	40 @ 30
	300 Eight	2502	127	In Block	3½ x 4¼	327	7.00	150 @ 3600	270 @ 2000	40 @ 30
	400 Eight	2506	127	In Block	3½ x 4¼	327	7.80	155 @ 3600	275 @ 2000	40 @ 30

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935–39	Junior Models	Above	.0015	12 to 18	.007	.007	.0025–.003	.0015	C	D
	Senior Models	B	.0015	12 to 18	.007	.007	.0025–.003	.0015	C	D
1940–52	All Models	Above	.0015	12 to 18	.007	.007	.0025–.003	.0015	C	D

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.

B—Push pistons up through top, pull out piston pins and take pistons out from above and rods from below.

C—Floating type. Pins retained by snap rings in piston bosses.

D—Thumb push fit in piston and rod but with piston heated.

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note A	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935	120	AC-45	.025	.020	33	16258374	E	Positive	375		63
	1200-5	AC-45	.025	.020	33	16258374	F	Positive	375		63
	V12	AC-45	.025	.020	33	N	F	Positive	375		63
1936	120B	AC-45	.025	.020	33	16258374	G	Positive	375		63
	1400-5	AC-45	.025	.020	36	16258374	F	Positive	375		63
	V12	AC-45	.025	.020	40(B)	N	F	Positive	375		63
1937	Six	AC-104	.028	.020	35–38(C)	153624	G	Positive	375		63
	Eight	AC-104	.028	.017	27–30(C)	16258374	G	Positive	375		63
	Super 8	AC-104	.028	.017	27–30(C)	16258374	H	Positive	375		63
	V12	AC-104	.028	.020	40	N	H	Positive	375		63
1938–39	Six	AC-104	.028	.020	35–38	153624	J	Positive	375		63
	Eight	AC-104	.028	.017	27–30	16258374	J	Positive	375		63
	Super 8	AC-104	.028	.017	27–30	16258374	H	Positive	375		63
	V12	AC-104	.028	.020	40	N	H	Positive	375		63
1940	Six	AC-104	.028	.020	35–38	153624	J	Positive	375		63
	Eight	AC-104	.028	.017	27–30	16258374	J	Positive	375		63
	Super 8	AC-104	.028	.017	27–30	16258374	K	Positive	375		63
1941	Six	AC-104	.028	.020	35–38(C)	153624	L	Positive	375		63
	Eight	AC-104	.028	.017	27–30	16258374	H	Positive	375		63
	Super 8	AC-104	.028	.017	27–30	16258374	K	Positive	375		63
1942–46	Six	P	.030	.020	35–38(C)	153624	K	Positive	375		63
	Eight	P	.030	.017	27–30	16258374	M	Positive	375		63
	Super 8	P	.030	.017	27–30	16258374	K	Positive	375		63
1947	Six	P	.030	.020	35–38(C)	153624	L	Positive	375		63
	Eight	P	.030	.017	27–30	16258374	H	Positive	375		63
	Super 8	P	.030	.017	27–30	16258374	L	Positive	375		63
1948–50	Eight	Q	.030	.017	27–30	16258374	L	Positive	375		63
	Super	Q	.030	.017	27–30	16258374	L	Positive	375		63
	Custom	Q	.030	.017	27–30	16258374	L	Positive	375		63
1951–52	All	Q	.030	.017	27–30	16258374	L	Positive	375	375	63

A—Plus or minus .002".
B—Cam angle given is for Auto-Lite; for Delco-Remy, 33 degrees.
C—Cam angle given is for Auto-Lite; for Delco-Remy, 35 degrees.
D—Cam angle given is for Auto-Lite; for Delco-Remy, 31 degrees.
E—Second line before TDC (top dead center) mark on flywheel.
F—S-1 mark on flywheel.
G—White line on flywheel.
H—Seventh line before TDC mark on vibration damper.
J—Third line before TDC mark on flywheel.
K—Fourth line before TDC mark on vibration damper.
L—Sixth line before TDC mark on vibration damper.
M—Fifth line before TDC mark on vibration damper.
N—Front cylinder (as viewed from drivers seat) is number one in both right and left banks. Firing order: 1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L
P—AC type 104 or Auto-Lite P4 or Champion Y4A.
Q—Auto-Lite A5 or Champion Y4A.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold Intake	Operating Clearance H-Hot C-Cold Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing (Note A) Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935–36	Eight	.007H	.009H	.013	B	5	5	36@1⅝	.001–.002	.001 –.002	.3398	.3398
	Super 8	.004H	.006H	.005	45	30	30	68@3 1/16	.002–.003	.004 –.005	.3398	.3398
	V12	Zero	Zero	Zero	45	C	10	65@2 7/32	.002–.003	.004 –.005	.3398	.3398
1937	Six	.007H	.010H	.013	B	5	5	36@1⅝	.001–.003	.003 –.005	.3398	.3398
	Eight	.007H	.010H	.013	B	5	5	36@1⅝	.001–.002	.001 –.002	.3398	.3398
	Super 8	.004H	.006H	.005	45	30	30	68@3 1/16	.002–.003	.004 –.005	.3398	.3398
	V12	Zero	Zero	Zero	45	C	10	65@2 7/32	.002–.003	004 –.005	.3398	.3398
1938	Six	.007H	.010H	.013	B	1	5	47@1⅝	.001–.003	.003 –.005	.3398	.3398
	Eight	.007H	.010H	.013	B	1	5	47@1⅝	.001–.003	.003 –.005	.3398	.3398
	Super 8	.006H	.008H	.005	45	30	30	68@3 1/16	.002–.003	.004 –.005	.3398	.3398
	V12	Zero	Zero	Zero	45	C	10	65@2 7/32	.002–.003	.004 –.005	.3398	.3398
1939	Six	.007H	.010H	.013	B	1	5	47@1⅝	.001–.003	.003 –.005	.3398	.3398
	Eight	.007H	.010H	.013	B	1	5	47@1⅝	.001–.003	.003 –.005	.3398	.3398
	Super 8	.006H	.008H	.005	45	26	34	68@3 1/16	.002–.003	.004 –.005	.3398	.3398
	V12	Zero	Zero	Zero	45	C	10	65@2 7/32	.002–.003	.004 –.005	.3398	.3398
1940–47	Six	.007H	.010H	.013	B	1	5	52@1⅝	.002–.003	.004 –.005	.3398	.3398
	Eight	.007H	.010H	.013	B	1	5	52@1⅝	.002–.003	.004 –.005	.3398	.3398
	Super 8	Zero	Zero	.013	B	4	10	60@1¾	.002–.003	.004 –.005	.3398	.3398
1948	Eight	.007H	.010H	.0125	B	10	5	60@1¾	.001–.003	.0025–.005	.3417	.3398
	Super 8	.007H	.010H	.0125	B	10	5	60@1¾	.001–.003	.0025–.005	.3417	.3398
	Custom 8	Zero	Zero	Zero	B	4	10	60@1¾	.001–.003	.0025–.005	.3417	.3398
1949–50	Eight	.007H	.010H	.0125	B	15	9	60@1¾	.001–.003	.0025–.005	.3417	.3398
	Super 8	.007H	.010H	.0125	B	15	9	60@1¾	.001–.003	.0025–.005	.3417	.3398
	Custom 8	Zero	Zero	Zero	B	4	10	60@1¾	.001–.003	.0025–.005	.3417	.3398
1951–52	200	.007H	.010H	.0125	B	15	9	60@1¾	.001–.003	.0025–.005	.3417	.3398
	Others	Zero	Zero	Zero	B	15	4	60@1¾	.001–.003	.0025–.005	.3417	.3398

A—BTDC means before top dead center; ATDC means after top dead center.
B—Intake 30, exhaust 45.
C—Top dead center.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935	120	.001–.004	.0015–.0025	2.0934–2.0944	.0008–.0028	.004–.010	55–60	2.7455–2.7465	.001–.003	.003–.008	82–85
	1200–5	.001–.004	.0015–.0025	B	.001–.003	.004–.010	45–50	2.6245–2.6255	.001–.003	.003–.005	65–70
	V12	.001–.004	.0015–.0025	2.499–2.500	.001–.003	.004–.010		2.746–2.747	.001–.003	.003–.005	65–70
1936	120B	.001–.004	.0015–.0025	2.0934–2.0944	.008–.0028	.004–.010	55–60	2.7455–2.7465	.001–.003	.003–.008	82–85
	1400–5	.001–.004	.0015–.0025	B	.001–.003	.004–.010	45–50	2.6245–2.6255	.001–.003	.003–.005	65–70
	V12	.001–.004	.0015–.0025	2.499–2.500	.001–.003	.004–.010		2.746–2.747	.001–.003	.003–.005	65–70
1937–39	6 and 8	.001–.004	.0015–.0025	2.0934–2.0944	.0008–.0028	.004–.010	55–60	2.7455–2.7465	.001–.003	.003–.008	82–85
	Super 8	.001–.004	.0015–.0025	B	.001–.003	.004–.010	45–50	2.6245 2.6255	.001–.003	.003–.005	65–70
	V12	.001–.004	.0015–.0025	2.499–2.500	.001–.003	.004–.010		2.746–2.747	.001–.003	.003–.005	65–70
1940–42	6 and 8	.001–.004	.0015–.0025	2.0934 2.0944	.0005–.0025	.004–.010	45–46	2.7455–2.7465	.001–.003	.003–.008	82–85
	Super 8	.001–.004	.0015–.0025	2.2497–2.2507	.0005–.0025	.004–.010	56–58	2.746–2.747	.0005–.0025	.003–.008	82–85
1946	6 and 8	.001–.004	.0015–.0025	2.0934–2.0944	.0005–.0015	.004–.010	45–46	2.7455–2.7465	.0005–.0015	.003–.008	82–85
	Super 8	.001–.004	.0015–.0025	2.2497–2.2507	.0005–.0015	.004–.010	56–58	2.746–2.747	.0005–.0015	.003–.008	82–85
1947	6 and 8	.001–.004	.0015–.0025	2.0934–2.0944	.0005–.0015	.004–.010	45–46	2.7455–2.7465	.0005–.0015	.003–.008	82–85
	Super 8	.001–.004	.0015–.0025	2.2497–2.2507	.0005–.0015	.004–.010	60–65	2.746–2.747	.0005–.0015	.003–.008	82–85
1948	8 & Super 8	.0025–.006	.001–.003	2.250	.0005–.0025	.004–.010	60–65	2.7465	.0005–.0025	.0035–.0085	90–95
	Custom 8	.004–.006	.001–.003	2.250	.0005–.0025	.004–.012	60–65	2.7465	.0005–.0025	.0035–.0085	90–95
1949-50	8 & Super 8	.004–.006	.001–.003	2.250	.0005–.0025	.003–.011	60–65	2.7465	.0005–.0025	.0035–.0085	90–95
	Custom 8	.004–.006	.001–.003	2.250	.0005–.003	.004–.012	60–65	2.7465	.0005–.0025	.0035–.0085	90–95
1951–52	All	.004–.006	.001–.003	2.250	.0005–.0025	.003–.011	60–65	2.7465	.0005–.0025	.0035–.0085	90–95

A—On 1941–47 models, thrust is taken by center bearing on 120's, front bearing on sixes and twelves, and rear bearing on super eights. On all 1948–51 models, thrust is taken by center bearing.

B—Standard size to which crankshafts are finished for use with copper-lead bearings is 2.187 to 2.188"; for cadmium-silver bearings 2.1875 to 2.1885".

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil Above +32°F.	Grade of Oil Above +10°F.	Grade of Oil Above −10°F.	Capacity, Pounds or Pints	Grade of Oil Summer	Grade of Oil Winter	Capacity, Pounds or Pints	Grade of Oil Summer	Grade of Oil Winter
1935	120	16½	20	6	30	20W	10W	2	140	90	5	90H	90H
	1200–1–2	20	25	8	30	20W	10W	4½	140	90	6	90H	90H
	1203–4–5	22	25	10	30	20W	10W	4½	140	90	6	90H	90H
	1207–8	40	30	10	30	20W	10W	4½	140	90	6	90H	90H
1936	120B	18	20	6	30	20W	10W	2	140	90	5	90H	90H
	1400–1–2	20	25	8	30	20W	10W	4½	140	90	6	90H	90H
	1403–4–5	22	25	10	30	20W	10W	4½	140	90	6	90H	90H
	1407–8	40	30	10	30	20W	10W	4½	140	90	6	90H	90H
1937	Six	14½	18	6	30	20W	10W	2	140	90	5	90H	90H
	Eight	17	21	6	30	20W	10W	2	140	90	5	90H	90H
	Super 8	20	24	8	30	20W	10W	4½	140	90	6½	90H	90H
	Twelve	40	30	10	30	20W	10W	4½	140	90	6	90H	90H
1938	Six	15	18	6	30	20W	10W	2	140	90	6	90H	90H
	Eight	15	21	6	30	20W	10W	2	140	90	6	90H	90H
	Super 8	20	24½	8	30	20W	10W	2	140	90	6	90H	90H
	Twelve	40	30	10	30	20W	10W	4½	140	90	6	90H	90H
1939	Six	15	18	5	30	20W	10W	2 (A)	140	90	6	90H	90H
	Eight	15	21	6	30	20W	10W	2 (A)	140	90	6	90H	90H
	Super 8	22	21	7	30	20W	10W	4½ (B)	140	90	6	90H	90H
	Twelve	40	30	10	30	20W	10W	4½	140	90	6	90H	90H
1940	Six	17	18	5	30	20W	10W	2 (A)	140	90	4½	90H	90H
	Eight	18	21	6	30	20W	10W	2 (A)	140	90	6	90H	90H
	Super 8	20	21	7	30	20W	10W	2 (A)	140	90	6	90H	90H
1941	Six	15	17	5	30	20W	10W	2 (A)	140	90	5	90H	90H
	Eight	17	20	5½	30	20W	10W	2 (A)	140	90	6¾	90H	90H
	Super 8	20	20	7	30	20W	10W	2 (A)	140	90	6¾	90H	90H
1942	Six	15	17	5	30	20W	10W	2 (A)	140	90	5	90H	90H
	Eight	17	17	5½	30	20W	10W	2 (A)	140	90	5	90H	90H
	Super 8	20	20	7	30	20W	10W	2 (A)	140	90	6¾	90H	90H
1946-47	Six	14	17	5	30	20W	10W	2 (A)	140	90	4	90H	90H
	Eight	17	17	5½	30	20W	10W	2 (A)	140	90	4	90H	90H
	Super 8	20	20	7	30	20W	10W	2 (A)	140	90	6¾	90H	90H
1948	Eight	18	17	6	20	20W	10W	2 (A)	90	90	4	90H	90H
	Super 8	20	20	6	20	20W	10W	2 (A)	90	90	4	90H	90H
	Custom 8	20	20	7	20	20W	10W	2 (A)	90	90	6	90H	90H
1949-50	Eight	18	17	7	20	20W	10W	2 (A)	90	90	4	90H	90H
	Super 8	19	20	7	20	20W	10W	2 (A)	90	90	4	90H	90H
	Custom 8	19	20	7	20	20W	10W	C	C	C	6	90H	90H
1951-52	200, 250, 300	20	20	7	20	20W	10W	2 (A)	90	90	4	90H	90H
	400	20	20	7	20	20W	10W	C	C	C	4	90H	90H

A—With ov rdrive, 3¼ pints.
B—With overdrive, 5¾ pints.
C—12 quarts of Packard Ultramatic Drive fluid.
H—Hypoid gear lubricant.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935	120	.003–.005	None	Nut	.004–.007
	1200–1208	.003–.005	Shims	None	.002–.004
1936	120B	.003–.005	None	Nut	.004–.007
	1400–1408	.003–.005	Shims	None	.002–.004
1937	115C, 120C	.003–.005	None	Nut	.004–.007
	1500–1508	.003–.005	Shims	None	.002–.004
1938	1600–1–2	.003–.005	None	Nut	.004–.007
	1603–1608	.003–.005	Shims	None	.002–.004
1939	1700–1705	.003–.005	None	Nut	.004–.007
	1707–1708	.003–.005	Shims	None	.002–.004
1940-52	All	.003–.005	None	Nut	.004–.007

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	120A	+2	+1	1/16	1½
	1200–8	+1½	+1	1/16	9
1936	120B	+2	+1	1/16	1½
	1400–8	+1	+1	1/16	9
1937	6 and 8	+2½	+1	1/16	1½
	V12	− ¼	+1	1/16	1½
1938	1600–1–2	+1½	+ ⅞	3/64	1⅚
	1603–4–5	+2½	+ ⅞	1/16	1½
	1606–7–8	− ¼	+1	1/16	1½
1939	1700–1–2	+1½	+ ⅞	3/64	1⅚
	1703–5	+ ½	+ ⅞	1/16	1⅚
	1707–8	− ¼	+1	1/16	1½
1940	1800–1	+1½	+ ⅞	3/64	1⅚
	1803–8	−1	+ ⅞	3/64	1⅚
1941	1900–1	+ ½	+1⅜	1/32	2½
	1951	−1	Zero	1/32	5½
	Super 8	− ¾	+ ⅞	1/32	2½
1942	Clipper 6 & 8	−1	Zero	1/32	5½
	Clipper Super 8	−2	Zero	1/32	5½
	2020–21	+ ¼	+ ½	1/16	2½
	Others	−1¼	+ ½	1/16	2½
1946-47	Six	−1	Zero	1/32	5½
	Eight	−1	Zero	1/32	5½
	Super 8	−2	Zero	1/32	5½
1948-50	Eight	−1	Zero	1/32	5⅚
	Super 8	−1	Zero	1/32	5⅚
	Custom 8	−2	Zero	1/32	5⅚
1951–52	All	−1	Zero	1/32	5⅚

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935	120	Molded	26	1¾	3/16	⅜
	1200-5	A	30¼	B	¼	⅜
	1207-8	A	32¼	C	¼	⅜
1936	120B	A	26	1¾	3/16	⅜
	1400-1-2	A	30¼	B	¼	⅜
	1403-4-5	A	30½	B	¼	⅜
	1407-8	A	32¼	C	¼	⅜
1937	115C	A	24	1¾	3/16	⅜
	120C	A	26	1¾	3/16	⅜
	1500-1-2	A	26	2½	3/16	⅜
	1506-7-8	A	30	2¾	¼	⅜
1938	1600	Molded	24	1¾	3/16	⅜
	1601	Molded	26	1¾	3/16	⅜
	1602	Molded	26	2¼	3/16	⅜
	1603-4-5	Molded	26	2½	3/16	⅜
	1607-8	Molded	30	2¾	3/16	⅜
1939	1700	Molded	24	1¾	3/16	⅜
	1701	Molded	26	1¾	3/16	⅜
	1702-3-5	Molded	26	2¼	3/16	⅜
	1707-8	Molded	30	2¾	¼	⅜
1940	1800	Molded	22⅝	1¾	3/16	⅜
	1801	Molded	24½	1¾	3/16	⅜
	1803-6	Molded	24½	2	3/16	⅜
	1804-5-7-8	Molded	26	2¼	3/16	⅜
1941	1900	Molded	22⅝	1¾	3/16	⅜
	1901-51	Molded	24½	1¾	3/16	⅜
	1903-6	Molded	24½	2	3/16	⅜
	1904-5-7-8	Molded	26	2¼	3/16	⅜
1942	Six	Molded	(D)24½ (E)22⅝	1¾	3/16	⅜
	Eight	Molded	24½	1¾	3/16	⅜
	2003-6	Molded	24½	(D)2¼ (E)2	3/16	⅜
	2023	Molded	24½	2	3/16	⅜
	2004-5-7-8	Molded	26	2¼	3/16	⅜
1946-1947	Six	Molded	(D)24½ (E)22⅝	1¾	3/16	¼
	Eight	Molded	24½	1¾	3/16	¼
	Super 8	Molded	24½	(D)2¼ (E)2	3/16	¼
1948-1950	Eight	Molded	24½	1¾	3/16	¼
	Super 8	Molded	24½	1¾	3/16	¼
	Custom 8	Molded	24½	(D)2¼ (E)2	3/16	¼
1951-1952	All	Molded	24½	(D)2¼ (E)2	3/16	¼

A—Primary shoe, molded. Secondary, woven
B—Left front 1¾″. All others 2¼″.
C—Left front 1⅞″. All others 2½″.
D—Front wheel.
E—Rear wheel.

FIRST ENGINE NUMBER

LOCATION—On left side of cylinder block or crankcase

Year	Model	Number
1935	120	X-1501
	1200-1-2	385000
	1203-4-5	755000
	1207-8	903001
1936	120B	X-27500
	1400-1-2	390500
	1403-4-5	757000
	1407-8	904000
1937	115C	T-1500
	120C	X-100000
	1500-1-2	395500
	1506-7-8	905500
1938	1600	A-1501
	1601-2	A-300001
	1603-4-5	A-500001
1938	1607-8	A-600001
1939	1700	B-1501
	1701-2	B-300001
	1703-5	B-500001
	1707-8	B-600001
1940	1800	C-1501
	1801	C-300001
	1803-4-5	C-500001
	1806-7-8	CC-500001
1941	1900	D-1501
	1901	D-300001
	1951	D-400001
	1903-4-5	D-500001
	1906-7-8	CD-500001
1942	2000-10	E-1501
	2020	E-1501
	2001-11	E-300001
	2021	E-300001
	2003	E-500001
	2004-5	E-500001
	2023	E-500001
	2006	CE-500001
	2007-8	CE-500001
1946	2100	F-1501
	2101-11	F-300001
	2103-23	F-500001
	2106-26	F-500001
1947	2100	F-15001
	2111	F-320001
1947	2103	F-506001
	2106-26	F-506001
1948	2201-11	G-200001
	2202-32	G-400001
	2206-33	G-600001
1949-50	2301	H-200001
	2302-32	H-400001
	2306-33	H-600001
1951	2401 (200)	J-200001
	2401 (250)	J-400001
	2402	J-400001
	2406	J-600001
1952	2501	K-200000
	2531	K-400000
	2502	K-400000
	2506	K-600000

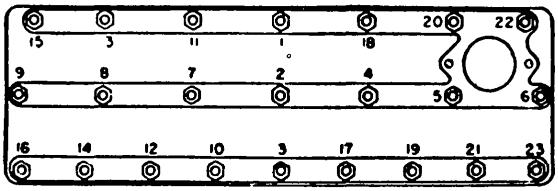


Fig. 1 Head tightening. 1937-47 Sixes

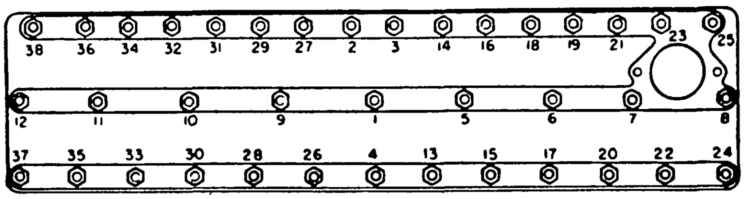


Fig. 3 Head tightening. 1939-47 Super 8 and all 1948-52

ENGINE

ENGINE REMOVAL

1935-42 Except Clippers — The general procedure for removing the engine is the same as that given below for later models except that the fenders and grille must be removed as a unit. The engine may then be hoisted through the top of the engine compartment.

1941-52—The general procedure for removing the engine is as follows:

1. Remove hood.
2. Disconnect and remove battery.
3. Drain cooling system.
4. Remove radiator core.
5. Remove upper radiator splasher (if so equipped).
6. Remove transmission as described under *Transmission*.
7. Use a jack or auxiliary support beam to support rear end of engine while transmission or Ultramatic Drive is removed.
8. Remove carburetor air cleaner.
9. Remove crankcase breather pipe.
10. Disconnect exhaust pipe at manifold.
11. Disconnect flexible line at fuel pump.
12. Disconnect heat indicator sending unit lead wire.
13. Disconnect wire at oil pressure indicator sending unit.
14. Disconnect electrical leads at generator, starter and ignition coil.
15. Disconnect clutch linkage and remove clutch torsion shaft bearing bracket from upper flywheel housing.
16. Remove front engine support insulator attaching nuts.
17. Using a chain hoist and an engine lifting bracket, raise engine off support insulators.
18. Remove jack or support beam from frame and lift out engine.

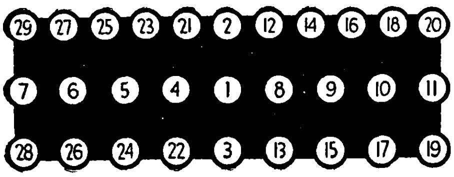


Fig. 2 Head tightening, 1935-47 Eight

CYLINDER HEAD

1935-52—The general procedure for removing the cylinder head is as follows:

1. Drain cooling system and remove upper hose.
2. Disconnect heater hose at cylinder head.
3. Disconnect temperature indicator sending unit wire.
4. Remove air cleaner.
5. Disconnect throttle linkage.
6. Remove throttle cross shaft.
7. Disconnect spark plug cables and remove cable support bracket and coil.
8. Remove oil filter, if necessary.
9. Remove nuts and washers and lift off cylinder head and gasket.

INSTALLATION NOTES — Before the cylinder is installed, make certain that all dirt and carbon is removed from both the head and block.

If possible, use a torque wrench when tightening cylinder head nuts. Uneven or excessive tightening of nuts may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder head nuts in the order shown in Figs. 1, 2 and 3. Tighten them a little at a time in the proper sequence about three times around before final tightening to the torque values given in the *Tune Up Chart*. After the engine has warmed up to operating temperature, recheck the nuts and adjust torque as required.

VALVE SERVICE, 1935-52

TAPPET ADJUSTMENT (Mechanical Type)—These tappets should be set to the clearances given in the *Valve Chart* with the engine hot and running.

1. Raise front end of car and support it on a stand.
2. Remove left front wheel and splash shield access cover.
3. Remove valve chamber covers.
4. While engine is idling, hold the tappet body with a tappet wrench to prevent it from turning. Then turn the tappet adjusting screw until the specified clearance (measured with a feeler gauge) is established.
5. Adjust all tappets in the same manner.

TAPPET ADJUSTMENT (Hydraulic Type)—Check the take-up reserve of each hydraulic unit after a valve grind job or when new valves are installed. This may be done by using the hydraulic tappet gauge set shown in Fig. 4 before the valve springs and locks are installed.

1. Remove the hydraulic plungers from the tappet bodies and place them on the work bench in the order in which they are removed from the engine.
2. Install the valves without springs

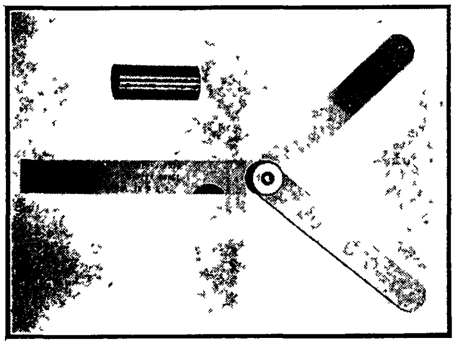


Fig. 4 Special feeler gauge and plug gauge set for checking tappet clearance on engines with hydraulic valve lifters, 1940-52

3. Bring No. 1 piston to the top of its compression stroke. At this time the intake and exhaust valves for this cylinder will be at the base of their respective lobes on the camshaft.
4. Place the plug gauge of the gauge set in the lifter body, and while holding the valve down on its seat, check the clearance between the upper end of the plug and the valve stem, using the feeler gauges supplied with the gauge set, Fig. 5.
5. The clearance should between .030 and .070". If less than .030", face off the end of the valve stem until the desired clearance is obtained.
6. Repeat this operation on all valves. Do not overlook having the piston at the top of its compression stroke when checking the corresponding valves for clearance.

VALVES, REMOVE—After taking off the cylinder head as outlined previously, take off the valve chamber covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the valve locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so that they can be identified as to the valve port from which they were removed.

VALVE SPRINGS—After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring pressure on a spring testing fixture if one is available. If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced. Likewise, any spring that stands shorter than the new spring used for comparison should be discarded.

VALVE GUIDES — Clean the valve guides with a wire guide brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the clearance between the valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between valve stems and guides will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the valve guide. If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed.

If it is necessary to replace valve guides, the old guides can be driven down and out of the valve chamber. A special driver is available for this work. However, in lieu of the driver, the guides can be pulled out of the block by using a suitable piece of pipe together with a long bolt and suitable washers.

When replacing the guides, maximum engine performance can only be secured when the guides are installed to the correct depth. Packard has available special driver and depth gauges for the proper installation of valve guides in all engine models.

VALVES, REFACE—In refacing valves take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve head becomes too thin or sharp due to excessive grinding, the valve must be replaced.

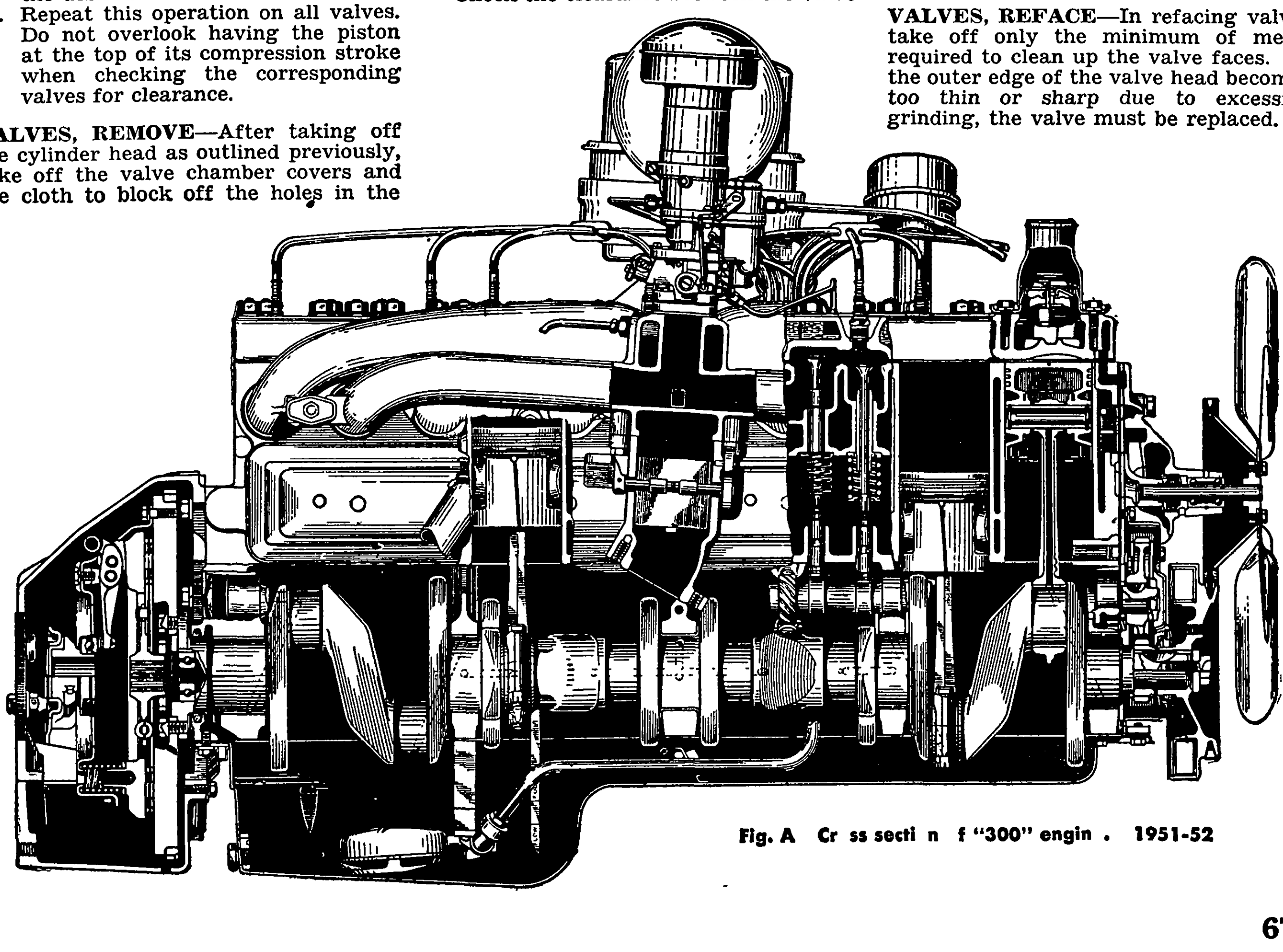


Fig. A Cross section of "300" engine. 1951-52

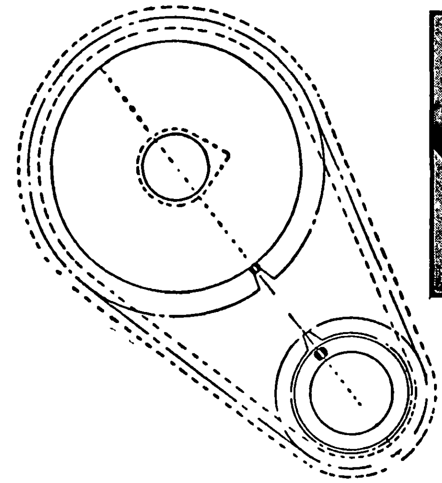


Fig. 6 Valve timing is correct wh n "O" marks on sprockets are align d as shown, 1935-52

Inspect the valve seats in the block for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

After the seat has been refaced, use a dial indicator and check for concentricity. Seats should be concentric within .001". The use of a dial indicator will show the actual relationship which exists between the valve guide bore and the valve seat circle.

VALVE LIFTERS & GUIDES

1935-37 "110" & "120"—Lifters on these models are of the barrel type running in guides integral with the cylinder block. Lifters are available in oversizes of .001", .002" and .005", and when necessary to replace, remove the cylinder head, valves and springs and take out the lifters through the valve compartment.

1935-39 STANDARD & SUPER 8 — Lifters on these models are carried in removable guides which are held in place by the bottom of the cylinder block. The lifters are removable through the valve compartment after the valves and springs are out. The lifter guides can be removed easily if the cylinder block is off, but if the block is not to be removed, the lifters can be taken out by dropping the oil pan and disconnecting the connecting rods. Then remove all the nuts which attach the cylinder block to the crankcase, raise the block about 4" and take out the lifters.

1938-47 "110" & "120"; 1948-52 Eight & Super 8—Lifters on these models are of the mushroom type running in guides which are cast integral with the cylinder block. If lifters are to be replaced, drop the oil pan, remove the timing case cover and withdraw the camshaft, after which take the lifters out from below. Lifters are available in oversizes of .001", .002" and .005".

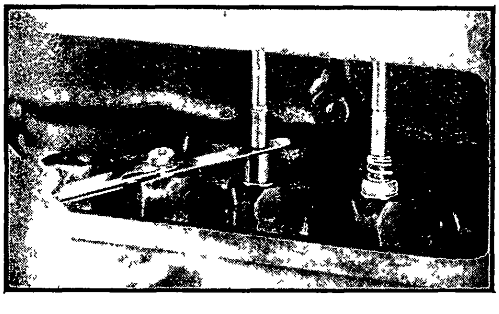


Fig. 5 Showing use of special plug gauge for checking tappet clearance on engines with hydraulic valve lifters. 1940-52

HYDRAULIC VALVE LIFTERS

1940-52 Eights—Details on the operation and servicing of these lifters are given in the *Hydraulic Valve Lifters* chapter. However, whenever they are removed when performing other work, it is advisable to clean the hydraulic units to remove dirt or other foreign matter before reinstalling them in the lifter bodies.

When cleaning the hydraulic units, bear in mind that the plungers and cylinders are very carefully matched and must not be interchanged. Disassemble one at a time, clean and reassemble before starting on another.

TAPPET LEVERS

1935-39 Standard & Super 8—The tappet levers, the rollers of which run directly on the cams of the camshaft, operate the valve lifters. When necessary to remove the levers, unfasten the housings from the crankcase and withdraw the levers through the opening in the side of the crankcase, bearing in mind that it is not necessary to remove the valves.

TIMING CHAIN, COVER & SPROCKETS

1935-52—To remove the chain, take off the radiator and front fender unit on all models except 1935-38 Standard and Super 8's. On these latter models, the radiator need not be removed. On all models, pull off the crankshaft pulley, support the engine under the front end, then remove the front engine support, timing case cover, timing chain and sprockets.

To assemble, place the chain over the sprockets so that when the camshaft sprocket is bolted to its hub, the timing marks on both sprockets are opposite each other and in line with the centers of both the camshaft and crankshaft, Fig. 6.

CAMSHAFT & BEARINGS

1935-52—To remove the camshaft on all models, take off the radiator and front fenders as a unit. Except on the Twelves, it is not necessary to drop the oil pan. On the "110" and "120", take out the oil pump.

Remove the cylinder head, fuel pump, valve cover plates and crankshaft pulley. Support the front of the engine and remove the front engine support, timing cover, chain and sprockets.

Raise the valves and hold them in position by inserting two wooden wedges

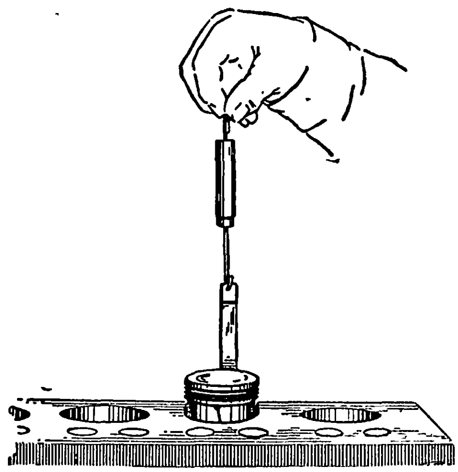


Fig. 7 Check piston fit with gauge on unslotted face of piston, 1935-52

under each valve head at opposite point to prevent cocking or warping the valve heads. (This operation is not required if the valves are to be reground as the valves and springs will have to be removed anyhow.)

Raise the lifters and hold them in place with spring-type clothes pins, rubber bands or some other similar appliance. The camshaft may then be withdrawn by rotating it so that it can clear any obstruction during the process.

If necessary, the bearings may then be removed and new ones installed, being sure that the oil holes in the bearings are aligned with the oil holes in the crankcase and that these holes are clean and open to assure adequate lubrication.

To install the camshaft, reverse the above procedure, using new gaskets when replacing the cover. Reset the ignition timing and check the valve clearance.

PISTONS & RODS, REMOVE

1935-52—On 1935-39 "110", "120" and all 1940-51 models, the pistons and rods are removed through the top of the block.

NOTE—On 1935-39 Standard 8, Super 8 and all 12's, it is necessary to disconnect the rods from the crankshaft and push them up through the bore far enough to permit removal of the piston pins. After the pistons are removed from the top, the rods are then pushed down and removed from below. To facilitate the performance of this operation, it is recommended that the engine be warm.

PISTON & ROD, ASSEMBLE

1935-52—When correctly assembled, the oil spray hole in the big end of the connecting rod and the slotted side of the piston should be on the camshaft side of the engine when installed in the cylinder. This applies to all engines except the Twelves, in which case the oil spray hole in the rod should face the starter side of the engine.

PISTONS

1935-52—Pistons are available in standard size and oversizes of .005, .020, .030 and 040 in.

On 1941-52 engines a star after the engine serial number indicates that the cylinder bores are .020 in. oversize.

When fitting pistons, use feeler stock of the thickness given in the *Piston and Ring* table. The feeler should be long enough to extend down into the bore for the full length of the piston. Insert the piston into the bore upside down and place the feeler stock between the piston and the cylinder wall as shown in Fig. 7. Hook the feeler to a spring scale and withdraw the feeler by pulling it out of the cylinder with the scale. The piston is fitted properly if the amount of pounds pull registered on the scale comes within the limits given in the *Piston & Ring* table.

PISTON RINGS

1935-52—Piston rings are furnished in standards and oversizes of .020, .030 and .040. Always use standard size rings in cylinders that are *standard at the bottom, regardless of the amount of taper.* Oversizes ordered must be determined by the measurement of the smallest portion of the bore.

Before removing pistons, the ridge at the top of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder wall, never try to remove the last traces of the ridge; this can be done afterward by honing.

New rings should be fitted according to the instructions given with the ring package. Ring grooves must be clean and free from carbon and must show no perceptible wear. When fitting rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side when installed in the piston.

PISTON PINS

1935-52—Pins are furnished in standards and oversizes of .003 and .006 inch. They should be fitted in the pistons with a finger push after heating the piston in water, and a similar fit in the rod bushing at normal room temperature. Rod bushings should be burnished in place and then reamed to size.

ROD BEARINGS

1935-52—Rod bearings are furnished in standards and undersizes of .001, .002, .003 and .015 inch. They are the replaceable shell type and can be renewed by removing the caps and replacing the upper and lower halves.

Upper and lower halves are not interchangeable because of the oil hole in the upper bearing for the connecting rod oil passage. Always make sure the upper half is installed correctly or no oil will reach the piston pins and cylinder walls.

MAIN BEARINGS

1935-52—On all Sixes, Eights and 1940-52 Super and Custom Eights, the bearings are of the replaceable shell type which can be renewed by simply removing the caps and replacing the upper and lower halves. On all other models, the engine must be taken out of the chassis to replace the bearings since they are retained by dowels in the crankcase.

Shell type bearings are furnished in standards and undersizes of .001, .002 and .015 inch. No attempt should be made to shim, file or otherwise take up bearings of this type.

To install new shell bearings, remove the cap and take out the worn lower half. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.

Place a new upper shell on the crankshaft journal, with the locating notch in the correct position, and rotate the shaft to turn the shell in place. Install the lower shell in the cap and replace the cap.

CRANKSHAFT REAR OIL SEALS

1935-47 Six & Eight—Oil sealing at the rear of the crankshaft on these models is controlled by an oil slinger which is integral with the crankshaft and running in a groove which has a cored hole leading into the oil sump. In addition, a back spiral groove on the crankshaft returns any surplus oil to the sump through the oil return hole.

1940-50 Super 8, All 1951-52—The rear main bearing oil seals may be changed while the engine is in the car. However, extreme care should be exercised in those steps which pertain to lowering and raising of the crankshaft as described in the following:

1. The car should be raised and stands placed under the car at all four corners, keeping the engine in its normal position and on a level plane.
2. Remove transmission or Ultramatic Drive.
3. Remove oil pan.
4. Remove rear main bearing and cap. Do *not* remove other main bearing caps.
5. Loosen each main bearing cap attaching screw approximately ¼ turn or just enough to break loose each screw from its fully tightened position.

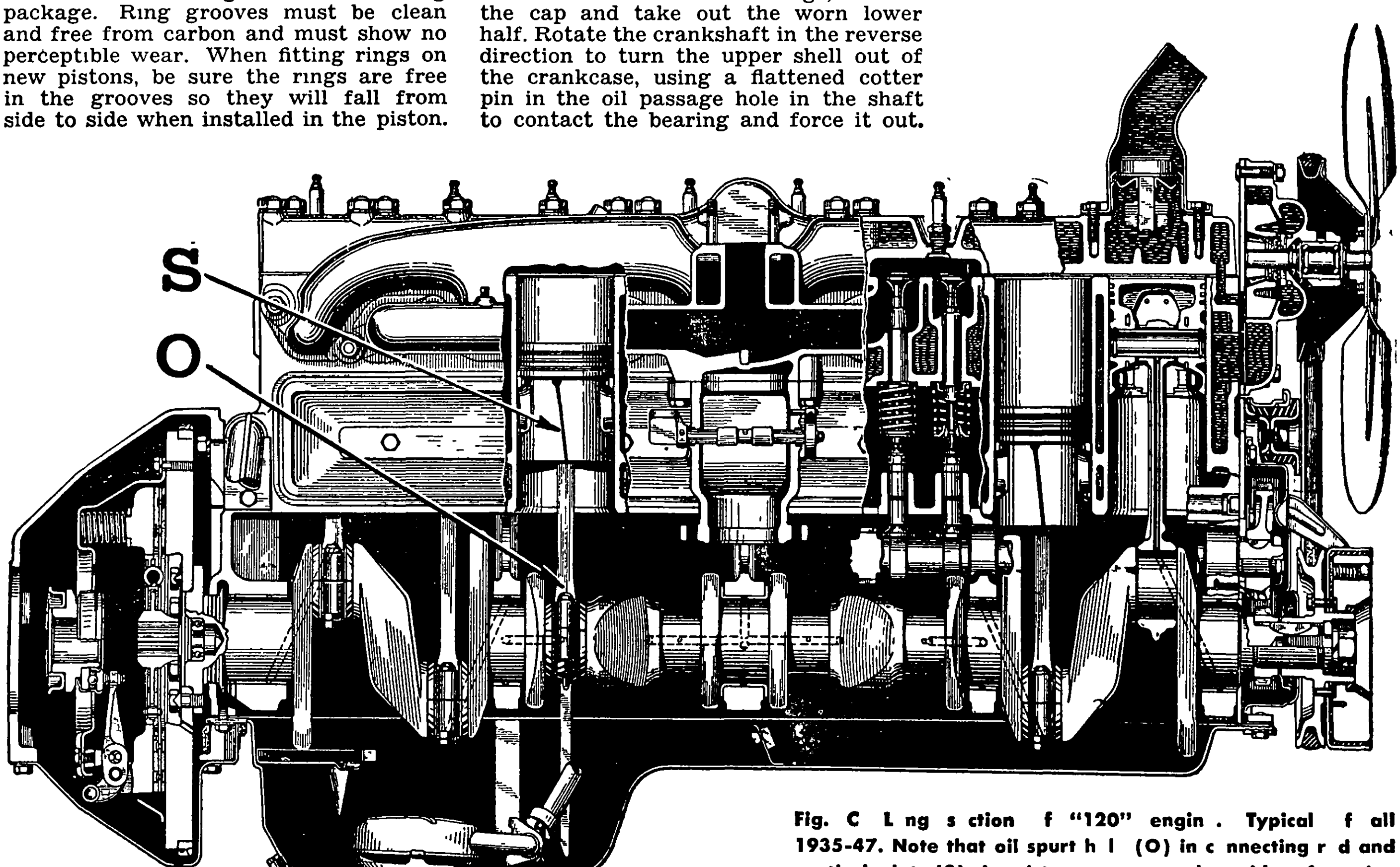


Fig. C L ng s ction f "120" engin . Typical f all 1935-47. Note that oil spurt h l (O) in c nnecting r d and vertical sl t (S) in pist n are n valv sid of engin

6. Back out each screw approximately ½ turn at a time. This will permit the crankshaft to lower itself slowly and evenly.
7. Continue backing out each screw ½ turn at a time, making sure that the crankshaft is being supported by all main bearing caps while being lowered. The rear end of the crankshaft may be lowered approximately ½" in this manner.
8. Remove the rear bearing upper seal from its groove in the cylinder block, using a pointed tool such as an awl or ice pick.
9. Remove the lower seal from the rear main bearing cap.
10. Remove the bearing cap side seals.
11. Before starting to install the upper seal, it first should be pressed into the form or shape it assumes when it is in its groove in the cylinder block. This may be done by pressing the seal into the groove in the bearing cap.
12. Use a smooth, rounded tool of wood or metal to work the packing from end to end toward the center of the cap to force and shape the packing in the groove.
13. After the seal has been formed and shaped, it may be fed up around the crankshaft and into its groove in the cylinder block.
14. When the seal is properly positioned, tighten each bearing cap attaching screw a ½ turn at a time to raise the crankshaft slowly and evenly.
15. Tighten the cap screws alternately in stages of ½ turn until all the screws are snugly tightened.
16. Turn the crankshaft over two or three revolutions. This will tend to burnish the seal into position.
17. Continue tightening the cap screws by stages until the final torque specified in the *Engine Bearing Data* chart is obtained. After each tightening operation, rotate the crankshaft to further "burnish-in" the seal.
18. After tightening the bearing caps to their final torque, the ends of the upper seal should be cut off *flush* with the split line in the cylinder block.
19. The lower seal may be installed in the bearing cap in the same manner but the over-lapping ends should be cut off so that 1/16 of the seal extends at each end.
20. Install the rear main bearing and cap, tighten the cap screws to the proper torque.
21. Install the side seals by driving them into the grooves and trim them off flush with the bearing cap.

ENGINE OILING

OIL PAN

1935-52—Before starting to remove the oil pan, it is advisable to have the car under a chain hoist since it may be necessary to raise the front of the engine slightly to obtain sufficient clearance to remove the pan.

On 1941 and later models, detach the steering idler lever support from the frame side rail to lower the steering linkage. Then remove the flywheel housing lower cover and oil pan retaining screws and lower the pan. The crankshaft may be in such a position that the crankshaft counterweights interfere with the pan while it is being removed. If so, turn the crankshaft with a bar or long screwdriver in the teeth of the flywheel while using the edge of the flywheel housing as a fulcrum.

If it is necessary to raise the front of the engine to obtain additional clearance, attach a chain hoist to the front of the cylinder block, using a suitable piece of flat stock over two of the cylinder head front studs. It is not necessary to loosen the front motor support bolts prior to raising the front of the engine to obtain this additional clearance. Simply relieving the load of the engine in the chassis will provide the necessary clearance.

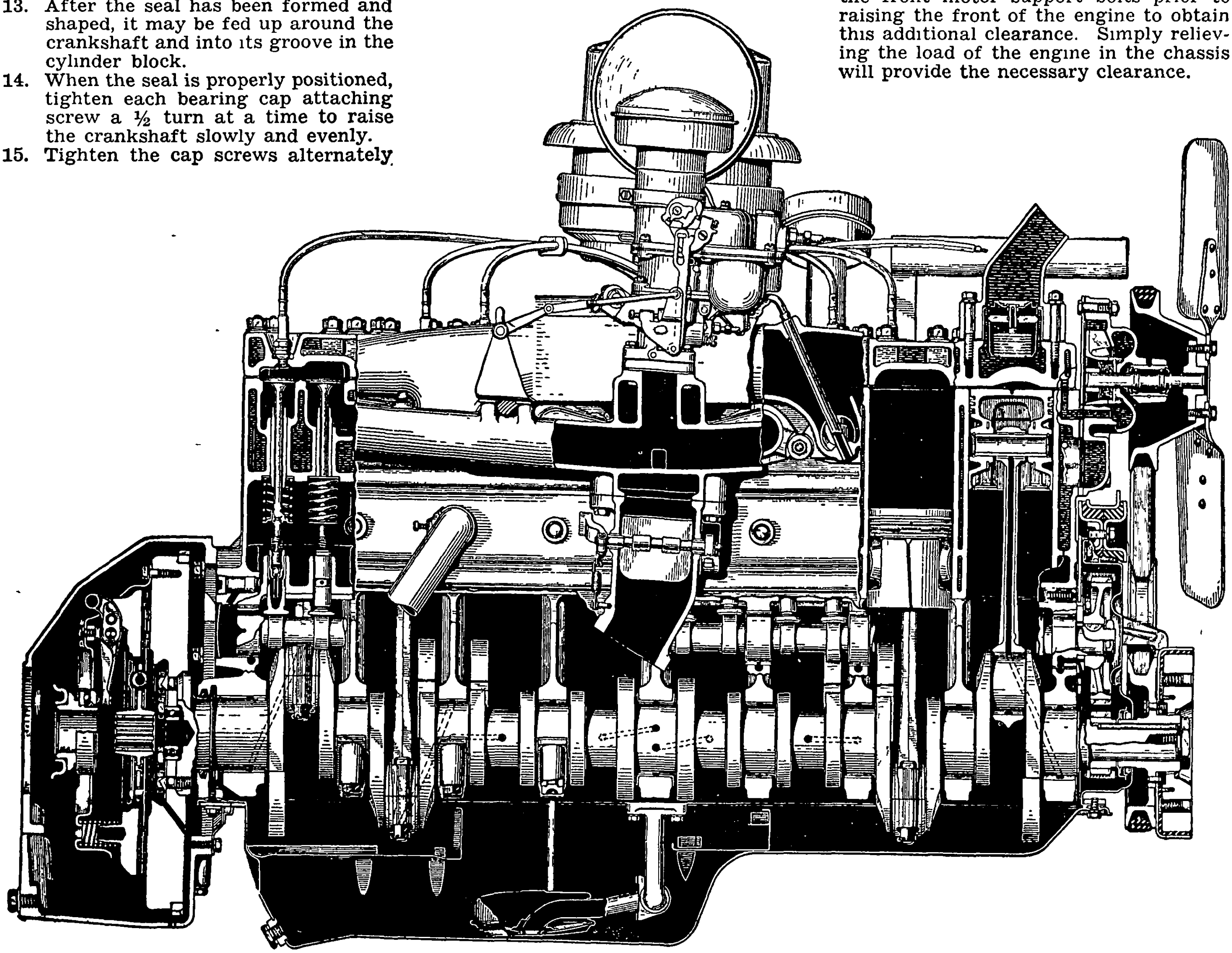


Fig. D L ng secti n f Super Eight ngine. Typical f all 1940-47. N t that th vertical slot in pist n is n valve side of engine

OIL PUMP

1935-52—Except for 1935-39 Super 8 and V12's which have the oil pump located in the bottom of the crankcase, the oil pump on 1940-52 models is mounted externally on the side of the cylinder block, and is removed and disassembled in the following manner Lift off the distributor cap and rotate the crankshaft until the distributor rotor is in firing position for No 1 cylinder Keep the engine in this position while the pump is off Remove the cap screws in the pump body, drop the pump, remove the pump cover and oil pump idler gear Drive out the pin from the oil pump and distributor drive gear, pull the shaft out of the housing and press the drive gear from the shaft

NOTE — Reverse the operations to assemble and install the pump If, for any reason, the crankshaft has been shifted, bear in mind that on the 1940-51 models the crankshaft will have to be turned again to bring No 1 cylinder on the firing position Set the distributor rotor on No 1 and install the oil pump, maintaining the same position for the rotor. Then reset the ignition timing

As an added precaution, bear in mind that *on the 1940-52 models*, the punch mark on the oil pump gear should be at the bottom on the Sixes and at the top on all Eights Always use new gaskets when installing the pump to the engine

1935-39 Standard & Super 8 & 12—The pumps on these engines are located in the bottom of the crankcase and may be disassembled after the oil pan is off following a like procedure as for the models described above

OIL PRESSURE REGULATOR

1935-52—On all models except 1935-39 Super 8 and V12, the oil pressure regulator valve is built into the oil pump and is not adjustable

On 1935-39 Super 8 and V12 oil pressure can be adjusted by removing the cap over the relief valve on the side of the crankcase Then turn the slotted screw clockwise to increase pressure and counterclockwise to decrease it.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-52 — To remove the core without disturbing the radiator shell or fenders, remove water hose, horn trumpet, fan, water pump, and loosen the radiator core anchorage bolt, after which lift out the core.

WATER PUMP, REMOVE

1935-52—On all models except 1935-38 Super 8 and 1936-39 Twelve, the water pump may be removed without taking off the radiator.

WATER PUMP, OVERHAUL

1935-37 "110" & "120"—To disassemble the pump, remove the impeller housing

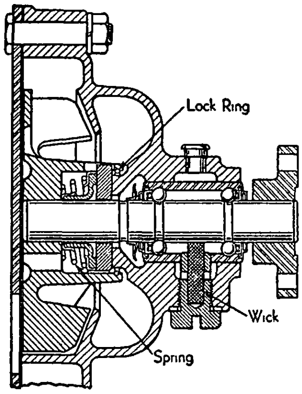


Fig. 8 1938 Six and Eight water pump

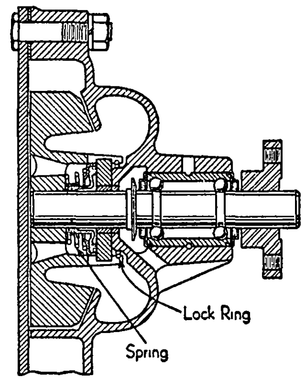


Fig. 9 1939-40 Six and Eight water pump

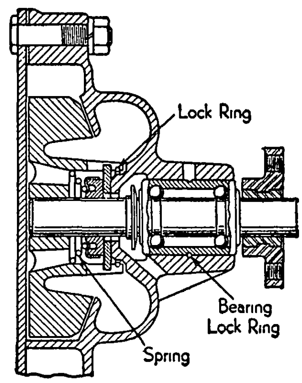


Fig. 10 1941-47 Eight water pump

cover, loosen the packing nut and press the shaft forward out of the impeller Remove the packing nut and packing, and if the bushings are to be replaced, press them out of the housing and press the new bushings in carefully to avoid damage to the housing and avoid burring the bushings These special composition bushings must not be reamed, but should be burnished in place

Assemble in the reverse order, using a new gasket under the impeller housing cover Heat the impeller in boiling water to facilitate pressing it off and on the shaft When correctly assembled the clearance between the water pump housing and the front face of the impeller blades should be 021" to 039", and between the rear face of the impeller hub and the cover plate, 005" to .015" Lubricate the pump before putting it into operation

1938-39 "110" & "120"; 1940-52 ALL—After removing the pump from the engine, take out the set screw which retains the bearing on 1938 and early 1939 units For late 1939 and 1940-50 units, remove the bearing snap ring Remove the rear cover plate and support the pump body securely between two blocks mounted on the bed of a press to force the shaft out of the impeller Remove the wire lock ring, thrust washer, rubber sleeve, brass retainers and spring in that order (see Figs 8, 9 and 10)

ASSEMBLY DETAILS — On the early type pump with the bearing retainer set screw, be sure to line up the hole in the bearing with the hole in the pump body

Heat the impeller in water just under the boiling point and coat the shaft and seal with engine oil before installation Make sure that the machined face on the pump body against which the washer rides is smooth and flat If any score marks are evident, renew the body or resurface the face if equipped to do so The clearance between the impeller and the front of the housing should be from .020" to .040" Coat the gaskets with a suitable sealing paste

Be sure that the smoother face of the composition thrust washer is nearest to the fan blades The shaft, bearing and fan hub is serviced as an assembly only.

ELECTRIC SYSTEM

IGNITION TIMING

1935-36 Standard & Super 8—It is advisable to remove the distributor from the car and synchronize the two sets of points, which should break at intervals of 90°

On the 1935-38 models, the points should break 6° before the UDC mark, except on the 1935 Super Eight for which they should break 8° before UDC

1935-36 Twelve—It is advisable to remove the distributor from the car to synchronize the dual breaker points Points fire at irregular intervals of 67° and 53° Stationary points should open when No 1 piston of the right bank, coming up on its compression stroke, is 6° to 8° before TDC Adjustable points break after 67° *or* 22 flywheel teeth after the stationary set of points

1935-36 "120"—Two breaker arms and a four-lobe cam are used Adjust both sets of points to 020" gap, set the octane selector at 0, and crank the engine with No 1 piston coming up on its compression stroke On the 120, stop 5° before the No 1 UP DC mark on the flywheel registers with the pointer at the peep hole, when the stationary points should break for No 1 cylinder Crank the engine one-quarter revolution until line 5° before the No 6 UP DC mark on the flywheel registers with the pointer at the peep hole, when the adjustable points should break On the 120B, stationary points open when the white line on the flywheel 7° before No 1 UP DC registers with the peep hole pointer, and the adjustable points open 7° before the mark No 6 UP DC registers with pointer.

1937-38 Twelve — Adjust both sets of points to 020" Align carbon brush end of rotor with distributor cap terminal 1R Turn engine until the graduation 6° before No 1R-UDC aligns with the pointer on timing chain cover, when fixed set of points should break for No 1 cylinder Rotate engine until the graduation of 6° before No 6L-UDC on vibration damper aligns with pointer, when adjustable points should break. When special high compression heads are used

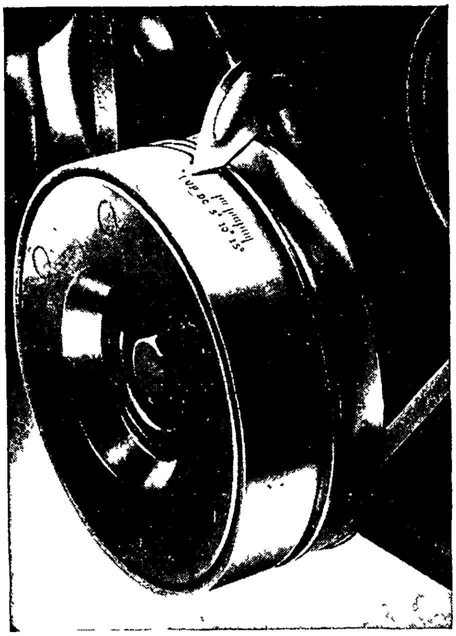


Fig. 11 Timing marks on vibration damper, 1941-52

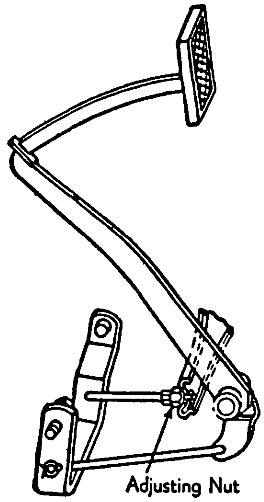


Fig. 12 1940-47 Sixes. Clutch pedal free travel should be 1½" to 1¾" on 1940-41 and 1½" to 2" on 1942-47

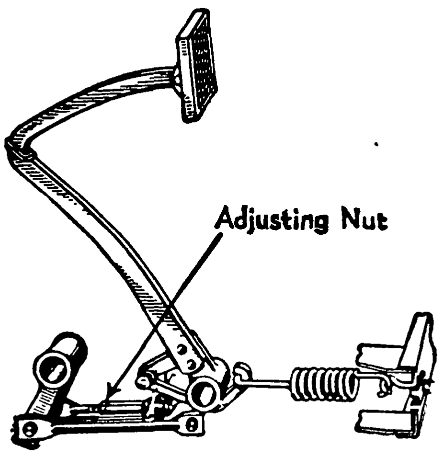


Fig. 13 Clutch pedal free play 1½" 1940-52

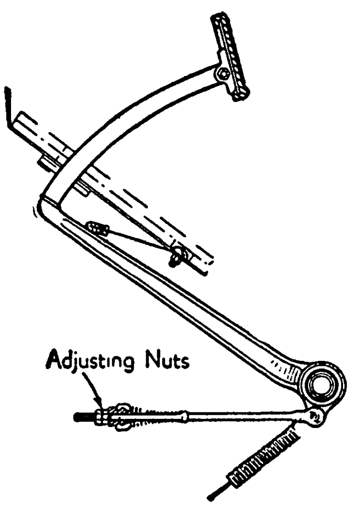


Fig. 14 1937-38 Super Eight. Clutch p dal free trav l sh uld be 1½" t 2"

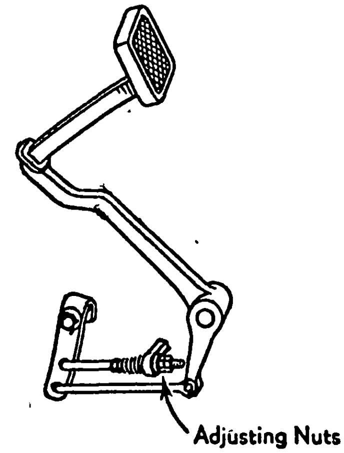


Fig. 15 1937-39 Six and Eight. Clutch pedal fr travel should be 1½" to 2"

the points should break 4° to 5½° before UDC.

1937-52 (Except V12)—With the breaker gap set to the clearance given in the *Tune Up* table, crank the engine to bring No. 1 piston up on its compression stroke and stop when the pointer is in line with the specified timing mark on the vibration damper or flywheel (Fig. 11)—given in the *Tune Up* table.

Locate No. 1 spark plug wire on the distributor cap, place the cap in position on the distributor and mark the housing opposite No. 1 terminal so that its relative position will be known when the cap is removed.

With the octane selector set at zero, loosen the distributor body clamp and rotate the distributor until the points close. Then rotate the distributor in the opposite direction until the points just begin to open, after which, tighten the clamp bolt.

NOTE—For best results, use a Neon timing light or a suitable test lamp to check the timing. Advance or retard the octane selector to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-36 Standard & Super 8 — Adjust free pedal travel by turning the adjusting nut on the pedal pull rod to obtain 1" clearance between pedal shank and toe board.

1935-39 Twelve—Adjust the pedal up against the toe board spring, or with 1$\frac{1}{8}$" clearance between pedal shank and toe board. Adjust linkage so that the power valve will open when the shifter yoke contacts the clutch throwout bearing.

1937-52 (Except Twelves) — Adjust the free travel of the pedal by turning the adjusting nut on the pedal pull rod to obtain the clearance as given in Figs. 12, 13, 14 and 15.

CLUTCH, REMOVE AND REPLACE

1935-50 Custom & Super 8 & 12—After removing the transmission, remove the clutch cover to flywheel bolts and lift cover and pressure plate assembly off. Note the "O" marks on clutch cover and flywheel which should be adjacent when replacing the clutch.

1935-50 Six & Eight—Remove the transmission as described under transmission. Depress the clutch pedal and insert a wedge (special tool ST-879 or equivalent) between each throwout finger and the cover, to hold the clutch in partly released position. This is necessary on most models through 1937, to permit removal of the clutch from below. On 1938-50 models, the fingers need not be wedged. Proceed, on all models, to remove the clutch throwout bearing, pedal rod and cover screws and withdraw the pressure plate and cover assembly from below.

1951-52—After removing the transmission as outlined under *Synchromesh Transmission,* take out the clutch as follows:

1. Remove flywheel lower housing.
2. Remove clutch release bearing and sleeve.
3. Mark clutch cover plate and flywheel so that these parts may be attached in the original location upon reassembly in order to preserve the original balance.
4. Loosen progressively the six capscrews that hold the clutch cover to the flywheel until clutch cover is free.
5. Remove clutch assembly and driven plate from flywheel housing.
6. Remove clutch shaft pilot bearing.

CLUTCH INSTALLATION

1935-52—The general procedure to reinstall the clutch is the reverse of the removal procedure. However, the following should be observed:

1. Pack the clutch pilot bearing with short fiber wheel bearing grease and install the pilot bearing with the open side toward the front of the engine and the shielded side toward the rear.
2. When installing a new clutch driven plate, try the splines of the plate on the splines of the clutch shaft for free movement.
3. Coat the splines of the clutch shaft very sparingly with a medium cup grease or "Lubriplate".
4. Hold the clutch cover and pressure plate assembly and driven plate in place, with the damper springs of the driven plate away from the flywheel.
5. Be sure the marks on the cover plate and flywheel line up.
6. Start the clutch cover-to-flywheel capscrews but do not tighten them at this time.
7. Insert a suitable aligning arbor or a spare clutch shaft through the clutch driven plate and into the clutch shaft pilot bearing.
8. Tighten the clutch cover-to-flywheel capscrews a few turns each in progression until they are all tight.
9. Install clutch release bearing and sleeve.

ELECTROMATIC CLUTCH

The Electromatic Clutch is a vacuum-electric device which engages and disengages the clutch, automatically synchronizing the clutch engagement with the throttle opening. The driver uses the accelerator and shifts gears in the normal manner but without the use of the clutch pedal.

ELECTROMATIC CLUTCH ADJUSTMENTS

It must be remembered that the purpose of the Electromatic Clutch adjustment is to regulate the Electromatic operation to the driver's personal preference and the specific operating conditions. These adjustments are not provided to offset any mis-adjustments, wear or faulty operation of the clutch and linkage. Once the adjustments are accurately made, they need not be changed except when the control valve linkage becomes worn. However, if this linkage is worn excessively it should be replaced. The clutch itself and the clutch linkage must be in good operating condition before any accurate Electromatic Clutch adjustments can be made.

Before making any adjustments, the clutch pedal free play should be checked and, if necessary, adjusted to obtain two inches of free play on 1941-42 cars or 1½ inches on post-war cars. Maintaining the proper clutch pedal free play is the most important factor in the operation of the Electromatic Clutch and, in many cases, further adjustments of the Electromatic mechanism may not be necessary after the clutch pedal has been properly adjusted.

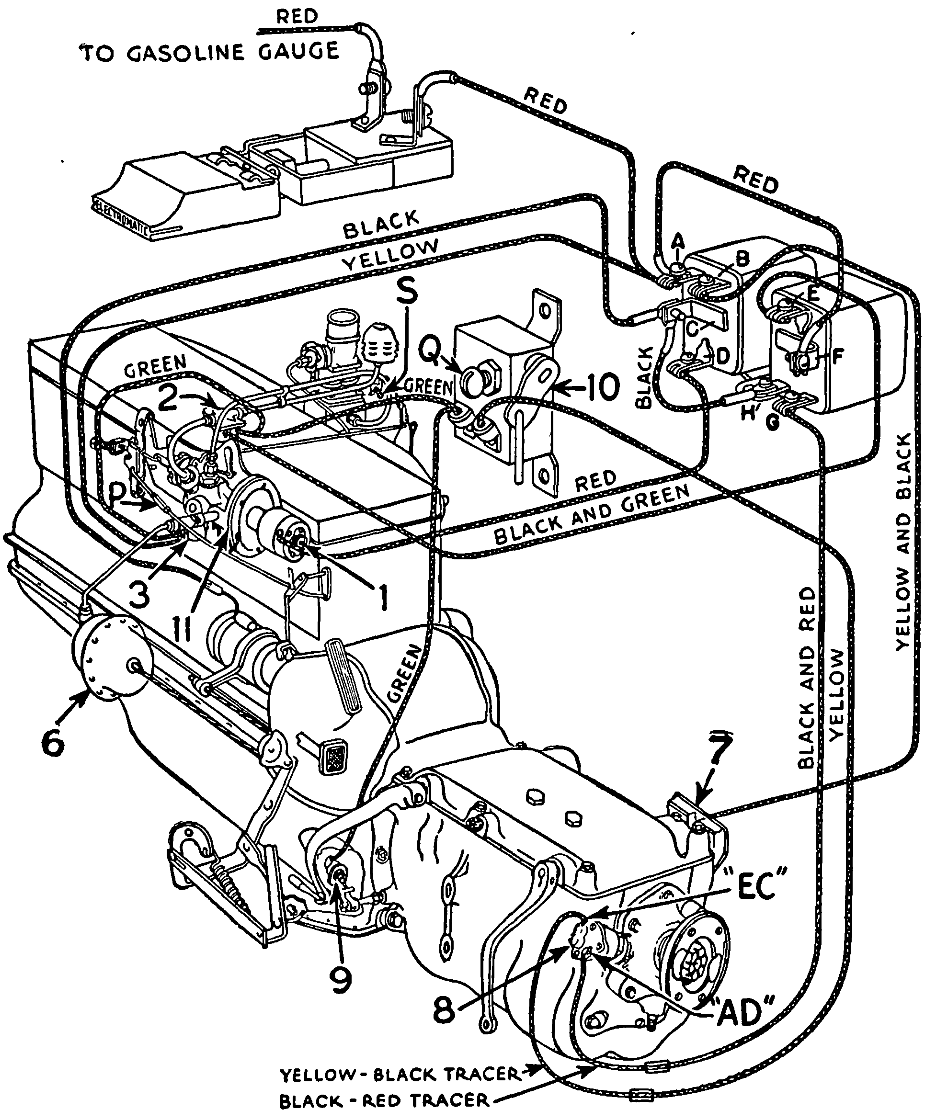


Fig. 16 Schematic diagram of 1941-42 Electromatic Clutch

1. **Low and reverse solenoid**
2. **Second speed solenoid valve**
3. **Solenoid shut-off valve**
6. **Power cylinder**
7. **Low and reverse switch**
8. **Governor switch**
9. **Direct speed switch**
10. **Accelerator switch**
11. **Clutch control valve**

P. **Accelerator pedal lever turnbuckle**
Q. **Accelerator switch adjusting screw**
S. **Engine idle adjusting screw**
AD. **Overdrive governor contact points**
EC. **Electromatic clutch govern r contact points**

ADJUSTMENTS, 1941-42

Accelerator Linkage — Disconnect the carburetor-to-cross shaft link from the carburetor. Adjust foot accelerator to lever rod by means of turnbuckle "P", Fig. 16, until, with the throttle operating lever, Fig. 18, against its stop pin, there should be $\frac{1}{32}$ to $\frac{1}{16}$ inch clearance between the accelerator cross shaft lever and its stop. Adjust carburetor-to-cross shaft link so that carburetor throttle stop screw is against the stop while the throttle operating lever is against its stop. When making this adjustment, the carburetor idle screw must not be on the fast idle cam.

Engine Speed Adjustment—Holding the lug on the clutch control lever, Fig. 18, against the throttle operating lever, adjust the idle screw to provide a gap of $\frac{1}{32}$ inch.

Accelerator Switch Adjustment—On 1942 cars, disconnect the three wires from the accelerator switch terminals. Ground one terminal of the switch with a jumper lead and attach one lead of a test lamp to the other terminal. Clip the other test lamp lead to the main

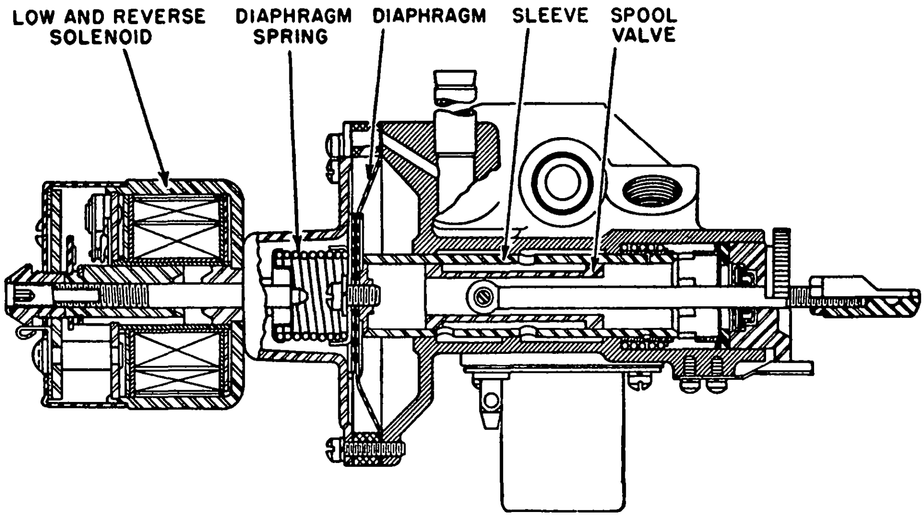


Fig. 17 Sectional view of clutch control valve, 1941-42

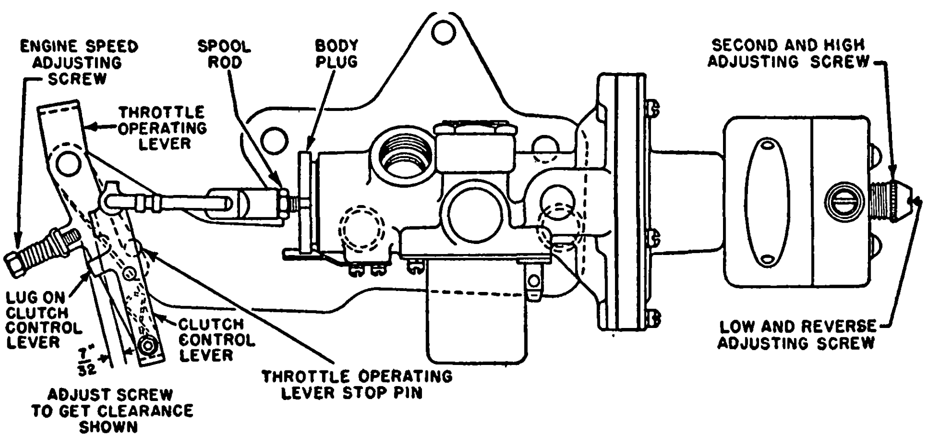


Fig. 18 Principal points of adjustment of clutch control valve, 1941-42

feed terminal "C", Fig. 19, and with the accelerator released the light should burn. If the lamp does not burn, turn the adjusting screw "Q", Fig. 16, in until the light burns. Slowly depress the accelerator pedal. The light should go out just as the lost motion in the accelerator linkage is taken up. If the light does not go out until after the accelerator linkage has started to move, turn the adjusting screw "Q" out until the correct timing is obtained.

On 1941 cars, with the Electromatic Clutch lockout switch and ignition switch "ON", and gearshift lever in high gear position, slowly move the accelerator linkage toward the open position by means of the accelerator-to-operating lever rod. When the throttle operating lever just contacts the adjusting screw the relay on the dash should click.

The 1941 Clipper model requires this adjustment to be made at the accelerator switch control rod turnbuckle due to the fact that this model switch does not incorporate an adjusting screw. If the relay clicks before the throttle operating lever contacts the idle adjusting screw, lengthen the control rod at the turnbuckle until the relay clicks at the proper time. If it does not click until after the accelerator linkage has started to move, shorten the control rod until proper timing is obtained.

Spool Valve Rod Adjustment—This adjustment determines the point in the accelerator linkage travel and engine speed at which the clutch starts to engage. Adjust as follows:

1. With engine running and gearshift in neutral, depress the accelerator pedal until the 7/32 inch clearance, Fig. 18, is just taken up. The clutch power cylinder rod or cable should just start to move as the clearance is just taken up.

2. If the power cylinder cable starts to move before this clearance is taken up, loosen the lock nut on the spool valve rod and screw the spool rod out of the clevis.

3. If the piston does not start to move when the clearance is taken up, screw the spool rod into the clevis until the proper action is obtained.

4. To check the spool valve adjustment, start the engine. Place the shift lever in low gear position and depress the accelerator pedal slowly. The car should start to creep forward at an engine speed of approximately 900 rpm. To increase engine speed, decrease the gap by turning the idle adjusting screw in 1/4 turn at a time until the speed is correct.

5. Check the engine speed adjusting screw gap and if it is less than 1/16 inch or more than 1/4 inch, the spool valve must be readjusted. If the gap is below the limit, screw the spool rod out of the clevis 1/2 turn. Readjust the engine speed screw gap to the original gap setting of 7/32 inch, Fig. 18. Recheck the adjustment with the car in low gear as previously described. If the car does not creep at the prescribed engine speed, repeat the above adjustments.

Clutch Engagement Adjustment — To properly compensate for the difference in engaging speed between low and reverse and second and high, an adjustment is provided on the low speed solenoid. This adjustment recalibrates the valve by changing the tension on the valve diaphragm spring. In low and reverse, where the rate of engagement is slower than in second and high, the valve is permitted to bleed slowly, thus retarding the rate of clutch engagement. In second and high a more rapid engagement is necessary, so in this position air is bled to the power cylinder more rapidly.

The low and reverse adjustment must always be made before the second and high adjustment since any change in the low and reverse setting will affect the second and high adjustment. Once the difference between the rate of engagement in low and in second has been properly established, these adjustments need never be changed.

Low and Reverse Adjustment—The inner adjustment at the rear of the low speed solenoid, Fig. 18, is adjusted by means of an Allen wrench. If clutch engagement in low gear is too sharp (grabs) turn the adjusting screw in 1/4 turn at a time until a smooth clutch engagement is obtained at not more than 900 rpm engine speed. If too much slippage is noted, turn the adjusting screw out one turn at a time until the clutch grabs. Then turn it in 1/4 turn at a time until engagement is correct.

Second and High Adjustment—With the shift lever in second speed position the car should begin to creep forward smoothly at approximately 700 rpm engine speed. If the engagement is too sharp (grabs) turn the knurled adjusting screw in 1/4 turn at a time until smooth engagement is obtained at not more than 700 rpm engine speed, Fig. 18. If too much slippage is noted, turn the adjusting screw out one turn at a time until a smooth engagement is obtained.

Direct Speed Switch Adjustment — On 1941 cars the direct speed switch is located on the outside of the transmission case in such a position that it is operated by the second-high transmission shifter lever when in high gear position. The purpose of this switch is to make it possible to shift from high to second above governed speeds. When the lockout switch is "On," ignition switch "ON" and accelerator pedal depressed, place the shift lever in high gear position. Move the shift lever toward the neutral position. When the

linkage slack has been taken up, but before the transmission shift fork moves out of its detent, a click should be heard in one of the relays on the dash. If the relay does not click in this position, adjust the switch bracket on the transmission either closer to or away from the the shift lever until the relay is heard operating at that point.

On 1942 cars the adjustment of the direct speed switch is made in the same manner as for 1941 models except that a test lamp is used. Disconnect the green wire from the eccelerator switch. Clip one lead of the test lamp to the disconnected green wire and the other lead to the main feed terminal "C," Fig. 19. The light should burn when the shift lever is moved from the high gear position toward the neutral position.

Full Throttle Engagement—This adjustment should be made on the road in second gear after the previous adjustments have been set up accurately. Full throttle adjustment should be made as sharp as possible without causing the engine to buck upon full clutch engagement.

To make the adjustment, screw the body plug, Fig. 18, out until the clutch grabs when starting from a standing position with full throttle. Then turn it in one notch at a time until smooth engagement is obtained. If clutch slippage is excessive during the intermediate portion of the engagement (after car starts to move but before full clutch engagement) screw in the second and high adjusting screw to reduce slippage.

ADJUSTMENTS, 1946-50

Operating Cable Adjustment—The operating cable should be so adjusted that the power cylinder will not move the clutch linkage as far as it can be moved by the clutch pedal with foot pressure.

The adjustment can be checked after the 1½ inch clutch pedal free play has been obtained by depressing the clutch pedal to the toe board with the engine running and the Electromatic operating. The travel of the clutch pedal to within ½ inch of the toe board should require a very slight pressure. Depressing the pedal through the last ½-inch travel should require the same pressure that would be applied if the Electromatic were locked out and the clutch disengaged by foot pedal.

If it is not possible to get this ½-inch additional travel with increased pedal pressure, adjust the operating cable by backing off adjusting nut at cable anchor bracket on starting motor.

If the end of the cable thread is reached before the proper adjustment is obtained, the Custom Eight bracket can be loosened and moved to provide additional adjustment. On the Eight and Super Eight it may be necessary to grind off the cable eye on the bracket to provide the necessary adjustment.

Accelerator and Throttle Linkage Adjustments—Fig. 21. The purpose of these adjustments is to remove excessive free play in the linkage. The procedure is as follows: Adjust the carburetor-to-cross shaft link clevis so that there is $\frac{1}{16}$ inch clearance between the throttle operating lever and stop on the Electromatic control valve bracket when carburetor idle speed screw is against the *slow* idle cam. Adjust the accelerator-to-Electromatic clutch control valve rod end so that the pin will enter the hole of the operating lever.

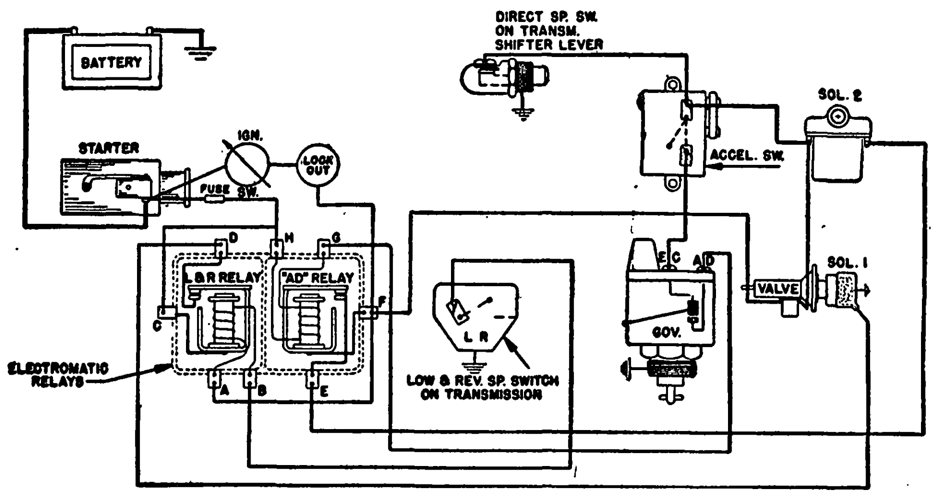


Fig. 19 Schematic wiring diagram of 1942 Electromatic Clutch

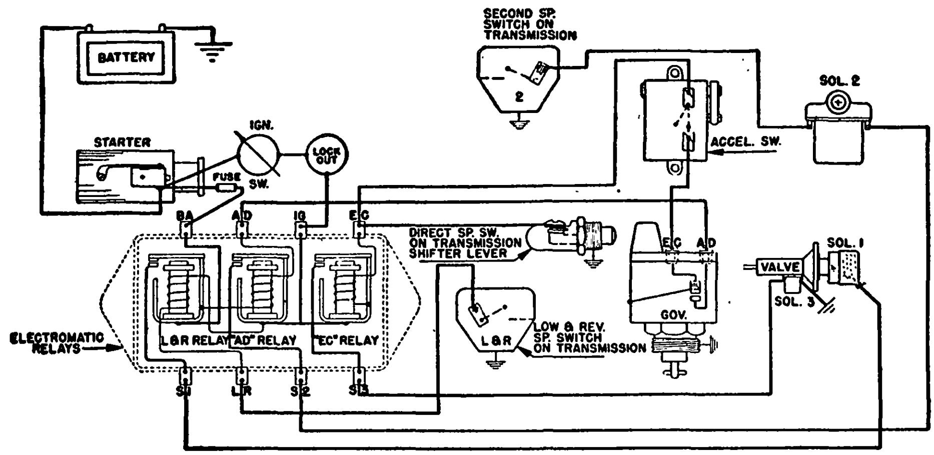


Fig. 20 Schematic wiring diagram of 1941 Electromatic Clutch

Valve Operating Rod adjustment—The purpose of this adjustment is to provide additional adjustment when the engine speed adjusting screw is turned in or out of the end. It is to be adjusted only when proper adjustment cannot be obtained by adjusting the engine speed adjusting screw. Make this adjustment when the engine is idling at normal engine operating temperature. The procedure is as follows:

Turn the engine speed adjusting screw in halfway. Disconnect the valve rod link at the valve operating lever. Hold the throttle operating lever against the bracket stop. Move the valve operating lever until there is ⅛ inch gap between the lever and stop, Fig. 22. Hold the valve operating lever in this position.

Move the valve rod in slowly until the power cylinder operating cable just starts to move out. Hold the valve rod at this point and adjust the valve rod clevis as shown in Fig. 22, until the valve operating link will go into place. Connect the valve operating link and fasten the spring clip lock.

Engine Speed Screw Adjustment—The purpose of this adjustment is to adjust the valve piston movement before the throttle opens. Make this adjustment with the engine warmed up and idling with the gear shift lever in second speed position.

Adjust the engine speed screw as shown in Fig. 23 so that the car will just move on a level floor when the operating lever is brought up against the engine speed screw.

Direct Speed Switch Adjustment—Its purpose is to adjust the movement of the gearshift lever necessary to close the direct speed switch contacts and cause the Electromatic to operate and disengage the clutch when shifting from direct to second speed. The procedure is as follows:

Disconnect the lead from the direct direct speed switch. Attach one lead of a six-volt test lamp to the direct speed switch terminal and the other lead of the test lamp to the ungrounded post of the battery. Place the shift lever in

high gear position. The light should not burn.

Move the shift lever toward the neutral position. The lamp should light when the gearshift linkage lost motion is taken up but before the transmission shifter fork moves out of its detent, Fig. 24. If the light fails to burn in this position, adjust the switch bracket on the stud away from the direct and second idler lever until the light goes on. If the light burns continually, adjust the switch bracket nearer to the idler lever so that the light will go out in the high gear position and will go on just as the linkage lost motion is taken up. Disconnect the test lamp and connect the direct speed switch lead.

Accelerator Switch Adjustment—Its purpose is to adjust the accelerator pedal movement necessary to open the accelerator switch contacts. The procedure is as follows:

Disconnect the two leads from the accelerator switch. Ground one accelerator switch terminal with a jumper lead. Attach one lead of a test lamp to the other accelerator switch terminal and attach the other test lamp lead to the ungrounded post of the battery. With the accelerator pedal released the light should burn.

Slowly depress the accelerator pedal. The light should go out just as the valve operating lever comes up against the engine speed screw. If the light does not go out, adjust the accelerator switch adjusting screw until the light goes out, Fig. 25. The light should burn when the accelerator pedal is released. Recheck the adjustment to make sure that the light goes out as the valve operating lever comes up against the engine speed screw. Disconnect the test lamp and connect the accelerator switch leads.

During the final road test, when slowly decelerating in high gear, the accelerator switch should make contact and the Electromatic Clutch should disengage when the accelerator is slowly released to about 10 mph speed.

Fast Start or Clutch Engagement at Full Throttle—The purpose of this adjustment is to regulate the clutch engagement at full throttle or fast starts. The adjustment should be made during the road test, making full throttle starts in second gear. The adjustment should be made to provide as rapid clutch engagement as possible without causing the engine to stumble or hesitate upon full throttle.

Turn the valve rod stop screw, Fig. 25A, counterclockwise until the screw extends 1¼ inches from the diaphragm cover. This will cause a very rapid clutch engagement on fast starts. Then turn the stop screw clockwise ¼ turn at a time until satisfactory clutch engagement at full throttle is obtained without excessive slippage. Care should be taken not to heat the clutch excessively by slipping the clutch during this adjustment.

Road Test and Final Check—Test the operation of the Electromatic Clutch on the road at normal driving conditions. Readjust according to previous instructions if the engagement is too severe or clutch slippage is excessive under any condition of clutch engagement.

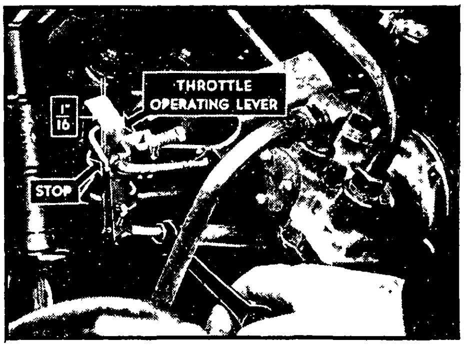


Fig. 21 Accelerator-to-clutch control valve rod adjustment. 1946-50 Electromatic Clutch

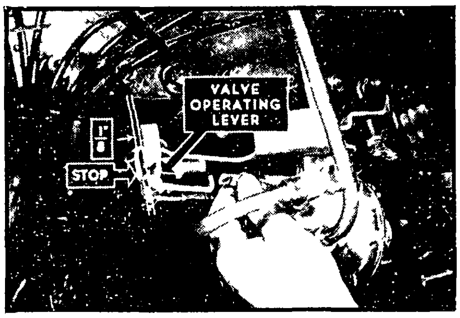


Fig. 22 Valve operating rod clevis adjustment. 1946-50 Electromatic Clutch

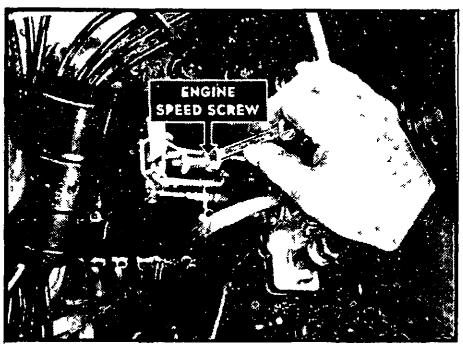


Fig. 23 Engine speed screw adjustment. 1946-50 Electromatic Clutch

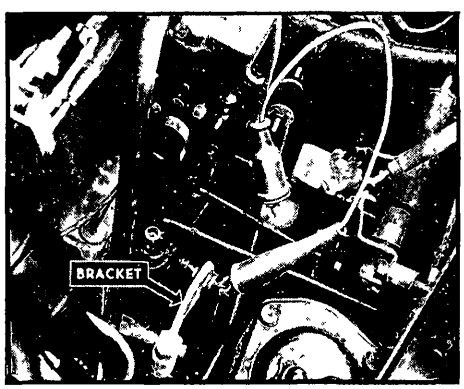


Fig. 24 Adjusting direct sp d switch, using a test lamp. 1946-50 Electromatic Clutch

ELECTRICAL TESTS, 1941-42

To test the switches, solenoids and circuits accurately, use a six-volt test lamp. And before any electrical tests are made, check the fuse in the electromatic main feed cable, Figs. 19 and 20.

First & Reverse Switch—With the lockout switch and ignition switch "ON" move the shift lever into first gear and then into reverse positions. A click should be heard in the relay on the dash when going into either position and also when returning the shift lever to neutral.

Direct Speed Switch—Disconnect the green wire from the accelerator switch terminal. Clip one lead of the test lamp to the relay main feed terminal, Figs. 19 and 20, and the other lead to the end of the disconnected wire. Place the gearshift lever in high and the light should *not* burn. Move the shift lever toward neutral and and the light should go on just before the transmission shifter fork moves out of its detent.

Accelerator Switch—Disconnect the three wires from the accelerator switch terminals. Ground one terminal and attach one lead of the test lamp to the second terminal. Clip the other lead of the test lamp to the relay main feed terminal, Figs. 19 and 20. Slowly depress the accelerator pedal. The light should go out just as the lost motion in the accelerator linkage is taken up.

Second Speed Switch (1941 Only)—The circuit for this switch does not go through the clutch control unit relay, which necessitates the use of a test lamp to check its operation. Remove the yellow wire from the solenoid operated choke valve (located in the air inlet line). Clip one lead of the test lamp to the wire and the other to the main feed terminal on the relay box. The light should burn when the shift lever is in second gear position, and should not burn when the lever is returned to neutral.

Lockout Switch—On 1941 models, disconnect the wire from the "IG" relay terminal, Fig. 20. Clip one lead of the test lamp to the "IG" terminal and ground the other lead. With the ignition and lockout switches "ON," the light should burn.

On 1942 models, disconnect the wires from relay terminals "A" and "F," Fig. 14. Clip one lead of the test lamp to "A" terminal and ground the other lead. With ignition and lockout switch "ON," the light should burn.

Governor Switch—With one lead of the test lamp clipped to the starter hot terminal or the main feed relay terminal, contact each of the terminals on the governor with the other lead. The light should burn when the "EC" terminal is contacted and should not burn when the "AD" terminal is contacted.

Note—No attempt should be made to repair these switches; defective switches should be replaced.

First & Reverse Solenoid—To check the circuit continuity in the solenoid (lo-

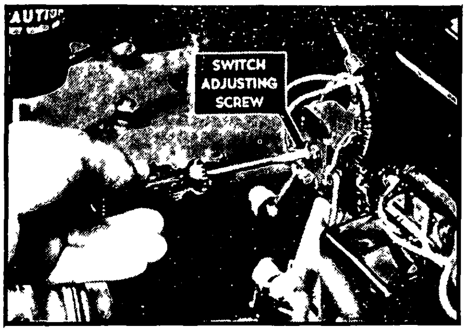


Fig. 25 Accelerator switch adjustment. 1946-50 Electomatic Clutch

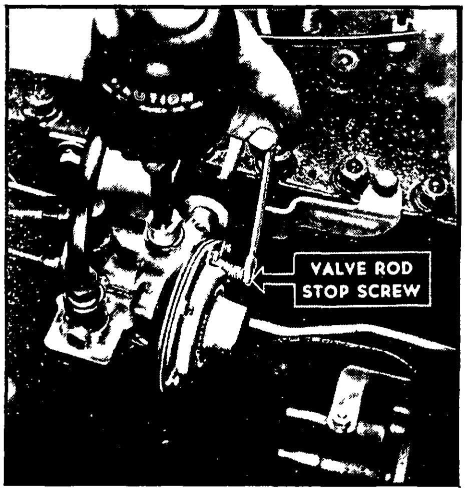


Fig. 25A Adjusting valve rod stop screw f r fast start adjustments. 1946-50 Electromatic Clutch

cated at the back of control valve) disconnect the wire from the solenoid terminal. Clip one lead of the test lead to the main feed terminal on the relay box and touch the other lead to the terminal on the solenoid. If the windings are continuous the light will burn.

To check the circuit to the solenoid, clip one lead of the test lamp to the disconnected wire and ground the other lead. With the ignition and lockout switches "On," the light should burn when the shift lever is placed in low or reverse.

Direct Speed Solenoid—To check the continuity of this solenoid (located on the bottom of control valve) disconnect the wire from the solenoid terminal which runs to the relay. Clip one lead of the test lamp to the main feed terminal on the relay box and touch the other lead to the terminal on the solenoid. If the windings are continuous the light will burn.

To check the circuit from the ignition switch to the solenoid, clip one lead of the test lamp to the disconnected wire and ground the other lead. With the ignition and lockout switch "ON," the light should burn.

ELECTRICAL TESTS, 1946-50

Before any electrical tests are made check the fuse in the Electromatic main feed cable between the ignition and lockout switches, Fig. 25B. If any switches show up as defective as a result of the following tests they should be replaced.

Direct Speed Switch—Disconnect the wire from the direct speed switch terminal. Clip one lead of the test lamp to the switch terminal and the other to the ungrounded post of the battery. Move the shift lever to the high gear position; the light should *not* burn. Move the shift lever toward the neutral position. The light should *go on* just before the transmission shifter fork moves out of its detent.

Accelerator Switch — Disconnect the leads from the accelerator switch terminals. Ground one terminal of the accelerator switch with a jumper lead. Clip one lead of the test lamp to the other accelerator switch terminal, and contact the other test lamp lead to the ungrounded post of the battery.

The light should burn with the accelerator released. Slowly depress the accelerator pedal. The light should go *out* just as the control valve operating lever contacts the engine speed screw.

Lockout Switch—Disconnect the red wire from the lockout solenoid. Clip one lead of the test lamp to the disconnected red wire and ground the other test lamp lead. With the ignition and lockout switches "ON" the light should burn.

Lockout Solenoid—Disconnect both wires from the direct speed solenoid terminals. Ground one of the lockout solenoid terminals with a jumper wire. Clip one lead of the test lamp to the other solenoid terminal. Clip the other test lamp lead to the ungrounded post of the battery. If the solenoid windings are continuous the light should burn.

Governor Switch—Clip one lead of the test lamp to the ungrounded post of the battery. Contact each of the governor terminals with the other test lamp lead. The light should burn when the "EC" terminal is contacted and should not burn when the "AD" terminal is contacted.

The "EC" terminal has a yellow wire with black tracer. The "AD" terminal has a black wire with a red tracer.

Circuit From Ignition Switch—Clip one lead of the test lamp to the disconnected red lead and ground the other test lamp lead. With the ignition switch "ON" and the lockout switch pushed in the light should burn.

MECHANICAL CHECK, 1941-42

Condition—Engine speed too high when making a part throttle start in low and reverse. *Remedy*—Turn engine speed screw out (¼ turn at a time) until engine reaches a speed of approximately 900 rpm at the initial engagement point.

Condition—Engine speed too low when making a part throttle start in low and reverse. *Remedy*—Turn engine speed screw in (¼ turn at a time) until engine reaches a speed of approximately 900 rpm at the initial engagement point.

Condition — Excessive clutch slippage after shift has been made into second and high gear. *Remedy*—Adjust knurled head screw in low and reverse solenoid.

Condition—Clutch engagement too severe after a shift has been made into second and high. *Remedy* — Adjust knurled head screw in low and reverse solenoid.

Condition—Car free-wheels in high gear above governed speed. *Remedy*—Direct speed switch at transmission shifter lever not contacting. Plunger on switch should be compressed ⅛" when hand shift lever is in high gear position.

Condition—Clutch will not release when attempting to shift from high to second above governed speed, but otherwise satisfactory in operation. *Remedy*—Check operation of direct speed switch on transmission. Switch should make contact on first movement of transmission shift lever rod before any movement of the shifter lever itself takes place.

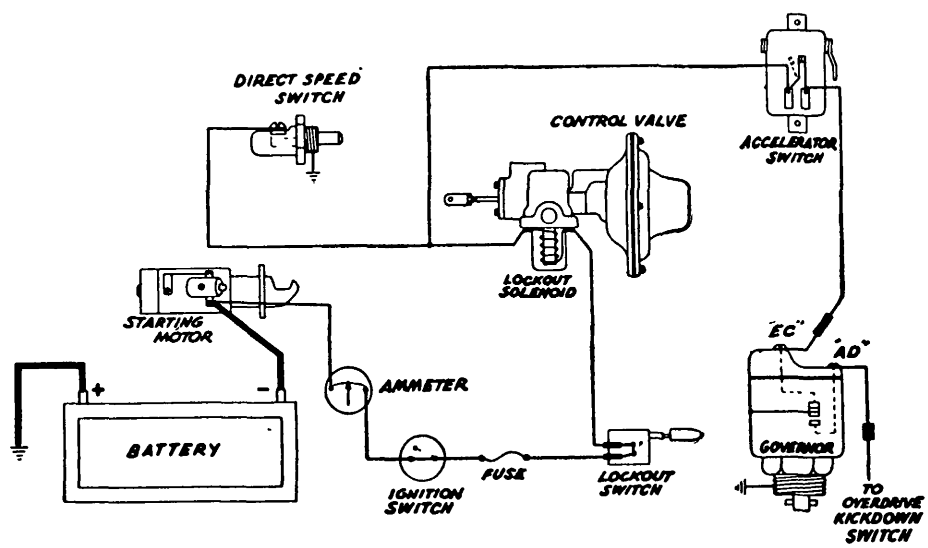


Fig. 25B Wiring diagram f 1946-50 Electr matic Clutch

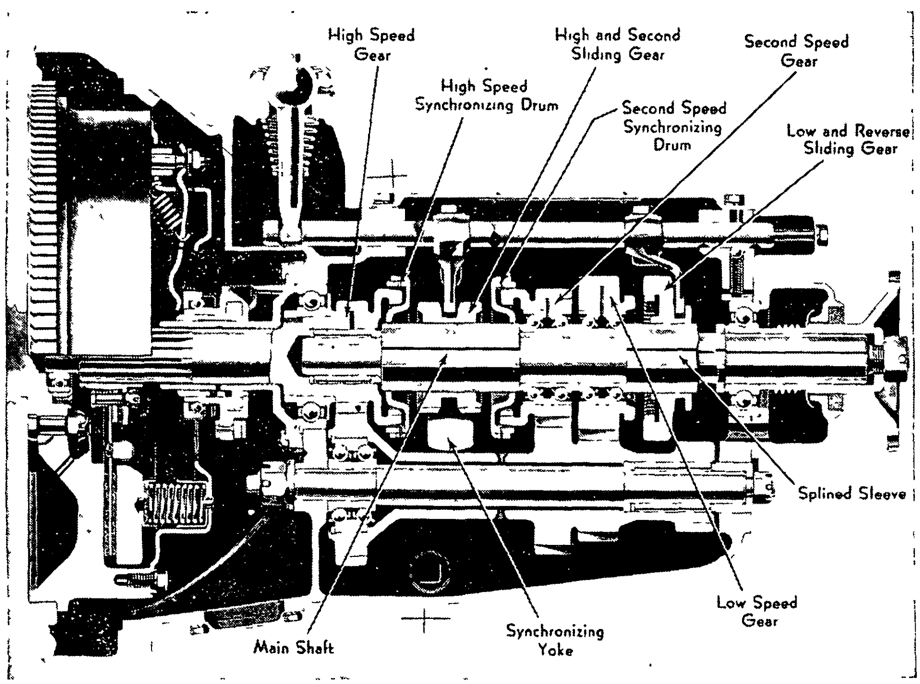


Fig. 25C Transmission, 1935-38 Super Eights and all V12's

Condition—When shifting from high to second, a lurch results on full throttle opening. When driving in second gear and releasing the foot from the throttle momentarily, the car lurches when the throttle is harshly depressed again. *Remedy*—Check speed solenoid valve to see if it is functioning properly. Check above governed speed in second gear.

Condition—Clutch engagement is not positive when driving in high gear with very small throttle opening below governed speed. *Remedy*—Throttle switch on dash is inoperative or improperly adjusted.

Condition—Clutch has too much slip on full throttle starts in all gears. *Remedy*—Move the front end valve body plug out one turn. If grab is too severe, screw the plug in ¼ turn at a time until engagement is satisfactory. The plug is screwed out first and then screwed in to prevent the clutch from overheating during the process of adjustment due to excessive slipping.

Condition—Clutch has too much grab on full throttle starts in all gears. *Remedy*—Screw the front end valve body plug in ¼ turn at a time until engagement is satisfactory.

Condition—Excessive accelerator pedal movement before clutch starts to engage. *Remedy*—Adjust engine speed screw gap to $\frac{1}{32}$", plus or minus $\frac{1}{32}$".

MECHANICAL CHECK, 1946-50

Condition—Engine speed too great, and excessive clutch slippage when making part throttle start in low or reverse. *Remedy*—Adjust engine speed screw with engine warmed up and idling with gearshift lever in second speed position. Adjust engine speed screw so that car will just move on a level floor when the valve operating lever is brought up against the engine speed screw. If satisfactory adjustment cannot be obtained by engine speed screw the valve operating rod clevis is out of adjustment.

Condition—Engine speed too low, clutch grabs and engine tends to stall when making part throttle start in low or reverse. *Remedy*—Engine speed screw gap too great.

Condition—Clutch slips badly in all gears; impossible to get full engagement in high gear. *Remedy*—May be one of following: 1, Clutch pedal free play too small. 2. Power cylinder operating cable out of adjustment. 3. Clutch control valve adjustments incorrect. Make necessary corrections.

Condition—Excessive slippage on fast starts. *Remedy*—May be one of the following: 1. Valve operating rod stop screw in too far. 2. Clutch pedal free play too small. 3. Power cylinder operating cable out of adjustment. Make necessary corrections.

Condition—Clutch engagement too rapid on fast starts but otherwise satisfactory. *Remedy*—Adjust valve operating rod stop screw.

Condition—Excessive accelerator pedal movement before clutch starts to engage. *Remedy*—May be one of the following: 1. Worn accelerator and control valve linkage. 2. Engine speed screw too great. 3. Valve operating rod clevis out of adjustment. 4. Accelerator and throttle linkage out of adjustment. Make necessary corrections.

Condition — Failure of Electromatic Clutch to disengage below governed speed in high gear. *Remedy*—Check and correct the following items as necessary: 1. Faulty governor; "NO" governor contacts not closing. 2. Faulty accelerator switch or it may be out of adjustment. 3. Control valve linkage binding. 4. Accelerator pull back spring broken or disconnected. 5. Broken diaphragm in power cylinder, usually indicated by racing engine when accelerator is released (air leak into manifold).

Condition — Failure of Electromatic Clutch to disengage when attempting to shift from high to second gear at above governed speeds. *Remedy*—Check the following and make necessary corrections: 1. Faulty direct speed switch or it may be out of adjustment. 2. Direct speed switch wire disconnected.

Condition—Electromatic Clutch inoperative. *Remedy*—Check the following and make necessary corrections: 1. Lockout solenoid wire disconnected. 2. Faulty lockout switch. 3. Lockout valve (rubber) stuck due to being swelled as a result of being oil soaked. 4. Control valve operating rod clevis disconnected. 5. Control valve piston link disconnected. 6. Broken diaphragm in power cylinder.

Condition—Failure of Electromatic to operate at proper time or erratic operation. *Remedy*—Check the following and make necessary corrections: 1. Loose or faulty electrical connections. 2. Improper adjustment of mechanism. 3. Oil on control valve operating rod. 4. Valve piston sticking in sleeve. 5. Clutch pedal free play or power cylinder operating cable out of adjustment.

Condition—Clutch does not disengage fully. Gears clash in low or reverse. Severe operation. *Remedy*—Check the following and make necessary corrections: 1. Control valve linkage out of adjustment. 2. Power cylinder operating cable out of adjustment. 3. Distorted clutch driven plate. 4. Grease on clutch driven plate facings.

Condition—Electromatic Clutch disengages each time accelerator is released while driving in high gear above governed speeds. *Remedy*—Check the following and make necessary corrections: 1. Direct speed switch grounded. 2. Direct speed switch out of adjustment. 3. Faulty governor switch; "EC" contacts stuck together or grounded.

Condition—Electromatic Clutch disengages while driving in high gear with very small throttle opening below governed speed. *Remedy*—Check the following and make necessary corrections: 1. Accelerator switch out of adjustment. 2. Accelerator switch operating rod disconnected. 3. Faulty accelerator switch.

SYNCHROMESH TRANSMISSION

TRANSMISSION, REMOVAL

1935-37 Six & Eight — Remove floorboards, speedometer cable, battery ground cable, propeller shaft, clutch housing pan, clutch release bearing spring, engine stabilizer (rear of transmission), two bolts in left transmission support, and remove the right support from the transmission and frame. Sup-

port the rear end of the engine with a jack, unfasten the transmission from the clutch housing and lift the transmission out from above.

1935-38 Super 8 & All Twelves—Remove the floor and toe boards, speedometer cable, battery ground cable, propeller shaft, light switch, two nuts on each side from studs holding transmission case brackets from rubber supports. Disconnect the hand brake cable at the equalizer, the rubber bushed stabilizer at the left side, the clutch pedal pull rod, and pedal spring. Support the engine with a jack. Remove the pedal shaft inner bracket, the brace rod on right side at rear end only, the lower cross member only, and the clutch housing nuts and cap screws. Jack up the rear end of the engine and remove the vertical support members from the frame. Remove the transmission.

1938 Six & Eight—Remove the metal floor plate, accelerator pedal, battery ground cable and speedometer cable. Disconnect the front end of the propeller shaft and block it up against the floor pan. Support the rear end of the engine with a jack, unbolt the cross member from the frame, and disconnect the hand brake cable at the equalizer. Remove the clutch housing pan, and unhook the clutch release bearing spring. Unfasten the transmission from the clutch housing and slide the transmission out.

1939-52—These transmissions can be removed from below without taking out the floor boards. The procedure is as follows:

1. Disconnect speedometer cable.
2. Disconnect gear shifter rods from levers on transmission case.
3. Disconnect propeller shaft at rear universal joint and remove propeller shaft completely by slipping the front universal joint flange off the transmission mainshaft. Wire or tape the two bearings of universal joint together to prevent them from falling off. This will prevent dirt from entering the bearings and will save time during reassembly.
4. On overdrive equipped cars, disconnect the overdrive control cable from the lever on the right side of the overdrive case.
5. Disconnect the electrical leads at the governor, lockout switch and solenoid. Identify the leads with tags to be sure to connect them at their proper location on reassembly.
6. Remove governor and solenoid.
7. Use a jack or auxiliary support bar to support the engine while the transmission is removed.
8. Remove the rear engine support mounting and support cross members.
9. Remove the capscrews attaching the transmission to the flywheel housing.
10. Using two pilot studs in the lower bolt holes, slip the transmission to the rear so that the clutch release bearing pull-back spring may be unhooked.
11. Remove the transmission.

TRANSMISSION INSTALLATION

1935-38 — Reverse the order of the removal procedure to install the transmission, being sure to use pilot studs in the upper transmission bolt holes so as to avoid allowing the transmission clutch shaft from resting on the hub of the clutch driven plate.

1939-52—To install transmission:

1. Install two pilot studs into the two lower holes in the flywheel housing.
2. Install transmission, guiding it into place with the pilot studs. Care must be taken that the transmission clutch shaft does not rest on, bend, or dish the clutch driven plate.
3. Remove the pilot studs and install and tighten all the capscrews attaching the transmission to the flywheel housing.
4. Connect the clutch release bearing pull-back spring.
5. Install the lower flywheel housing.
6. Adjust clutch pedal free play to 1½".
7. Install engine support mounting and support cross member. Do not tighten the attaching bolts to the frame cross member.
8. Rock the engine back and forth to stabilize the engine supports. Then tighten the engine support mounting attaching bolts.
9. Remove the jack from under the engine.
10. Connect the gearshaft rods to their respective levers.
11. Connect speedometer cable.
12. Connect universal joint.
13. On overdrive-equipped cars, install the governor.
14. Connect governor, lockout switch and solenoid electrical leads.
15. Energize the solenoid by grounding the terminal of the governor with a jumper lead.
16. Install the solenoid while energized, making sure the plunger rod ball is engaged in the pawl.
17. Remove jumper lead from governor.
18. Connect overdrive control cable to lever on overdrive case.

TRANSMISSION, OVERHAUL

1935-38 Standard & Super 8; 1935-39 Twelve—Fig. 25C. Remove shifter mechanism. Check the synchronizer yoke travel and record on a piece of paper for reference when assembling. Remove stop light switch; screws from shifter forks and remove shifter rails and plunger balls. Remove drive gear bearing cap, and nut at front end of countershaft. Remove universal flange and mainshaft rear bearing cover. Remove synchronizing lock screws (one on each side of case) and yoke centralizing screw on left side. Remove main drive gear bearing nut. Drive countershaft out rearward. Pull main drive gear out forward. Move mainshaft rearward until rear bearing is released from case and remove bearing. Align one of the slots in the clutch sliding gear with the synchronizer yoke. Remove front brake shoe, yoke, yoke bronze links, clutch gear and rear brake through top. Move mainshaft forward and remove first and reverse sliding gears and the splined sleeve. Remove the mainshaft through the top and also the countershaft cluster. Remove the reverse idler shaft lock screw and drive the shaft out rearward.

ASSEMBLY DETAILS — Synchronizer Travel: If gears do not shift smoothly and quietly, check the yoke travel which should have .018" clearance at each clutch. Movement of the yoke after a second and high speed shift should not be less than .140" and not more than .160" measured with a dial gauge mounted on the top of the case and contacting rear face of yoke. If yoke travel is not within these limits, add or remove spacer washers in front of mainshaft rear bearing or behind clutch shaft bearing. A change of washer thickness of .006" will change yoke travel .040".

Countershaft cluster should have .003" to .004" backlash at the 19 and 29 teeth gears. The "L" on the flat at front end of the countershaft must face towards the reverse idler gear. Gears are lapped at the factory and must be replaced in sets if one is defective.

Chatter marks on the mainshaft pilot bearing journal surface will cause noise at idling speed. Do not remove more than .0015" total in cleaning up the marks. Make sure the bevel on the washer faces towards the rear.

Both of the synchronizer yoke bronze links must be installed with the relieved side up. On late 1937 and all 1938 models, the word "TOP" is cast into the piece.

Make sure the synchronizer plunger bleed hole is not obstructed, otherwise the gear shift lever will not move easily.

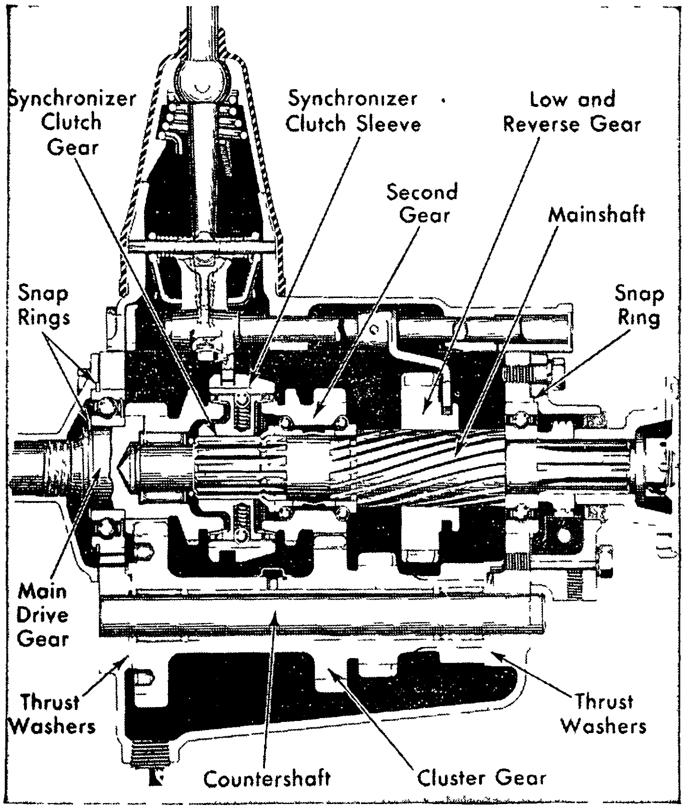
TRANSMISSION, OVERHAUL

1935-38 Six & Eight—Fig. 25D. Before proceeding, read *Assembly Details*. Remove universal flange, rear mainshaft bearing cap and lock plate at the end of the housing. Mark the sliding gears before removal to assure correct installation. Remove front bearing cap. Drive countershaft out rearward and clutch shaft forward. Move the mainshaft with gears rearward until bearing is released from case. Tap bearing off of shaft and remove the assembly through the top. Remove countershaft cluster and drive out reverse shaft rearward.

ASSEMBLY DETAILS — Cluster should be a free fit in the case with no perceptible end play. Use a tapered dummy countershaft or arbor to facilitate insertion of regular countershaft through the roller bearings. Packard arbor S. T. 5043 is available for this work and also functions as a jig for inserting the cluster rollers. Make sure that the lug on the bronze washer at each end of the counter shaft is aligned with corresponding slots in the case before entering the cluster gear.

The main drive gear and universal flange splines should be coated with Lubriplate or equivalent when assembling. The mainshaft with direct drive and second speed stationary gear is serviced as an assembly only and should not be disassembled. The synchronizing clutch and sliding gear is also serviced as an assembly. Should one of the mating gears be defective, it will be necessary to replace both as they are lapped at the factory.

Do not shift the gears with the cover off, as the synchronizer balls and springs will jump out.



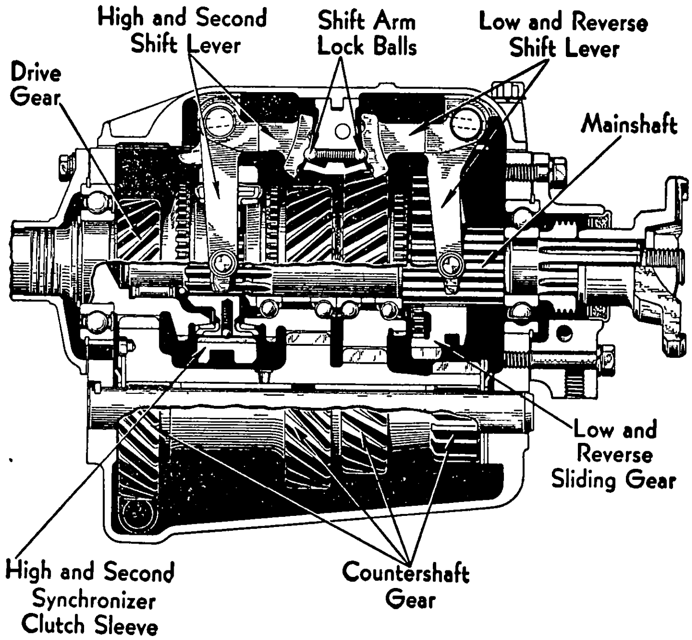


Fig. 25E Transmission. Typical of 1939-52 exc pt V12's

Fig. 25D Left—Transmission, 1935-38 Sixes and Eights

TRANSMISSION, OVERHAUL

1939-52—Fig. 25E illustrates the transmission design which is typical of all these models. For models with overdrive, see the *Overdrive* chapter for details on the servicing of these units. To disassemble the transmission, proceed as follows:

1. Remove transmission cover and shifting fork assembly.
2. Drive out the countershaft from the rear of the transmission case, using a suitable arbor and soft hammer. The arbor in place will permit the gear cluster to drop to the bottom of the case. This is necessary since the clutch shaft cannot be removed until the countershaft gear cluster is out of mesh with the main drive gear.
3. Remove the clutch shaft bearing retainer and pull the clutch shaft and bearing out through the front of the case.
4. Remove the mainshaft front pilot bearing from the bore of the clutch shaft gear.
5. Remove the spacer from the forward end of the mainshaft.
6. *On 1951-52 transmissions without overdrive,* remove the transmission rear housing attaching capscrews. Remove the rear housing and mainshaft assembly from transmission case. Remove synchronizing unit and mainshaft front bearing spacer from forward end of mainshaft while it is being removed from transmission case. Remove the large snap ring from the bearing bore of the front end of the rear housing. Press the mainshaft and rear bearing from the rear housing. Remove speedometer drive gear snap ring and press off speedometer gear. Remove mainshaft rear bearing snap ring and press off rear bearing.
7. *On 1951-52 transmissions with overdrive,* remove the capscrews attaching the adapter plate to the transmission case. Remove adapter plate and mainshaft assembly from transmission case. Remove synchronizing unit and mainshaft front bearing spacer from forward end of mainshaft. Remove large snap ring from forward side of adapter plate. Press drive shaft and rear bearing from adapter plate. Remove mainshaft rear bearing snap ring from mainshaft and press bearing from shaft.
8. On all transmissions, slip reverse sliding gear from rear end of mainshaft.
9. Remove synchronizing unit from forward end of mainshaft.
10. Separate synchronizer sleeve from clutch gear. When separating these parts, be careful that the synchronizing clutch springs and plungers are not lost. Remove plungers and springs.
11. Remove countershaft gear cluster, end plates and thrust washers from transmission case. Strip gear cluster of needle bearings, spacer rings and long bearing spacer.
12. Drive reverse idler pinion shaft from case by using a long drift through bearing opening at forward end of case.
13. Lift out reverse idler gear.
14. Remove two countershaft thrust springs from inside of transmission case.
15. Drive thrust spring plugs from case, using a small drift.

ASSEMBLY NOTES—Reverse the foregoing procedure when reassembling the transmission, being sure to observe the following precautions:

1. When assembling the countershaft gear cluster, insert the needle bearings in position. Then install a steel end plate at each end of the gear cluster and a bronze thrust washer next to each steel plate. Be sure the locking lips of washers are up and away from the cluster gear.
2. After the clutch shaft is installed and when lifting the countershaft gear cluster into position it may be necessary to turn the thrust washers to either side so that the lips of the washers will line up with grooves in the transmission case.
3. When installing the cover, be sure the shifter fork shoes slip into the groove of the synchronizer sliding sleeve and the reverse sliding gear.

GEARSHIFT

GEARSHIFT LINKAGE, ADJUST

1939-52—Insert a $\frac{3}{16}$ inch rod or drill through the aligning holes in both column lower levers, Fig. 26. With this pin in place set the gearshift lever and the transmission cover levers in neutral. Disconnect the link rods and adjust their length to fit and reinstall the levers.

ULTRAMATIC DRIVE

1950-52—The Packard Ultramatic Drive, Fig. 27, uses a torque converter for acceleration and direct mechanical drive for cruising. Coupled with a lower-than-standard axle ratio, this no-shift drive

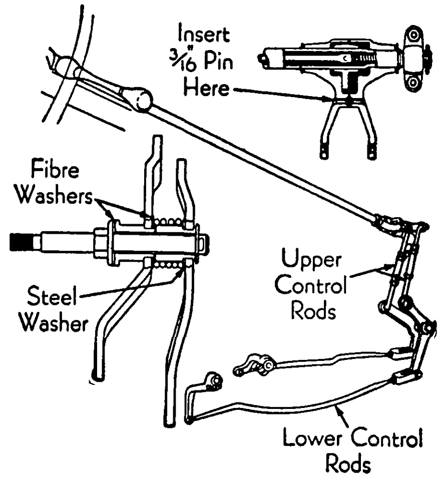


Fig. 26 Gearshift linkage. Typical of 1939-52

gives reasonably quiet acceleration, adequate performance for most driving conditions, and added performance when required.

The driver has maximum control over the unit which functions automatically. He has no clutch pedal to push or gears to shift. The driver merely flips the control lever on the steering column to "P" for Parking, "N" for Neutral, "H" for High Range, "L" for Low Range, or "R" for Reverse. The automatic drive does the rest.

The engine can be started only when the lever is at Parking or Neutral. Parking holds the car on hills, positively locking the rear wheels. High Range is for all normal driving, Low Range for unusually steep grades, maximum acceleration or downhill braking. The driver can rock the car out of ruts or bad spots by just flipping the lever back and forth from Low Range to Reverse.

In case of a dead battery, push starting is easy. The driver merely keeps the lever at neutral position until the car is moving about 25 mph. Then he slips the lever to High Range, which starts the engine.

The driver is never "handcuffed" to the torque converter or the direct drive. He can use one or the other as he pleases or requires. For a fast getaway he presses hard on the accelerator; the Ultramatic Drive stays in torque converter until the car reaches 55 mph when it shifts automatically into direct drive. Between 15 to 55 mph, shift into direct drive occurs automatically, depending upon accelerator position.

GENERAL DESCRIPTION—The transmission, Fig. 27, consists of a torque converter with planetary gearing. One clutch and two brakes are arranged to obtain the high range, which is a straight-through drive, and low range and reverse which are geared drives. Converter or direct mechanical drive operates in either range.

Starting is through the torque converter in either range, with automatic shift into direct mechanical drive by application of a single plate clutch, governed by car speed and accelerator position. Converter operation can be obtained when in direct drive at any time in high or low range under top governed speed by "kicking down" the accelerator as on overdrive cars. The two ranges and reverse are obtained by the clutch and brakes, with no gear tooth engagement.

A flexible disc is mounted on the crankshaft and bolted to the direct-drive clutch housing which, in turn, is attached to the converter pump that has a rear extension driving the front oil pump. The converter turbine, or driven member, is attached to a hub also carrying the direct clutch member and damper.

The direct clutch, Fig. 28, is located just ahead of the converter turbine, Fig. 29. The hub carrying these two members is splined to a shaft, the rear end of which is splined to the rear sun gear of the planetary train. This shaft also carries a hub driving the plates of the high range clutch.

The reactor is mounted on a sleeve which engages with a one-way sprag clutch mounted in the housing to the rear of the front oil pump.

The planetary gearing, Fig. 30, is of a familiar type. Double pinions mounted in a cage attached to the final driven shaft meshing with two sun gears and a ring gear, provide an underdriven low ratio of 1.82 by braking the forward sun gear, and a reverse ratio of 1.64 by braking the ring gear. High range is obtained by locking the sun gears together by the high range clutch.

The controls and the cylinders for operating the brakes are attached to the bottom of the center case for easy removal, Fig. 31. A helical gear located back of the rear oil pump drives the governor and speedometer gears. The governor is located on the right side of the case and can be removed as an assembly. Rearward of the governor is a parking gear with an actuating sprag underneath.

MAINTENANCE & ADJUSTMENTS

Adjustments — Before making any adjustments, the engine and transmission should be properly warmed up. The engine should be idling properly at 375 rpm in the High Range with the hand brake on. The control linkage and throttle linkage should operate freely. Correct adjustments cannot be made with worn or binding linkage. Replace worn linkage parts and free up all points of pivot before attempting to make a correct adjustment.

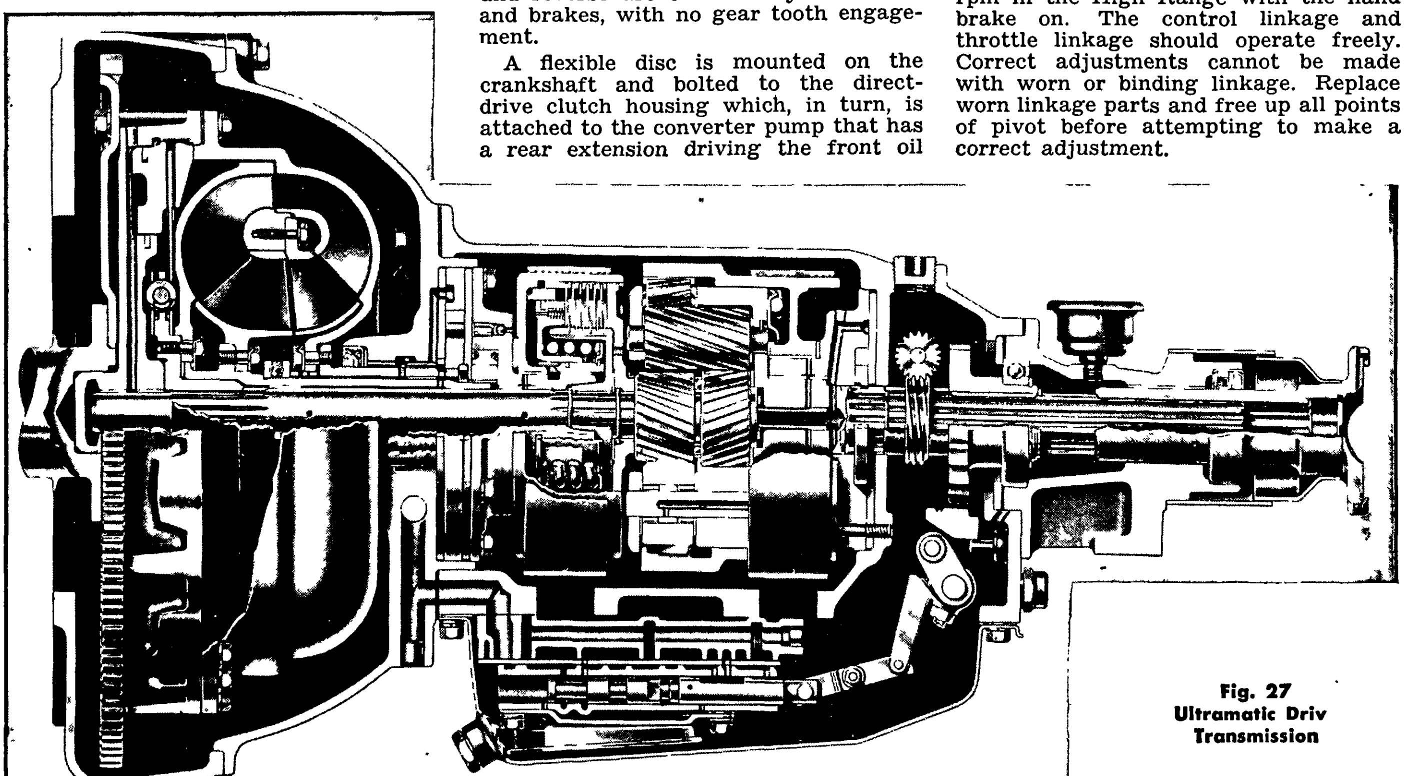


Fig. 27 Ultramatic Driv Transmission

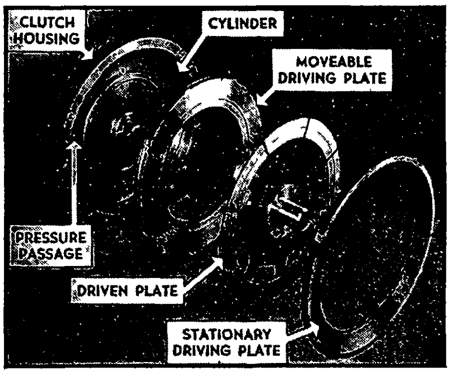


Fig. 28 Dir ct drive clutch

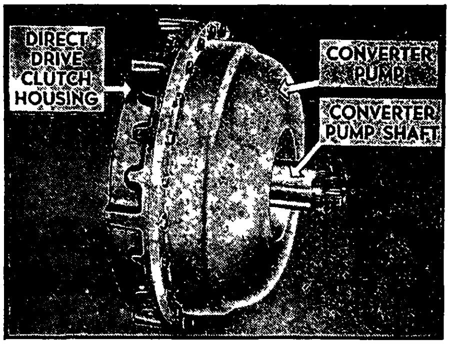


Fig. 29 C nverter pump and clutch housing

Selector Control Linkage—Fig 32 Place steering column selector lever in Low Range position Be sure detent plunger can be felt going into its well

Adjust selector rod turnbuckle so steering column lever stop is 030 to 040′ away from stop on bracket Tighten turnbuckle lock nut Recheck lever in other positions "N", "R" and 'P" should be possible without permanent overtravel when contacting stops

Throttle Valve Linkage—Place throttle shaft adjusting gauge, Fig 33, over throttle cross shaft and end of carburetor throttle rod. When rod length is properly adjusted, forward end of gauge will rest on upper milled surface of carburetor throttle body Rod can be lengthened or shortened by loosening lock nut and turning spring-loaded throttle override This adjustment determines proper length of carburetor throttle rod and correct angle of cross shaft lever

Disconnect throttle cross shaft to transmission throttle valve link rod, Fig. 34 Push rod downward lightly to seat transmission throttle valve plunger against stop Adjust clevis so that link rod is $\frac{5}{32}$" short of lining up with pin hole in throttle cross shaft Use throttle valve rod gauge PU-326 to obtain this distance Tighten clevis lock nut Connect throttle cross shaft to transmission link rod Lock pin with cotter pin The $\frac{5}{32}$" upward movement of rod will move transmission throttle valve plunger .050" from its stop

Adjust accelerator relay lever to throttle cross shaft rod, Fig 35, so that when carburetor throttle is wide open, accelerator pedal push rod lever will come within 050" of spring-loaded stop.

Service Note—An alteration which went into effect with transmission No 106958 for the Eight and 6486 for the Super Eight and Custom Eight, eliminates the Woodruff key which positioned the throttle valve outer lever on the shaft The key was eliminated so that the lever could be rotated on the shaft to a position which is in proper relation to the position of the carburetor control relay lever

A Throttle Valve Lever Adjusting Gauge (PU-334) is available and this tool should be used in the following manner whenever the accelerator linkage is checked or adjusted

Disconnect the two rods (A and B, Fig 35A) from the relay lever or bellcrank on the right side of the transmission bell housing

At this time, the gauge can be used to determine whether the throttle valve

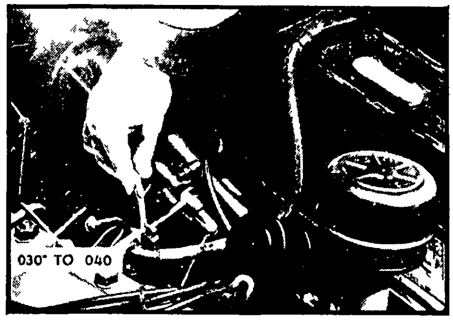


Fig. 32 Selector lev r linkage adjustment

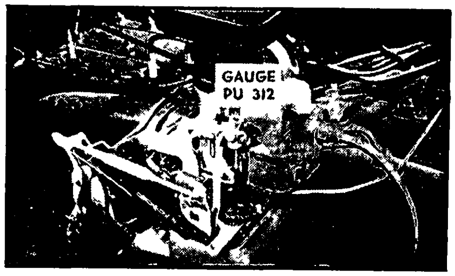


Fig. 33 Adjusting throttle cr ss shaft to carburetor r d

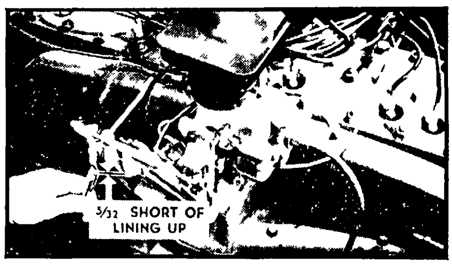
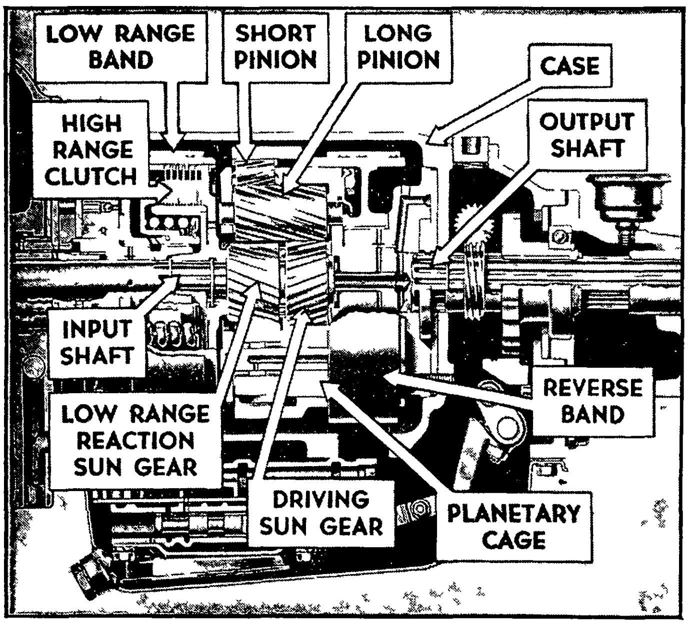


Fig. 34 Adjusting throttle cr ss shaft to throttle relay r d



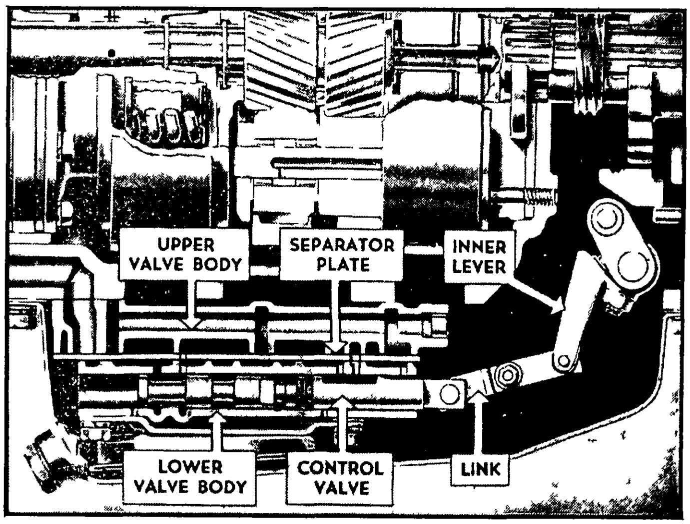


Fig. 31 C ntr l valve assembly

← **Fig. 30 Planetary transmissi n**

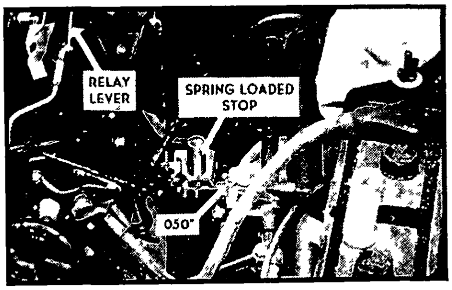


Fig. 35 Adjusting relay lever to cross shaft rod

lever is properly positioned or whether an adjustment is required.

Move rod "A" toward the rear of the car until the throttle valve lever reaches its rearward limit of travel. While holding the valve back against its stop, line up the clevis pin holes in rod "A" and the relay lever as shown in Fig. 35B. The adjustment is correct if the dowel or pin of the gauge can be inserted into the clevis pin holes and the opening in the opposite end of the gauge placed over the end of the valve lever shaft as shown in Fig. 35C.

If an adjustment is necessary, loosen the valve lever clamp screw so that the lever can be turned on the shaft. If the unit being serviced is one in which a Woodruff key is installed, remove the lever and discard the key.

Snugly tighten the clamp screw so that the lever will rotate the shaft but still will turn on the shaft after the valve stops are reached.

Rotate the lever toward the front of the car (clockwise) until the stop is reached and then continue to rotate the lever on the shaft approximately ⅛ of a turn.

Next, rotate the lever in the opposite direction (counterclockwise) until the stop is reached and then slowly continue to turn the lever on the shaft to a position which will permit the gauge to be installed as shown in Fig. 35C. The clamp screw then should be tightened to a torque of 80 lbs. in. (6½ lbs. ft.)

After this adjustment has been made and rods "A" and "B" connected to the relay lever, the throttle cross shaft to throttle valve rod adjustment should be checked and, if necessary, adjusted as outlined prior to this note.

Low Range & Reverse Band—Fig. 36. Loosen band adjusting screw lock nut. Turn adjusting screw clockwise to a torque tightness of 20 pounds feet. Back off adjusting screw 1¾ turns and tighten lock nut to a torque tightness of 25-30 pounds feet.

Checking Fluid Level—Packard Ultramatic Drive Fluid should be used or any type "A" automatic transmission fluid which has an AQ-ATF number embossed on the top of the can.

The fluid level should be checked with the control lever in Neutral within five minutes after the engine has been allowed to operate at 800 rpm for at least one minute.

To check fluid level, remove dipstick in oil filler cover. Add fluid to bring the level up to the "full" mark on the dipstick. Fluid may be added through the filler tube from the underside of the car, Fig. 37, by using an oil gun or pump with a flexible hose or curved spout.

If frequent addition of fluid is required, inspect transmission and converter for fluid leaks. Correct leak and bring level up to full mark. Fluid level should be checked at 1,000-mile intervals.

Changing Fluid—The transmission and converter should be drained and refilled at 25,000-mile intervals. See Fig. 38 and proceed as follows:

1. Remove front lower flywheel housing.
2. Loosen one converter drain plug so it may act as a vent.
3. Rotate flywheel one-half turn until other drain plug is at lowest point.
4. Place container under flywheel and remove converter drain plug. If container is long enough to reach under the transmission at the same time, remove transmission drain plug. If not, drain transmission after converter has drained.
5. Install and tighten all drain plugs.
6. Install lower flywheel housing.
7. Install seven quarts of fluid in transmission, putting the last quart in more slowly than the previous six.
8. Start and operate the engine at approximately 800 rpm for two minutes to fill the converter.
9. Stop engine and add approximately five quarts of fluid to bring it to the full mark.
10. Start and operate engine at 800 rpm for one minute to be sure converter has filled.
11. Recheck fluid level.

Fig. 35A Rods A and B connected to relay lever or bellcrank

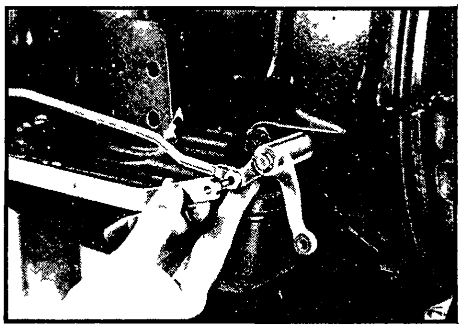


Fig. 35B Installing Throttle Valve Lever Adjusting Gauge PU-334 on relay lever

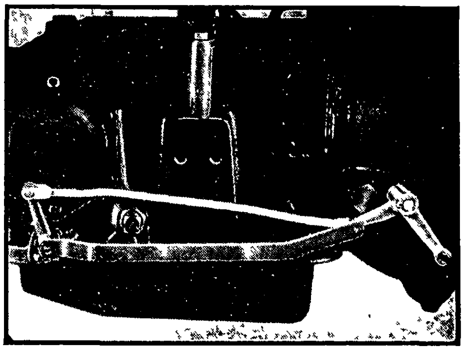


Fig. 35C Throttle valv l ver adjustm nt is correct when gauge fits linkage as shown

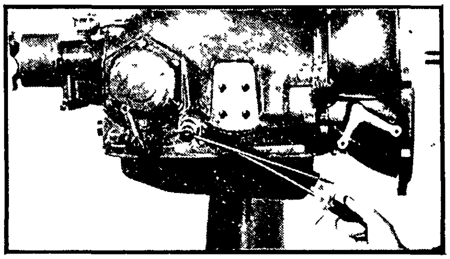


Fig. 36 Low and revers band adjustm nt

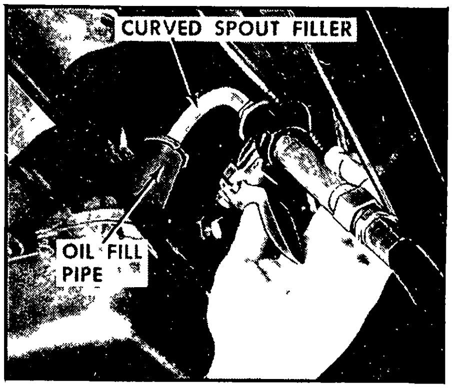


Fig. 37 Filling Ultramatic transmissi n

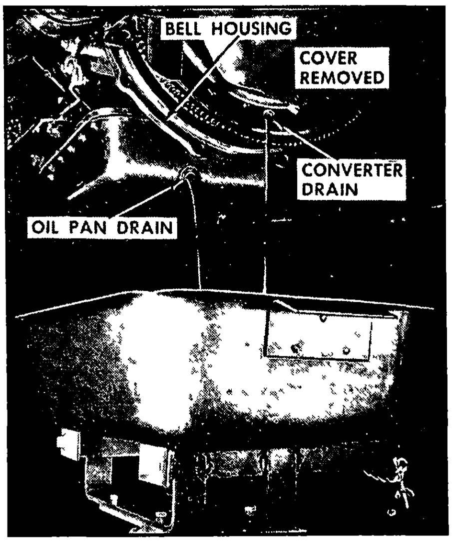


Fig. 38 Draining transmissi n and c nvert r

HYDRAULIC TESTS

CAUTION—Do not disassemble any part of the transmission until the oil level is checked and filled to full mark, the car road tested, a hydraulic unit pressure test made, and the cause of the complaint definitely located or established.

Fluid Level—Low fluid level can be the cause of many complaints ranging from excessive noise to a noticeable slip in any or all of the operating ranges.

Road Test — After the fluid level is brought up to the full mark, road test the car to determine if correcting the oil level has corrected the complaint. The road test will warm up the engine and transmission to operating temperature necessary to make an accurate pressure test.

Drive the car with frequent stops and starts, at low speed, accelerating, and at medium speeds, similar to the conditions that would exist in driving in heavy traffic and highway driving. After the engine and transmission are thoroughly warmed up, and the non-standard operation noted, make a hydraulic pressure test as outlined below.

Hydraulic Pressure Test — To diagnose and isolate the cause of the faulty operation, a pressure test should be made of the following hydraulic units:

1. Front pump regulated pressure.
2. High range clutch pressure.
3. Direct drive clutch pressure.
4. Front pump relief valve boost pressure.
5. Hydraulic governor pressure.
6. Converter inlet pressure.
7. Throttle valve pressure.
8. Low range application pressure.
9. Reverse application pressure.

Pressure Gauge—A pressure gauge calibrated 0 to 100 and flexible line 48" long with a ⅛" elbow fitting may be used for all the pressure tests except the reverse application test. A ⅜" to ⅛" pipe reducer may be used when making the front pump regulated pressure test. A pressure gauge calibrated 0 to 200, or 0 to 300 *must* be used for the reverse application test.

Preparation — Remove front floor mat and transmission inspection cover from floor panel to permit entry of pressure gauge and lines into front compartment where the pressure gauge can be seen while driving.

Front Pump Regulated Pressure Test—Remove the ⅜" pipe plug from the lower left side of the transmission bell housing. Insert a ⅜" to ⅛" pipe reducer. Support the 0 to 100 gauge from one of the fresh air ventilating system knobs. Connect the flexible pressure line from the gauge to the reducer.

Start the engine and operate at 600 rpm. Observe the pressure reading on the gauge, which should be 80-85 pounds. If the reading does not come within this range, check the condition according to the symptoms given in the *Trouble Diagnosis* section of this discussion.

High Range Clutch Pressure Tests—Remove the ⅛" pipe plug at the center of the lower rear of the transmission bell housing. This plug is located just to the right of the front pump outlet passage plug. Connect the pressure gauge flexible line to this opening.

Road test the car. With the engine running, place the control lever in the High Range position. Observe the reading on the gauge. The pressure should be approximately 35-43 pounds with the throttle closed, and approximately 85 pounds with the throttle wide open. Repeat this test, operating the car in the Low Range at first and then shift into the High Range.

If the readings do not come within this range, check the condition according to the symptoms outlined in the *Trouble Diagnosis* section of this discussion.

Direct Drive Clutch Pressure—Remove the ⅛" pipe plug just to the right of the center of the lower rear end of transmission bell housing. This plug is located just to the right of the high range passage plug. Connect the pressure gauge flexible line to this opening.

Road test the car at light throttle opening. At speeds between 15 and 18 mph, steady driving and light engine load, when the clutch engages, the pressure gauge reading should be about 33-41 pounds. At full throttle engagement at approximately 56 mph, the gauge reading should be about 85 pounds.

If the readings do not come within this range, check the condition according to the symptoms outlined in the *Trouble Diagnosis* section.

Front Pump Relief Boost Pressure Test—Remove the ⅛" pipe plug at the lower right rear end of the transmission bell housing. Connect the flexible gauge line to this opening.

Start and operate the engine at 600-1000 rpm. Observe the reading on the gauge, which should be 65-75 pounds. If not within this range, check the condition as outlined in the *Trouble Diagnosis* section.

Hydraulic Governor Pressure Test—Remove the ⅛" pipe plug at the right rear end of the transmission case just to the rear of the governor. Connect the gauge flexible line to this opening.

Road test the car at various speeds above 15 mph and observe the gauge reading. The reading at the various speeds should be in direct proportion to the car speed and should come within the range of approximately 31 pounds at 15 mph and 61 pounds at 56 mph.

If the readings do not register in direct proportion to car speed, check the condition according to the symptoms outlined in the *Trouble Diagnosis* section.

Converter Inlet Pressure—Remove the ⅛" pipe plug at the upper left side of the bell housing and connect the pressure gauge line to this opening.

Start and operate the engine at 600 rpm and observe the gauge reading. The pressure should be 60-75 pounds. If not within this range, check the condition according to the symptoms outlined in the *Trouble Diagnosis* section.

NOTE—The next three tests require the removal of the transmission oil pan to connect the flexible gauge lines. It is recommended that a three-gauge panel (PU-300) be used to make all three tests at the same time. However, a single gauge may be used, removing and installing the pan for each test. The pressure gauge flexible lines may be inserted into the transmission through the oil filler tube, and the test pan installed after they are connected to their respective openings. Be sure to use the 0 to 200 (or over) gauge for the reverse application test. The description of the following procedure is using a single gauge. However, the three-gauge panel may be used, following the same connection and test procedure.

Throttle Valve Pressure Test—With the pressure gauge supported in the front compartment, drain the transmission oil and remove the oil pan. Remove the ⅛" pipe plug from the throttle valve body, located at the right side of the control valve lower body.

Insert the flexible gauge line through the oil filler tube and connect to the opening in the throttle valve body. Install the test pan and pour the oil back into the transmission.

Road test the car at various throttle openings. The gauge readings should be in direct proportion to the throttle openings, ranging from 24-28 pounds at closed throttle to 54-63 pounds at full throttle. If not within this range, check the condition according to the symptoms outlined under *Trouble Diagnosis*.

Low Range Application Pressure Test—With the flexible gauge line inserted through the filler tube, and oil pan removed, remove the ⅛" pipe plug from the low range cylinder body, located at the right front end of the control valve upper body.

Connect the flexible line to this opening, install the test pan and pour the oil back into the transmission.

Road test the car under conditions similar to those of driving in heavy traffic, making frequent stops and starts in the low range, at low speed, accelerating and shift into high range.

The gauge readings should be approximately 37-45 pounds when low band application starts at light throttle to 80-90 pounds at full throttle. If not within this range, check the conditions outlined under *Trouble Diagnosis*.

Reverse Application Pressure Test—Be sure to use the 0 to 200 pound minimum scale. With flexible gauge line inserted through the filler hole and oil pan removed, remove the ⅛" pipe plug from the reverse cylinder body, located at the left rear end of the control valve upper body.

Connect the flexible line to this opening, install the test oil pan and pour the fluid into the transmission.

Road test the car, making frequent stops and using reverse as it is normally used. The gauge reading should be 160-180 pounds when the control lever is in the reverse position and engine running at 1500 rpm. If not within this range, check conditions outlined under *Trouble Diagnosis*.

TROUBLE DIAGNOSIS

Condition—If the car fails to move regardless of selector lever position (appears to be in neutral), check the following:

1. Low oil level in transmission.
2. Clogged inlet screen to oil pumps.
3. Front pump relief valve stuck in open position.
4. Pump selector valve stuck in open position.
5. Selector control linkage disconnected.
6. Broken axle shaft.
7. Transmission tail shaft broken loose from planetary cage.
8. Parking gear lever spring broken, allowing the pawl to remain engaged in parking gear.
9. Hand brake may be on.
10. Low and reverse bands may be adjusted too tight.
11. Bushings or bearings seized in transmission. Noise may or may not be present.

Condition—Car fails to move regardless of shift lever position — rear wheels locked, car cannot be moved.

If the parking gear pawl disengages but the transmission is still locked up, it may be due to broken parts within the transmission.

Condition—If car fails to move in High Range, check the following:

1. Low oil level in transmission.
2. Selector control linkage disconnected or out of adjustment. Check by moving selector lever slightly to each side of "H" detent.
3. Loss of pressure to high range clutch piston.
4. Sticking or inoperative modulating valve.
5. Burned or worn clutch plates.

Condition—If the car fails to move in the low range while operation in high range and reverse is satisfactory, look for the following:

1. Selector control linkage out of adjustment. Check the adjustment by moving the selector lever slightly to either side of the low detent.
2. Worn or broken low range band.
3. Band strut dropped out of position.
4. Low range apply piston jammed.
5. Vent for release side of low range fast acting piston (automatic take-up) is closed.
6. Timing valve stuck in "high range" position. Car acts as if in neutral.

Condition—If the car will not move in reverse but operates satisfactorily in low and high range, check the following:

1. Selector control linkage out of adjustment.
2. Worn or broken reverse band.
3. Band strut dropped out of position.
4. Reverse apply piston jammed.

Condition—If excessive slip is evident in all ranges, check the following:

1. Low oil level in transmission.
2. Selector control linkage out of adjustment.
3. Low front oil pump pressure due to faulty front pump relief valve or spring, faulty pump selector valve, or worn or scored rotors.

Condition—If there is excessive slip in the high range only, look for:

1. Control valve link out of adjustment.
2. Loss of pressure to high range clutch. The leakage may be in the high range pressure passages, bushings in the low range drum, check valve in the reactor clutch housing, or in the high range clutch piston rings.
3. High range clutch piston stuck in cylinder in low range drum.
4. High range clutch plates sticking on their splines.
5. High range clutch plates worn or burned.

Condition—If there is excessive slippage in the low range only, look for:

1. Control valve linkage out of adjustment.
2. Timing valve sticking.
3. Vent for release side of fast acting piston closed.
4. Low range piston sticking in cylinder body, or worn seals.
5. Band out of adjustment.
6. Low range band or drum worn, burned or scored.

Condition—If there is excessive slippage in reverse only, look for:

1. Control valve linkage out of adjustment.
2. Loss of pressure to reverse piston.
3. Lack of boost pressure to pump selector valve.
4. Vent for release side of fast acting piston closed.
5. Reverse piston sticking in cylinder body, or worn seals.
6. Band out of adjustment.
7. Reverse band or drum worn, burned or scored.

Condition—If there is excessive drag in the high range or reverse, yet OK in the low range, look for:

1. Low range band too tight.
2. Low range piston jammed in the "on" position.
3. Low range band strut out of position.
4. Timing valve stuck in low range position, keeping low range band on when in high range or reverse.

Condition—If there is excessive drag in high range and low but OK in reverse, look for:

1. Reverse band too tight.
2. Reverse piston jammed in "on" position.
3. Reverse band strut out of position.

Condition—If the car creeps forward in neutral, look for:

1. Control valve linkage out of adjustment.
2. Low range band too tight.
3. High range clutch pressure line vent ball check in the reactor clutch housing may be stuck. This is generally indicated by creeping only when the engine is speeded up.
4. High range clutch plates may be sticking on their splines.

Condition—If the car creeps excessively in the high range during idle, adjust engine idling speed.

Condition — If the car creeps forward when selector lever is in reverse, adjust the control valve linkage.

Condition—If the car creeps backward when selector lever is in the low range, adjust the control valve linkage.

Condition—If the high range clutch engages when the selector lever is in the park position, look for:

1. Control valve and detents out of adjustment with stops on steering column.
2. Steering column tube not in position with key on steering gear case.
3. Control valve link out of adjustment.
4. Inner control valve lever may be bent, giving the wrong geometry in park position.

Condition—If there is excessive lag when shifting from low range to high, look for:

1. Sticking timing valve.
2. Obstruction in metered passage to rear end of timing valve. A sticking timing valve or obstruction in the metered passage will cause the low range band to remain on after the high range clutch has engaged. This causes the low range band to act as a brake and will cause the car to lag.
3. Low range piston sticking in "on" position.
4. Low range fast acting piston vent valve not dumping the pressure as soon as the pressure is cut off.

Condition—If there is excessive delay when shifting from high range to low, look for:

1. Sticking timing valve.
2. Obstruction in the metered passage at rear end of timing valve. A sticking timing valve or obstruction in the metered passage will cause the engine to race for a period of time before the low range band is applied.
3. Low range band out of adjustment.
4. Vent for release side of fast acting piston closed.
5. Low range piston sticking in cylinder body, or worn seals.

Condition—If the shift is severe from low range to high at light throttle opening but normal at greater throttle opening, look for:

1. Transmission throttle valve linkage out of adjustment.
2. Throttle valve sticking in bore.

Condition—If the shift is severe from low to high at all times, look for:

1. Throttle valve linkage out of adjustment.

2. Throttle valve stuck open.
3. Faulty modulating valve.
4. Low range band out of adjustment.
5. Worn, scored or damaged clutch plates.
6. Loose cover at rear end of timing valve.

Condition—If the shift is severe from the high to low range, look for:
1. Low range band out of adjustment.
2. Sticking timing valve.
3. Loose cover at rear end of timing valve.
4. Worn, scored or rough drum or band.

Condition—If the transmission chatters when starting in the high range, look for:
1. Low range band dragging.
2. Reverse band dragging.
3. Worn, scored or rough low range drum or band.
4. Worn, scored, burned, distorted or sticking high range clutch plates.

Condition—If the transmission chatters when starting in the low range, look for:
1. Low range band out of adjustment.
2. Reverse band dragging.
3. Worn, scored or rough low range band and drum.
4. Worn, scored, burned, or sticking high range clutch plates. Sticking high range pistion.

Condition—If the transmission chatters when starting in reverse, look for:
1. Reverse band out of adjustment.
2. Low range band dragging.
3. Worn, scored or rough reverse band and drum.
4. Reverse drum bushing or thrust washer worn or scored.
5. Worn, scored, burned or sticking high range clutch plates.
6. Sticking high range clutch piston.

Condition—If the direct drive clutch disengages with a severe clunk at stop, look for:
1. Sticking direct drive shift valve.
2. Sticking or faulty governor vent valve.
3. Direct drive clutch driven plate facing groove too shallow.
4. Direct drive clutch movable driving plate stuck in clutch housing.

Condition—If the direct drive clutch fails to disengage when coming to a stop and engine stalls, look for:
1. Faulty governor.
2. Sticking direct drive shift valve.
3. Sticking converter relief valve.
4. Sticking direct drive clutch movable driving plate.
5. Broken direct drive clutch driven plate.

Condition—Failure of direct drive clutch to engage. Car operates in converter at all times:
1. Faulty governor.
2. Sticking direct drive shift valve.
3. Sticking direct drive clutch movable driving plate.

Condition — Operation of direct drive clutch erratic and noisy. Clutch engages and disengages alternately:
1. Faulty governor.
2. Sticking direct drive shift valve.

Condition—Failure of direct drive clutch to disengage on kickdown:
1. Throttle valve linkage out of adjustment.
2. Sticking throttle valve piston.
3. Faulty governor; pressure too high.
4. Sticking direct drive shift valve.
5. Throttle valve operating rod bell crank on bell housing reversed. This gives wrong geometry to operating rod.

Condition — Operation of direct drive clutch erratic and noisy. Direct drive clutch engages and disengages alternately at approximately 15 mph:
1. Faulty governor; vent valve sticking or clogged by dirt.
2. Faulty governor drive pinion; teeth worn or chipped, causing chattering operation of governor.

Condition—Direct drive clutch slips:
1. Leak in direct drive clutch hydraulic system.
2. Faulty converter inlet valve, causing high converter pressure when driving in direct.
3. Faulty converter outlet valve.
4. If abnormal noise and abnormally high creepage is noticed, it may indicate a broken driven plate.

Condition — Converter and transmission overheats on hills: This indicates insufficient oil flow through the converter, which could be caused by a sticking "converter inlet" valve, or converter relief valve stuck open.

Condition—Scraping noise in converter: If faulty direct drive clutch disengagement is noticed, it may be a broken driven plate. It may also be caused by a worn or faulty reactor shaft bearing or thrust washer, causing converter parts to rub or scrape.

Condition — Rattle in transmission in neutral or high range: If the rattle is at idle only, it may be just rough engine performance on idle. If rattle occurs in neutral and high, it is a band strut rattle in the transmission.

Condition—Abnormal torsional disturbance in drive line at 20 mph or at higher speeds in direct drive:
1. Incorrect friction lag in direct drive clutch driven plate (disturbance most noticeable when driving in direct drive).
2. Scored or burned out rear bearing retainer babbitt bearing (extension housing bearing).

Condition—Excessive backlash in transmission, most noticeable when accelerating and decelerating in direct drive:
1. Worn or faulty transmission thrust bearing or thrust washers, along the input and output shafts.
2. Excessive backlash in differential.

Condition—Roar coming up from area around transmission:
1. Body floor panel striking transmission or bell housing.
2. Exhaust pipe striking frame or body.
3. Muffler rear bracket not neutralized.
4. Hole in muffler or tail pipe.

Condition—Knock or grating noise in neutral, low range or reverse: This is caused by chipped or broken tooth in planetary unit, or a chip wedged between the teeth. Also broken planetary pinion roller bearings.

Condition — Excessive planetary unit whine in low range or reverse: Caused by worn, scored or burned planetary gears or excessive play in planetary pinions.

Condition—Whine or hum in neutral or high range below 35 mph, but noise disappears at higher speeds:
1. Front oil pump inlet exposed to air leak.
2. If front pump pressure holds regularly and the noise still exists, the front oil pump rotors may be noisy.
3. Oil foaming (change oil and notice if noise is gone).

Condition — Hum or whine at speeds above 30 mph:
1. Front oil pump relief valve stuck, not allowing front pump to idle.
2. If front oil pump cuts out as it should and noise is still present, it may be that the rear pump is noisy.

Condition — Incorrect front oil pump pressure:
1. Front pump relief valve sticking or broken spring.
2. Pump selector valve sticking or broken spring.
3. Pump check valve not seating, allowing pressure to escape through rear pump.
4. Air leak in pump inlet passage.
5. Pressure escaping at control valve bore, modulating valve bore, or throttle valve bore.
6. Pressure escaping at release side of low or reverse piston.

Condition—Incorrect high range clutch pressure:
1. Throttle valve linkage out of adjustment.
2. Sticking throttle valve.
3. Sticking modulating valve.
4. Sticking ball check in high range pressure passage in the reactor clutch housing.
5. Worn or leaking high range clutch piston rings.
6. Worn or scored bushings in low range drum.

Condition—Incorrect direct drive clutch pressure:
1. Throttle valve linkage out of adjustment.
2. Sticking throttle valve.
3. Sticking modulating valve.

4. Worn or leaking direct drive clutch piston rings.

5. Worn input shaft pilot bushings.

6. Worn bushings in reactor shaft and in the reactor over-running clutch housing.

Condition—Incorrect front pump relief valve boost pressure:

1. Front pump relief valve sticking or broken spring.

2. Pump selector valve sticking or broken spring.

Condition — Incorrect converter inlet pressure when driving in converter drive:

1. Faulty converter inlet valve.

2. If pressure is low, it may indicate a loss of pressure through the converter pump shaft bushings in the bell housing.

3. If the converter pressure exceeds 22 pounds when operating in direct drive, it may indicate a sticking converter inlet valve. This is usually accompanied by a slipping direct drive clutch.

Condition—Incorrect governor pressure:

1. Sticking governor valve or vent valve.

2. Governor housing loose on shaft.

3. Worn valves or valve support.

Condition — Incorrect throttle valve pressure:

1. Throttle valve linkage out of adjustment.

2. Sticking throttle valve.

Condition—Incorrect low range application pressure:

1. The low range application pressure is modulated pressure and should be the same as the high range clutch pressure. If the variation is excessive, it could be caused by a leak in the low range pressure passages, or a loose low range cylinder body.

2. Leaking seal rings on the low range piston.

Condition — Incorrect reverse application pressure:

1. Leaks in reverse pressure passages, or a loose reverse cylinder body.

2. Leaking seal rings on reverse piston.

3. Sticking pump selector valve. Check the front pump relief valve boost pressure in reverse at 1500 rpm. The boost pressure should be 135-150 pounds. If not within this range, pump selector valve is at fault.

TRANSMISSION REMOVAL

1. Place selector lever in neutral.

2. Remove front seat cushion, floor mat and carpet.

3. Remove floor panel inspection cover.

4. Lift both ends of car and place stands at all four wheels.

5. Connect Remote Control Starter Switch J-2679 between the ungrounded post of the battery and the solenoid small terminal. This switch is used to turn over the engine from beneath the car.

6. Remove lower flywheel housing.

7. Using switch mentioned in Step 4, rotate engine until one converter drain plug is at the bottom. Loosen this plug so it acts as a vent. Then rotate engine until the other drain plug is at the bottom.

8. Drain fluid from converter and transmission and replace plugs.

9. Disconnect selector control linkage.

10. Disconnect engine throttle to transmission throttle valve linkage.

11. Disconnect oil cooler lines.

12. Disconnect speedometer cable.

13. Remove propeller shaft.

14. Disconnect hand brake cable at equalizer bar.

15. Support engine on a beam across the frame channels or on a hydraulic jack with a block of wood over the jack ram, large enough to cover the rear end of the engine oil pan.

16. Raise engine and transmission until load is off engine supports.

17. Remove engine snubber and both rear engine support insulators.

18. Place transmission lift under transmission and pick up transmission load by slightly lifting lift.

19. Mark relative position of flywheel and converter clutch housing.

20. Remove flywheel to direct drive clutch housing bolts.

21. Tap clutch housing to loosen and slide converter to rear.

22. Remove transmission bell housing to flywheel housing bolts.

23. Fasten converter to transmission bell housing to prevent it from falling off.

24. Slide transmission rearward until clutch housing is clear of flywheel.

25. Lower transmission with lifting device, remove unit from under car and place it on the bench or a special fixture.

TRANSMISSION INSTALLATION

1. Place transmission on lift under car, directly under opening in floor panel.

2. Install 2 pilot studs in forward side of clutch housing to guide it onto flywheel. Be sure converter drain plug lines up with opening in flywheel.

3. Raise transmission with lift until clutch housing pilot is in line with bore in center of crankshaft.

4. Slide transmission forward until clutch housing pilot enters crankshaft and bell housing contacts flywheel housing.

5. Install bell housing to upper flywheel housing capscrews.

6. Remove pilot studs and install clutch housing to flywheel capscrews, tightening them to 25-30 pounds feet torque.

7. Install lower flywheel housing.

8. Install bell housing to lower flywheel housing capscrews.

9. With bell housing tightly against flywheel housing, tighten capscrews evenly to a torque of 25-30 pounds feet.

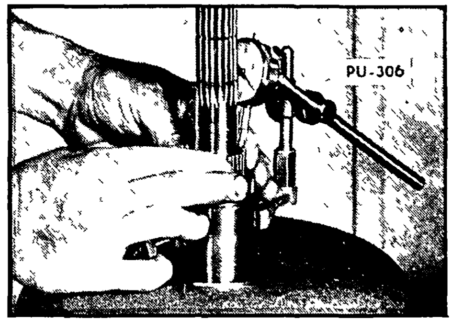


Fig. 39 Measuring reactor shaft end play

10. Install rear engine support insulators, and insulator to bracket attaching capscrews, washers and nuts. *Do not tighten at this time.*

11. Lower transmission lift and engine supporting device so that engine will rest on its rear supports.

12. Rock engine back and forth to neutralize supports. Then tighten insulator to bracket capscrews.

13. Install engine snubber.

14. Remove support beam or jack from under engine and the lift from under transmission.

15. Connect oil cooler lines.

16. Install propeller shaft.

17. Connect speedometer cable and hand brake cable.

18. Connect and adjust selector control linkage and throttle linkage and install fluid as directed under *Adjustments & Maintenance.*

SERVICING THE CONVERTER

IMPORTANT — The Ultramatic transmission is a precision built unit and it is of the utmost importance that all precautions for care and cleanliness be taken when servicing the device. The bench or work space, tools and hands must be clean. All parts must be removed gently without forcing them. If a part is slightly stuck, use a soft-faced hammer to jar it loose. Be sure all parts have the proper fit and all tolerances are maintained. It is strongly recommended that torque tightening specifications be closely followed, and that the special tools illustrated be acquired and used. These tools may be purchased through the Packard Motor Car Company, Detroit, Mich.

Disassembly of Converter—

1. Remove converter from transmission.

2. Place converter on bench with pump end up.

3. Mount dial indicator as shown, Fig. 39, and measure reactor shaft end play to determine if a new thrust washer is needed. End play should be .018-.022".

4. Unfasten and lift off converter pump.

Caution: These are special capscrews and should not be interchanged with other capscrews of same size. Tap converter pump with plastic hammer to

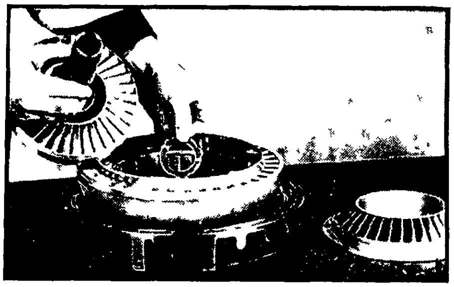


Fig. 40 R m ving reactor and shaft

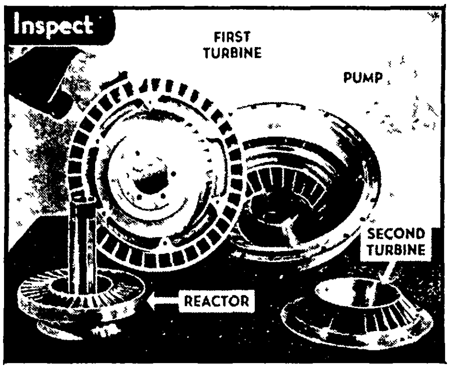


Fig. 41 Layout f torque converter parts

Fig. 42 Measure ring gap in clutch driving plate

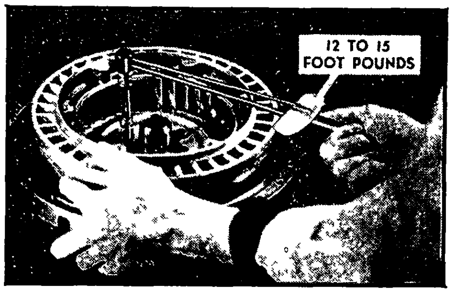


Fig. 43 Tightening first turbine attaching screws

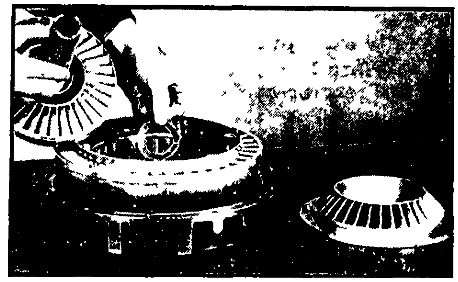


Fig. 44 Installing thrust washer and r act r

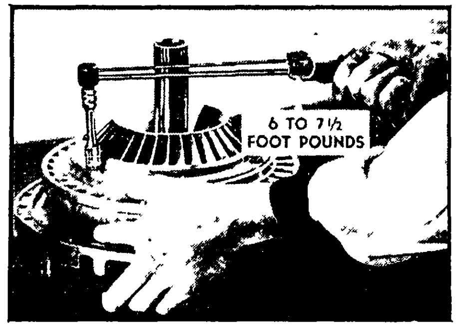


Fig. 45 Tightening sec nd turbine attaching screws

loosen, and slip off converter pump and thrust spacer.

5. Unfasten and remove second turbine, after tapping it loose with plastic hammer.

6. Remove reactor, shaft and ball thrust bearing, Fig. 40.

7. Unlock and remove first turbine to converter clutch driven hub capscrews. Remove first turbine and reactor thrust washer.

8. Remove direct clutch stationary driving plate and clutch driven plate.

9. Remove clutch movable plate and piston by bumping clutch housing on bench. Note piston rings on inner diameter of clutch housing and on outer diameter of piston.

Converter Inspection—Fig. 41.

1. Wash all parts in clean unleaded gasoline, kerosene or carbon tetrachloride and dry with compressed air.

2. Inspect contact surface of outer flange of converter pump and outer edge of clutch housing for nicks, burrs, indentations, warpings, or low spots that might cause converter to leak.

3. Inspect machined area around vanes and torus ring for wear or rubbing condition, which would be an indication of worn reactor bearing or thrust washer. Inspect vanes and torus ring for any indication of cracks.

4. Inspect converter pump shaft surface for pits, scores or wear. If shaft surface is scored or worn, replace shaft and babbitt bearing in transmission bell housing. Inspect condition of converter pump shaft splines.

5. Inspect general condition of second turbine for any indication of cracks. Inspect machined area around vanes for wear or rubbing condition, which would be an indication of worn reactor bearing or thrust washer.

6. Inspect mounting flange of second turbine for being warped, or cracked bolt hole bosses.

7. Inspect general condition of first turbine for any indication of cracks. Inspect machined area around vanes, torus ring and center for wear or rubbing condition, which would be an indication of worn converter bearings or thrust plates.

8. Inspect outer mounting flange for being warped or distorted. Inspect condition of bolt holes and threads, and center mounting surface for burrs, nicks or distortion. Inspect condition of center alignment flange.

9. Inspect general condition of reactor for any indication of cracks. Inspect machined area around vanes and hub for wear or rubbing condition which would be an indication of worn reactor bearing or thrust plate.

10. Inspect reactor shaft bearing surfaces and splines for wear, pits or scores. Inspect reactor shaft attaching flange and capscrews.

11. Inspect reactor to first turbine thrust washer, and the reactor to converter pump thrust bearing for wear, pits or scores.

12. Inspect direct drive clutch driven plate for worn or loose facings, or loose torque springs. Inspect driven plate hub splines.

13. Inspect clutch stationary driving plate for wear, burrs, pits and scores. Inspect condition of driving lugs.

14. Inspect clutch movable driving plate and piston for wear, burrs, pits or scores. Inspect condition of piston rings and grooves. Measure ring gap of inner and outer rings, Fig. 42, which should be .003-.012". Install new rings if not within these limits.

15. Inspect condition of clutch housing to converter pump contact surfaces for nicks, burrs, indentations, warping or low spots that may cause the converter to leak. Clean and inspect the oil passage from input shaft bearing to direct drive clutch piston.

Assembling Converter—

1. Install and tighten drain plugs in converter direct drive clutch housing. Place clutch housing on bench with rear side up.

2. Install direct drive clutch piston. Be sure there are no burrs on clutch cylinder, piston or rings. Make sure driving plate lugs do not bind in clutch housing grooves, and that rings are free in their grooves. Center rings for easy installation and to prevent ring damage.

3. Install clutch driven plate and stationary driving plate.

4. Install first turbine, attaching it to driven plate hub. Tighten capscrews evenly to a torque of 12-15 foot pounds, Fig. 43. Be sure to bend over lock plate tabs to lock capscrews.

5. Install thrust washer in hub of first turbine, Fig. 44. Coat thrust washer with clean cup grease to hold it in place. Install reactor and shaft.

6. Install second turbine, attaching with capscrews and lock plates. Torque tighten capscrews to 6-7½ foot pounds, Fig. 45.

7. Install ball thrust bearing in place over reactor shaft. Coat ball thrust bearing with clean cup grease to hold it

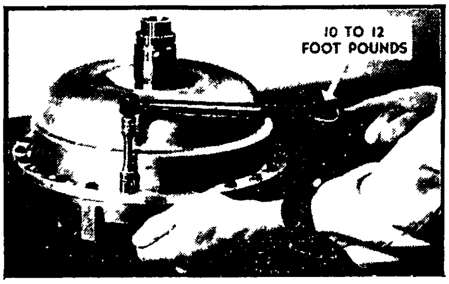


Fig. 46 Tight ning converter pump attaching screws

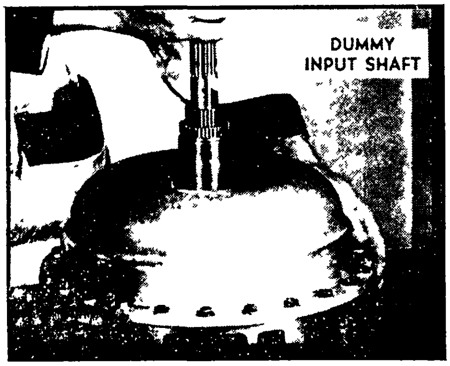


Fig. 47 Checking clutch driven plate f r free rotation

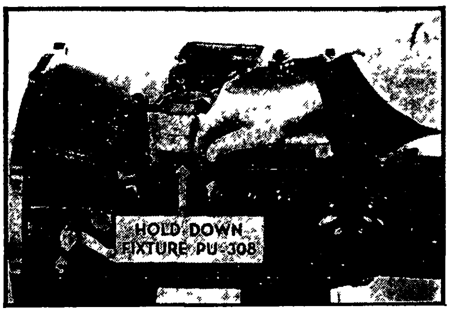


Fig. 48 Installing hold-down fixture n low and reverse band levers

in place. Install bearing spacer in forward end of converter pump shaft.

8. Install new converter pump gasket.

9. Install converter pump, tightening capscrews evenly to a torque tightness of 10-12 foot pounds, Fig. 46.

10. Check driven plate for free rotation by spinning it with a dummy input shaft, Fig. 47. There should not be any drag on the driven plate.

DISASSEMBLE TRANSMISSION

1. Place transmission on bench with oil pan up; take off pan and gasket.

2. Install hold-down fixture, Fig. 48, on low range band and lever and reverse band lever. This is accomplished by inserting narrow end of fixture between lever and piston, attaching other end to transmission case by two knurled head screws. This will prevent dropping band struts when control valve is removed.

3. Remove oil screen.

4. Disconnect control valve link.

5. Remove control valve lower body, separator and upper body as a unit, Fig. 49.

6. Remove bell housing and gasket.

7. Loosen low band adjustment.

8. Remove high range clutch, Fig. 50.

9. Remove front sun gear thrust bearing.

10. Remove hold-down fixture from low range band lever, Fig. 48.

11. Remove struts from low range band, being careful that struts do not drop into transmission.

12. Remove low range band.

13. Remove governor, Fig. 51, and speedometer driven pinion and retainer.

14. Remove rear bearing retainer, Fig. 52, and converter outlet valve.

15. Remove snap ring and parking gear, Fig. 53.

16. Remove speedometer drive gear and spacers.

17. Remove entire planetary unit and output shaft through front end of transmission case, Fig. 54.

18. Loosen reverse band adjustment and remove reverse drum and planetary ring gear.

19. Remove hold-down fixture from reverse band lever and take out struts and reverse band.

20. Remove rear oil pump.

21. If necessary to strip case completely, the safety starter switch, selector control detent, control valve cross shaft, throttle valve lever and shaft, low and reverse band levers, and parking gear pawl and lever may be removed; otherwise leave these parts in the case.

OVERHAULING TRANSMISSION PLANETARY UNIT

Disassemble—

1. Pry away lock plate tabs.

2. Support output shaft and planetary cage in a soft-jawed vise.

3. Unfasten forward half of planetary cage. Tap it sharply with a plastic hammer and lift it off, Fig. 55.

4. Move short pinion shaft to rear and remove locking key.

5. Remove three short pinions, shafts, thrust washers and bearings as an assembly.

6. Remove rear sun gear and thrust washer.

7. Move long pinion shaft to rear and remove locking key.

8. Remove long pinions, shafts, thrust washers and roller bearings as an assembly.

9. Pinions, shafts and bearings may now be disassembled.

Inspection—

1. Inspect all gears for wear, chipped teeth, scores, pits, nicks and burrs.

2. Inspect input shaft bearing surfaces and splines for wear and scores.

3. Inspect pinion shafts and output shaft for wear, scores and pits.

4. Inspect planetary cage halves for a snug accurate fit.

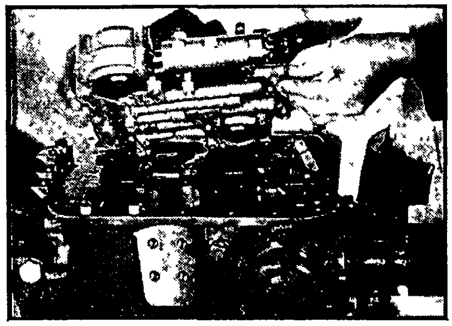


Fig. 49 Removing contr l valve assembly

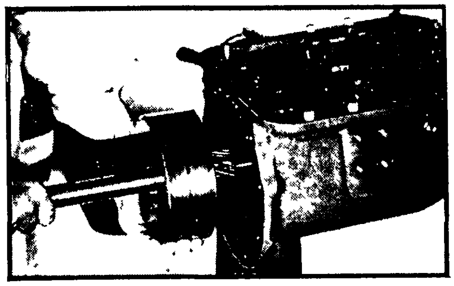


Fig. 50 Removing high range clutch assembly

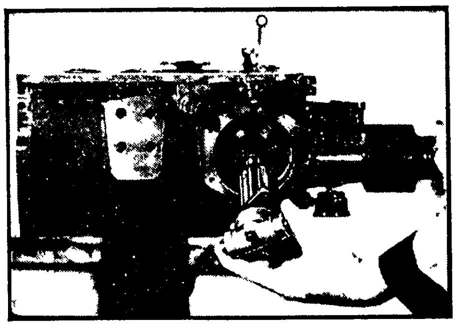


Fig. 51 Removing govern r

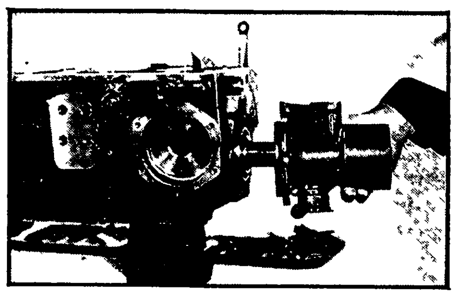


Fig. 52 Removing rear bearing retain r

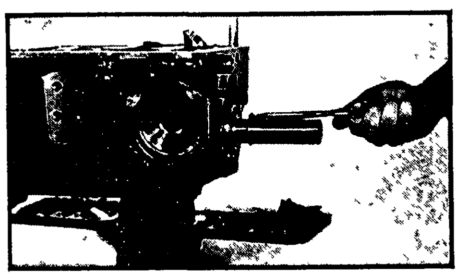


Fig. 53 Rem ving snap ring and parking gear

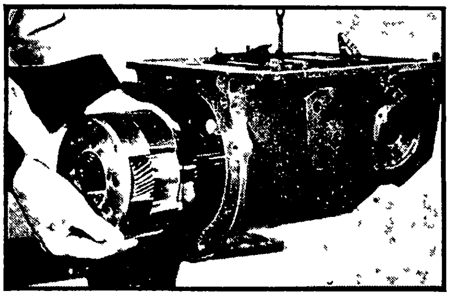


Fig. 54 Removing planetary unit

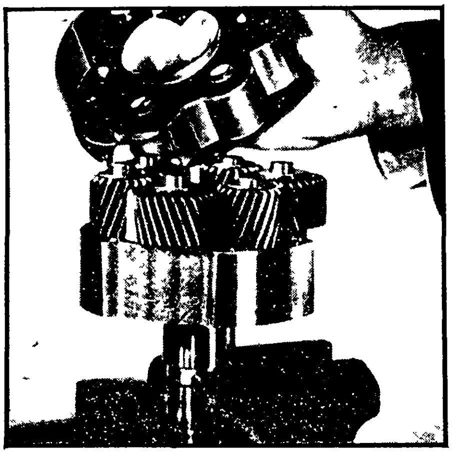


Fig. 55 Removing forward half f planetary cage

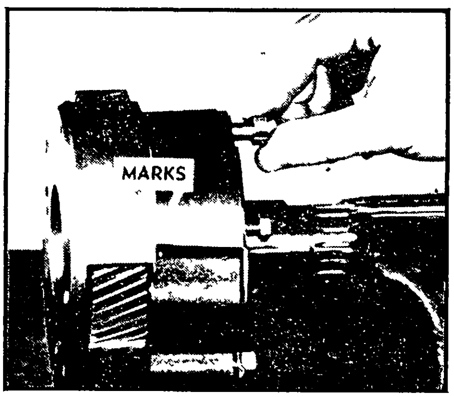


Fig. 56 Line up marks when installing fr nt half of planetary cage

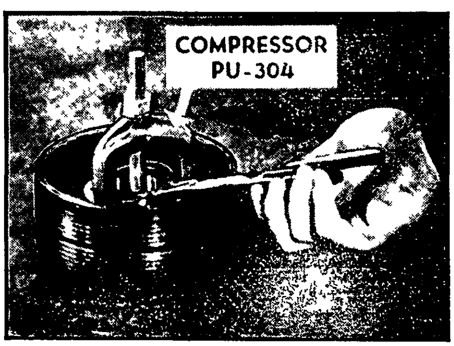


Fig. 57 C mpr ss clutch spring with to l sh wn and remove snap ring

5. Replace any parts that do not come up to inspection requirements with new parts.

Assemble—

1. Assemble pinions, spacers and roller bearings on each corresponding shaft. Be sure chamfered end of pinion is opposite key end of shaft.
2. Each pinion has 38 rollers, 19 at each end separated by a spacer.
3. Hold rollers in place with clean cup grease.
4. Install thrust washers.
5. Grip output shaft in a soft-jawed vise in a horizontal position.
6. Install long pinion assemblies in cage with chamfered ends to front.
7. Push shafts far enough to install woodruff keys. Then push shafts forward so that keys will lock shafts.
8. Install rear thrust washer on rear sun gear, holding it in place with clean cup grease.
9. Install rear sun gear in planetary cage.
10. Be sure thrust washer seats in cage.
11. Install short pinions in cage with chamfered end to front.
12. Push shafts to rear and insert locking keys.
13. Then push shafts forward so keys will lock shafts.
14. Be sure all thrust washers are in place.
15. Install front half of planetary cage, being sure marks line up, Fig. 56.
16. Install lock plate and attaching capscrews.
17. Torque tighten larger capscrews to 25-30 foot pounds and smaller ones to 12-15 foot pounds.
18. Bend over tabs of lock plate.

HIGH RANGE CLUTCH

Disassemble—

1. Remove large snap ring from low range drum.
2. Remove front sun gear and flange from drum.
3. Remove clutch hub and input shaft.
4. Remove clutch plates
5. Using clutch spring compressor, Fig. 57, compress clutch piston return spring.
6. Remove retaining snap ring.
7. Remove compressing tool and take out piston spring and seat.
8. Bump low range drum, piston side down, on a wooden block or bench to dislodge and remove clutch piston.
9. Remove outer piston ring from piston.
10. Remove inner piston ring from inner hub of low range drum.
11. Remove snap ring from input shaft, Fig. 58, and remove clutch hub from input shaft.

Inspection—

1. Inspect drum for wear, scores, cracks or nicks.
2. Inspect low range drum clutch plate splines and inner hub surfaces.

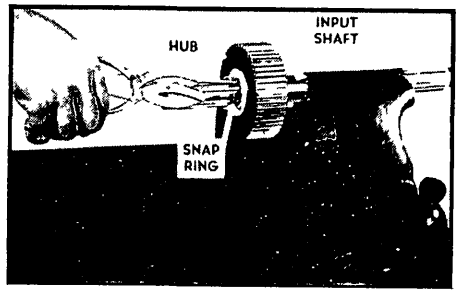


Fig. 58 Removing snap ring from input shaft

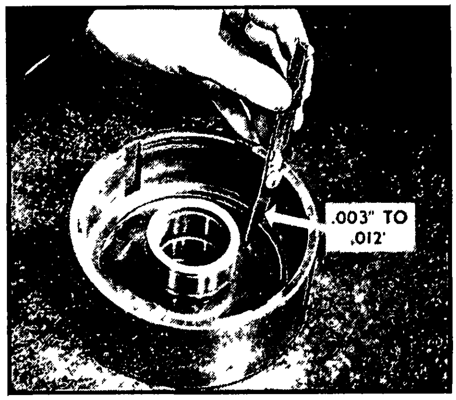


Fig. 59 Measuring ring gap of high range pist n rings

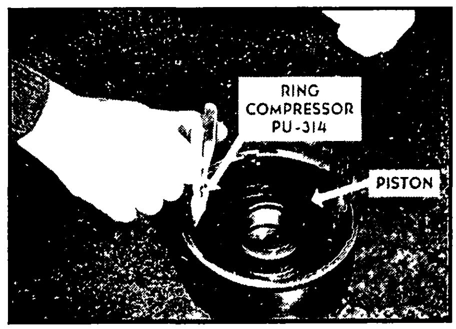


Fig. 60 Installing high rang clutch pist n

3. Inspect clutch plates for proper wave, wear, scores, nicks and burrs.
4. Inspect clutch hub thrust plate.
5. Install new clutch plates if necessary.
6. Inspect pistons for wear, scores, nicks and burrs.
7. Measure ring gap of high range piston rings, Fig. 59.

Assemble—

1. Install outer piston ring on piston.
2. Install inner ring on journal of low range drum hub.
3. Centralize inner ring on drum hub.
4. Install clutch piston in low range drum, using ring compressor, Fig. 60, to guide outer ring in position.
5. Install clutch release spring so that one end seats in clutch piston.
6. Using clutch spring compressing tool, Fig. 61, compress spring and in-

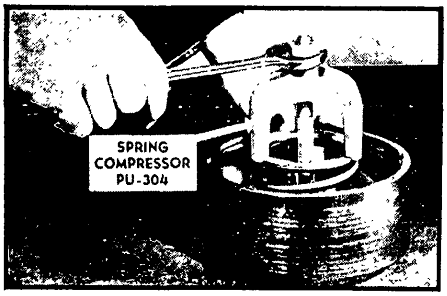


Fig. 61 C mpress high range clutch spring with tool shown

Fig. 62 Installing front sun gear and flange

stall retainer and snap ring. Remove compressing tool.

7. Coat clutch hub thrust washer with clean cup grease and install it in place.
8. Install snap ring on input shaft ahead of clutch hub.
9. Install clutch hub and thrust washer.
10. Install rear snap ring.
11. Install clutch hub and input shaft in low range drum.
12. Install clutch driving and driven plates, installing each alternately, starting with a steel plate.
13. Install front sun gear and flange, Fig. 62.
14. Install retaining snap ring.

FRONT OIL PUMP

Disassemble—

1. Unfasten and remove pump and reactor over-running clutch housing, Fig. 63. *Do not disassemble the latter but see instructions given further on.*
2. Remove pump relief valve and spring.
3. Remove threaded plugs for oil pressure passages.
4. Unfasten pump from reactor clutch housing.
5. Remove pump front cover plate.
6. Remove pump body and rotors and separate parts. Fig.64

Inspection — Inspect rotors for wear, pits or scores. Inspect outer surface of outer rotor and pump body for wear and scores. Replace with new parts if necessary.

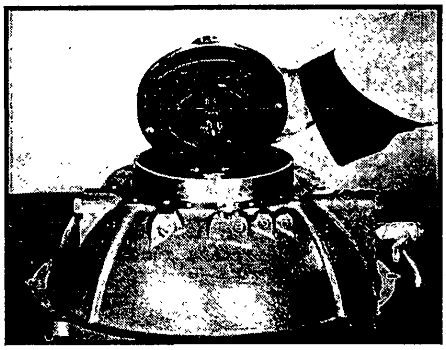


Fig. 63 Removing front oil pump

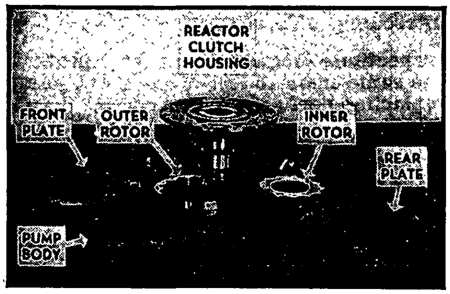


Fig. 64 Layout of front oil pump and reactor clutch

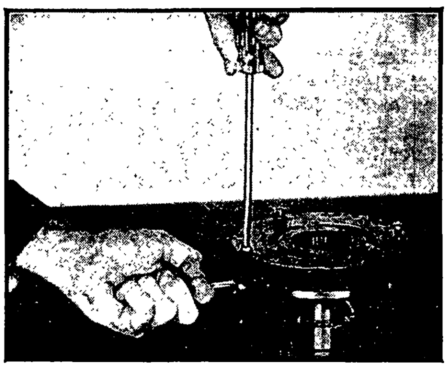


Fig. 66 Install front pump front plate

Assemble — Before assembling pump, see instructions regarding reactor overrunning clutch which follows assembly of front oil pump.

1. Place rear pump plate on reactor clutch housing with journal end of reactor housing down.
2. Place pump body in correct position on rear plate, being sure all oil passages line up.
3. Install outer rotor in body.
4. Install inner rotor with inner groove down, with centering ring in place so rotors mesh at the bottom.
5. Install front pump plate, being sure oil passages line up.
6. Hold plate and body in alignment with two reactor clutch housing capscrews, Fig. 66.
7. Install two pump attaching screws and torque tighten to 7½ to 8½ foot pounds.

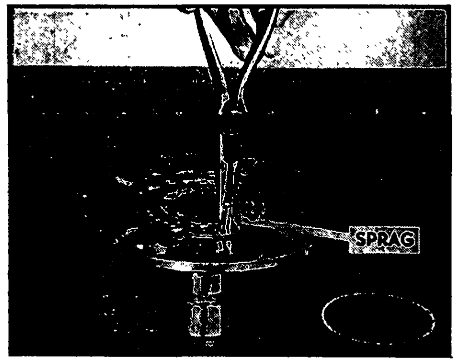


Fig. 67 Removing sprag from reactor clutch housing to inspect parts

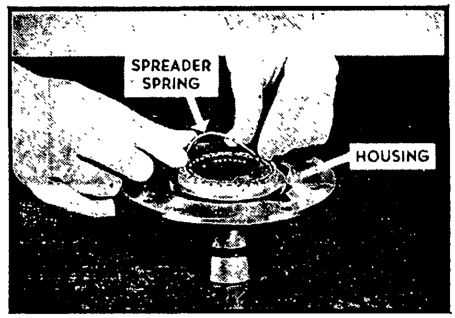


Fig. 68 Installing r act r ver-running clutch int h using

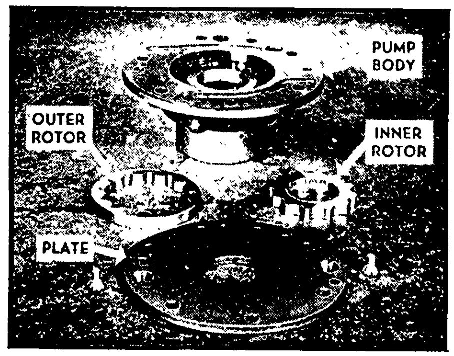


Fig. 69 Layout of rear il pump parts

REACTOR OVER-RUNNING CLUTCH

CAUTION — Do not disassemble this unit. If worn or faulty, replace entire assembly. However, to inspect its condition, slip the circular coil spring from the front end of the sprags. Gently remove one of the sprags with a pair of long-nosed pliers, Fig. 67. Inspect the condition of the sprag and inner and outer races. If they are worn, pitted or brinelled, install a complete new unit. If inspection shows that the unit is OK, gently reinstall the sprag and coil spring.

If the unit should accidentally come apart, it may be assembled in the following manner:

1. Hold inner race with front face toward you.
2. Install sprags so that their curved sides at top are toward left, and curved sides at bottom are to the right.

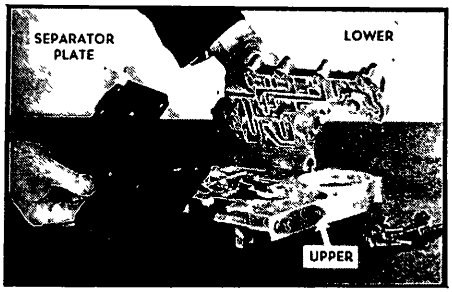


Fig. 70 Separating valve bodies

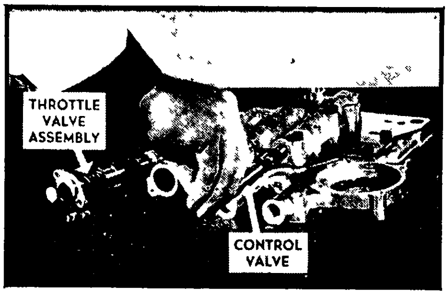


Fig. 71 R moving throttle and c ntrol valves

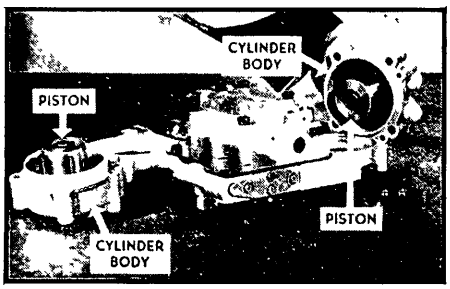


Fig. 72 Rem ving low range and rev rs cylinder bodies and pistons

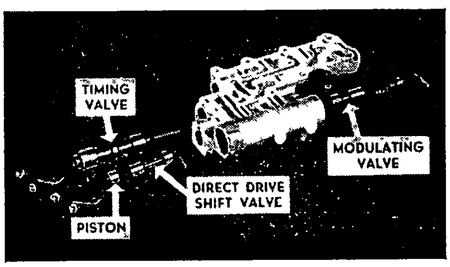


Fig. 73 Lay ut f lower valve body parts

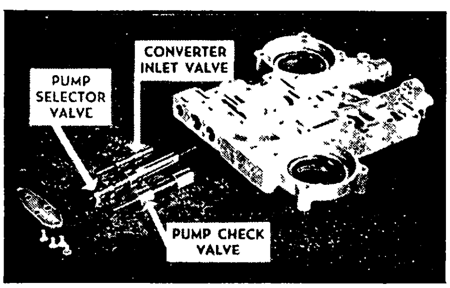


Fig. 74 Lay ut f upper valv b dy parts

3. Hold sprags around inner race with a strong rubber band.

4. Be sure sprags lean counterclockwise at top.

5. Install coil spreader spring at each end, Fig. 68.

6. Carefully install over-running clutch into housing, letting housing slip off rubber band.

7. When clutch is assembled, be sure inner race will rotate clockwise from the front, and will lock up when attempting to rotate it counterclockwise.

REAR OIL PUMP

Disassemble — Remove the cover plate and take the rotors from the body. The rotors of the rear pump are smaller than those of the front pump and are not interchangeable, Fig. 69.

Inspection—Inspect the pump parts in the same manner as for the front pump, replacing parts if necessary.

Assemble—Install outer and inner rotor. Output shaft will automatically line up inner rotor. Install rear plate and tighten two attaching screws securely.

CONTROL VALVE ASSEMBLY

Disassemble—

1. Remove capscrews and separate lower valve body, separator plate and upper valve body, Fig. 70.

2. Remove throttle valve piston spring seat screws.

3. Remove throttle valve, piston, spacer, spring and seat, Fig. 71.

4. Remove control valve and link, using a slight twisting motion, Fig. 71.

5. Remove low range and reverse cylinder bodies and pistons, Fig. 72.

6. Remove plate at rear end of timing valve bore.

7. Remove timing valve and spring, Fig. 73.

8. Remove plate at rear end of direct drive shift valve bore.

9. Remove shift valve piston, Fig. 73.

10. Remove pins at forward end and at center of modulating valve bore and remove modulating valve, guide and direct drive shift valve.

11. Remove plate at forward end of upper valve body and take out pump check valve, pump selector valve and converter inlet valve, Fig. 74.

Inspection—

1. Inspect pistons for wear, nicks, scores or burrs.

2. Inspect ring lands for looseness and burrs.

3. Inspect fast-acting inner pistons and vent valves.

4. Inspect lower valve body and control valve for binding, looseness, wear, scores, gouges or pits. A very close tolerance must be maintained between valve and valve body to prevent loss of oil pressure. However, the control valve must be able to slip in and out of the body by its own weight. If not, install new parts.

5. Measure all bores in valve bodies with plug gauges. Fig. 75. Install new

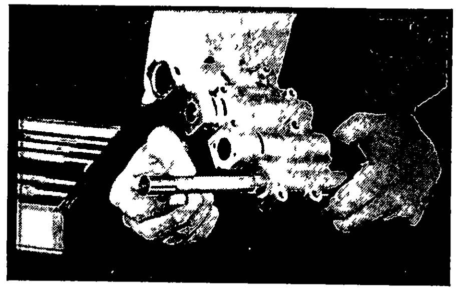


Fig. 75 Measuring bores in valve b dies with gauges PU-324

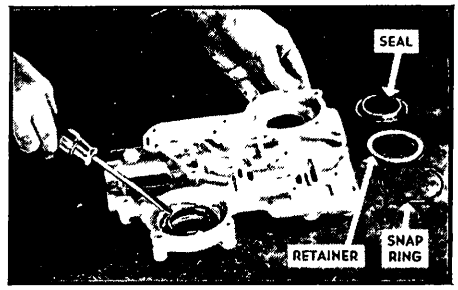


Fig. 76 Installing low range and reverse piston upper seals and r tainers

valve bodies if they do not come up to specifications.

6. Inspect contact surfaces of lower body, separator plate and upper valve body for evidence of oil leaks between passages, which would indicate that the body may be uneven or have low spots. Remove low spots by rubbing valve body on surface plate or plate glass, using No. 400A wet or dry sandpaper soaked in kerosene.

7. Inspect throttle valve and plunger, modulating valve and direct drive clutch valve for freedom of operation, looseness, wear or scores. These valves should always be free enough to move by their own weight through their entire length of travel.

Assemble—Figs. 70 and 74.

1. Install converter inlet valve and spring, pump selector valve and spring, and the pump check valve in forward end of upper valve body.
2. Install retaining plate and screws.
3. Install direct drive clutch shift valve through forward end of bore.
4. Install stop pin at center of bore.
5. Install modulating valve and guide.
6. Install retaining pin.
7. Install direct drive shift valve piston at rear end of bore.
8. Install retaining plate and screws.
9. Install timing valve and spring and retaining plate and spring.
10. Install control valve and link, using a slight twisting motion.
11. Install throttle valve, piston, spacer, spring and seat.
12. Install attaching screws and tighten evenly.
13. Assemble upper and lower valve bodies and separator plate. Be sure correct length screws are installed in their proper positions and torque tighten capscrews 6-7½ foot pounds.

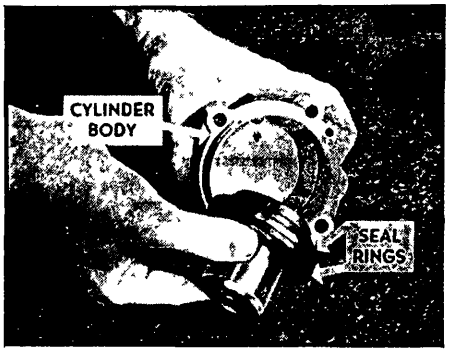


Fig. 77 Installing lower seal rings and pist ns in cylinder bodies

14. Install low range and reverse piston upper seal retaining rings and snap rings in upper valve body, Fig. 76.

15. Assemble fast acting pistons, seats and retainers in low range and reverse pistons.

16. Install seals on pistons.

17. Moisten seals with Ultramatic Drive oil and install pistons in cylinder body, Fig. 77.

18. Assemble pistons and cylinder bodies to control valve upper body. Be sure piston does not damage upper seal.

19. Attach cylinder bodies with round head screws.

HYDRAULIC GOVERNOR

Disassemble & Inspection—

1. Unfasten governor housing from flange and separate.

2. Check governor drive shaft to adapter for end play and side clearance. End play, Fig. 78, should be .010-.018″ while shaft side clearance should be .0005″ to .002″. If not within these limits, disassemble drive shaft as follows:

3. Drive out driving gear pin, press off gear and remove shaft from adapter.

4. Check governor valve for free operation. Push valve into inner limit of its travel. The spring should push it out to its outer limit when released without any drag.

5. Pull vent valve flyweight and valve to its outer limit of travel. The spring should pull the flyweight and valve into its inner limit of travel when released, without any drag.

6. If any sticking or excessive looseness between the valves and housing is noticed, disassemble the valves as follows:

7. Pull vent valve to its outer limit of travel and remove snap ring holding flyweight. Then remove flyweight.

8. Remove snap ring holding valve support in place. Then remove valve support, outlet valve and springs.

9. The governor valve may be removed through the vent valve support opening.

Assemble—Assemble the governor in the reverse order of removal, referring to Fig. 79.

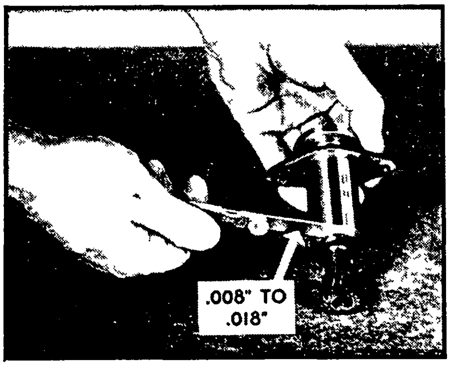


Fig. 78 Measuring governor shaft end play

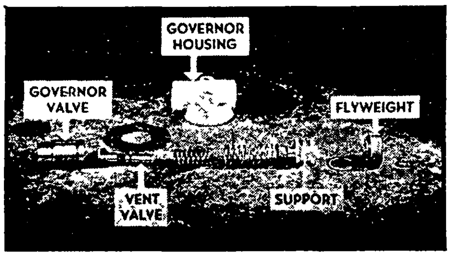


Fig. 79 Layout of governor parts

ASSEMBLING TRANSMISSION

1. Install rear oil pump, being sure oil passages line up. Attach pump with capscrews and torque tighten to 12-15 foot pounds.

2. Coat reverse drum thrust washer with clean cup grease and place in position over rear oil pump body journal.

3. Install reverse band.

4. Install reverse band struts; then install band lever holding fixture (PU-308).

5. Install reverse drum, being sure not to score reverse drum bushing.

6. Install entire planetary unit and output shaft through front end of transmission, being sure it is all the way in against reverse drum thrust washer.

7. Install speedometer driving gear spacer and gear.

8. Install parking gear spacer.

9. Install parking gear and output shaft rear bearing and parking gear snap ring.

10. Install new rear bearing retainer oil seal in retainer.

11. Install retainer and torque tighten capscrews 12-15 foot pounds.

12. Install hydraulic governor, fastening adapter screws to a 7½-8½ foot pound torque.

13. Using a new cover gasket, install governor cover and torque tighten screws 6-7½ foot pounds.

14. Install speedometer drive pinion and retainer.

15. Install low range band.

16. Install rear sun gear front thrust ball bearing, holding it in place with clean cup grease.

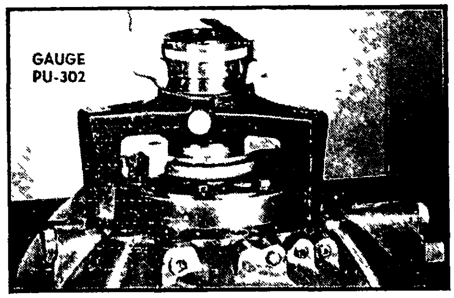


Fig. 80 Using gauge sh wn, measur distance from rear face f bell h using to rear face of reactor clutch h using

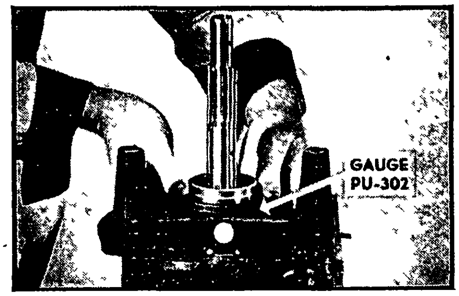


Fig. 81 Using other end f gauge sh wn in Fig. 80, measure distance fr m f rward thrust face of low rang drum t fr nt face of transmissi n cas

17. Install high range clutch unit. Be sure it is all the way back with front sun gear in mesh with planetary pinions and seated against rear sun gear thrust ball bearing.

18. Install low range band struts, and band lever holding fixture, PU-308.

19. Using gauge PU-302, Fig. 80, measure distance from milled rear face of bell housing to milled surface at milled rear face of reactor over-running clutch housing. Lock gauge cylinder in this position.

20. Using other end of gauge PU-302, Fig. 81, measure distance from forward face of low range drum thrust surface to milled front face of transmission case. Observe micrometer reading. This measurement determines the correct thickness of thrust washer. Thrust washers are available in .010″ variation, from .085″ to .135″. Be sure gasket is removed when measurement is taken on bell housing. With correct thrust washer being used, gasket will then provide necessary clearance of .008-.018″. After measurements have been taken and correct thrust washer selected, coat thrust washer with clean cup grease and stick it in place.

21. Using a new gasket, install bell housing, torque tightening capscrews 40-45 foot pounds.

22. Install control valve and attaching capscrews, being sure to install longest screw in position shown in Fig. 82. Tighten capscrews finger tight. Be sure collar of throttle valve slips onto throttle valve operating lever.

23. Remove two oil pump screen at-

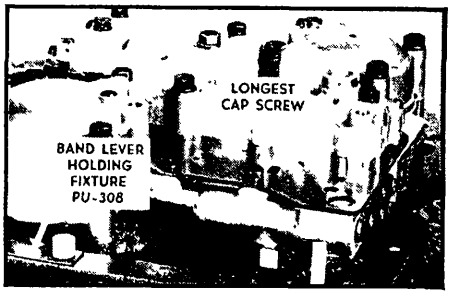


Fig. 82 Installing control valve attaching screws

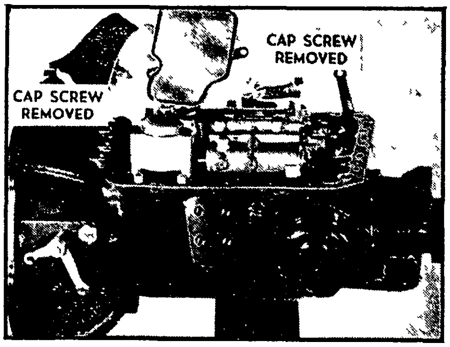


Fig. 83 Installing oil pump screen

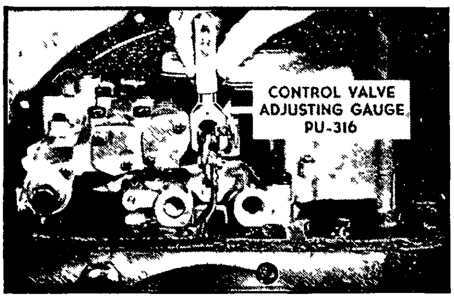


Fig. 84 C ntrol valve adjustment

taching capscrews, Fig. 83. Then torque tighten remaining control valve body and cylinder capscrews to 10-12 foot pounds.

24. Connect control valve link to cross shaft inner lever. Adjust control valve link, Fig. 84, so rear land of control valve extends ¾" from lower valve body. In this position, distance from center of link pin to control valve lower body should be 1.28". Tighten link clamp bolt.

25. Install oil pump screen, Fig. 83, and tighten attaching screws 10-12 foot pounds torque.

26. Remove low range and reverse band lever holding fixture.

27. Using a new gasket, install and tighten oil pan screws 12-15 foot pounds torque.

28. Adjust bands. Tighten to 20 foot pounds, then back off 1¾ turns.

29. Install converter on transmission input shaft and install transmission in car.

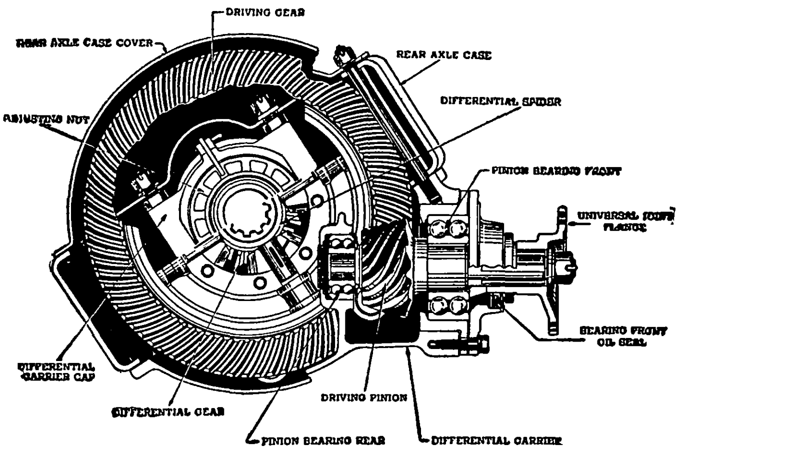


Fig. 86 Rear axle. 1935-38 Super Eights and all V12s

REAR AXLE

REAR AXLE SERVICE

1935-52—The axle designs used are shown in Figs. 85 and 86. In both designs, the threaded nut type of differential bearing adjustment is employed. The procedure for making this adjustment differs somewhat from the conventional due to the pre-load which must be placed on the bearings. How this is done is explained further on.

The assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, may be accomplished according to the instructions given in the *Rear Axle Chapter*.

PINIONS & BEARINGS, REPLACE—Fig. 85. After removing the differential unit from the carrier, unscrew the pinion flange retaining nut and pull off the pinion flange. Press the pinion out of the front bearing and through the rear end of the carrier. The rear bearing cone and bearing spacer will come out with the pinion. The bearings may then be removed and installed with suitable pulling equipment.

Reverse the operations to assemble and, after pressing on the pinion flange, slip on the washer and nut. Tighten the nut until the bearings have a pre-load drag of 30 to 35 pound inches to rotate the pinion shaft.

To adjust the pre-load, draw up the nut until the spacer starts to buckle. Check the scale pull required to rotate the pinion shaft. If the pull is less than 30 pound inches (six pounds on a five-inch lever), tighten the nut further until the drag is secured. Fig. 87 shows a handy scale for checking this adjustment. This adjustment must be made every time the flange nut is removed or loosened. If the adjustment is to be made with the differential unit in the carrier, the rear wheels must be jacked off the floor.

NOTE — The Packard Motor Car Co. makes no provision for servicing Fig. 86 type differential units in the field. When in need of overhauling, checking and replacing of parts the unit may be exchanged for a factory rebuilt one. As a point of information, however, the pinion

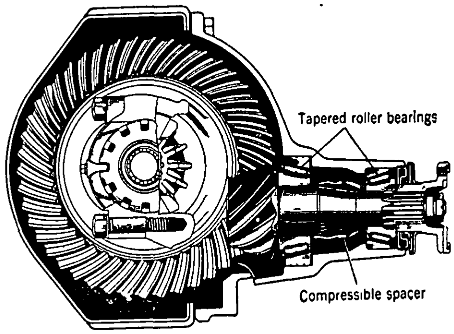


Fig. 85 Rear axle. Typical f all 1935-52 except models using typ , in Fig. 86

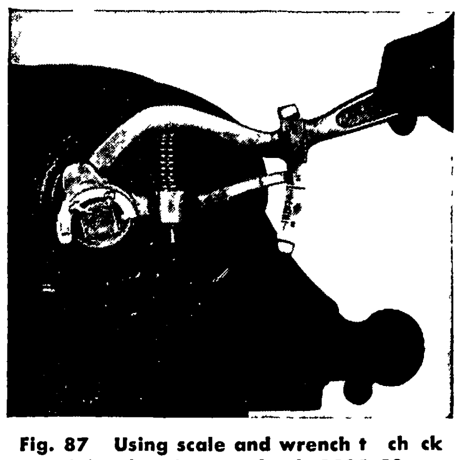


Fig. 87 Using scale and wrench t ch ck pinion bearing pre-l ad, 1935-52

can be moved in toward the center of the axle by removing the required thickness of shims from between the pinion sleeve and the differential carrier. If it is to be moved away from the center of the axle, add shims.

DIFFERENTIAL BEARING PRE-LOAD—In both type axles, the differential side bearings should be pre-loaded from .010 to .012 inch on Fig. 85 axles. On cars using Fig. 86 type axle, the pre-load should be .010 inch on 1935-36 eight-cylinder models and .015 inch on all others. To adjust the pre-load, loosen each bearing cap slightly and then back

Fig. 88 Using calip r to set up differential sid b aring pr -load, 1935-52

off the right adjusting nut until the differential is loose in the bearings. Make sure the left-hand adjusting nut is backed out far enough to provide some backlash between the ring gear and pinion.

Use a large outside caliper, Fig. 88, and a feeler gauge of the thickness to the amount the unit must be pre-loaded. For example, if the bearings should be pre-loaded .010 to .012 inch, spread the bearing support pedestals. Then, with the caliper shown, measure from the finished boss of one bearing cap to the other with a .010 inch feeler blade interposed between one of the bosses and the caliper. Lock the caliper at this setting. Then tighten the right-hand adjusting nut until the caliper, minus the .010 inch feeler, will just slide over both bearing bosses. This will spread the bearing support pedestals and pre-load the bearings.

NOTE—After the proper pre-load has been established, care should be used when adjusting ring gear and pinion backlash to see that the pre-load is not disturbed. By turning each adjusting nut exactly the same amount, backlash may be adjusted without disturbing the previously adjusted spread of the bearing support pedestals.

RING GEAR SUPPORT ROLLER—This roller, Fig. 89, presses against the back face of the ring gear to assist accuracy of meshing. After adjusting ring gear and pinion backlash the roller should be adjusted to provide .005 inch clearance between the roller and ring gear face. To make the adjustment, turn the square end of the roller shaft as required.

AXLE SHAFT, BEARINGS & OIL SEALS

1935-52—Except for 1935-38 Standard and Super 8 and 1935-39 V12, to remove an axle shaft, take off the wheel and pull off the hub and brake drum. Block the brake pedal so it cannot be depressed. Disconnect the brake line from the wheel cylinder. Unfasten the brake

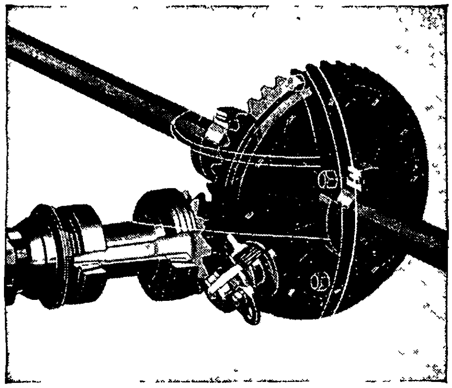


Fig. 89 Ring gear support roller, 1939-52

support and take out the outer oil seal and adjusting shims. (If both shafts are to be removed keep the shims on each side separate to maintain the correct bearing adjustment.) Pull the shaft and bearing and inner oil seal out of the housing.

If the old parts are to be replaced and the shims have not been disturbed, the end play should be correct when the parts have been assembled. However, if a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play. (1935-37 Six and Eights, the axle shaft bearing is the ball type and no adjustment for end play is required.)

Axle shaft end play can be checked when all parts have been replaced except the wheel and hub. To make this check, rap each shaft after the nuts are tight to be sure the bearing cups are seated. Then place a dial indicator so that its stem contacts the end of the axle shaft. Work the shaft in and out by hand and note the reading on the indicator. Then add or remove shims as required to obtain the specified end play.

NOTE—When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain the central position of the differential thrust block.

1935-38 Std. & Super 8; 1935-39 V12—Procedure is practically the same as above except that the inner bearing race must be removed to get at the adjusting shims.

WHEEL ALIGNMENT

CASTER & CAMBER, ADJUST

1935 (Except "120")—Caster up to about two degrees can be adjusted by tapered caster shims between the spring seat and the spring. To increase caster, place the thick side of the shim toward the back of the car and to decrease caster, place the thick side toward the front. When the caster is out more than two degrees the axle should be straightened to change spring seat angle.

The only camber adjustment is bending the axle.

1935-42 (Except Clippers) Knee Action—Camber is adjusted by installing offset bushings in the outer end of the shock absorber arm, Fig. 90. Bushings of 0, $\frac{1}{16}$", ⅛" and $\frac{3}{16}$" offset are available. A change of $\frac{1}{16}$" in offset changes the camber approximately ½ degree. It is important to note the positions of the bushings when making an adjustment because reversing their position will change the camber.

Caster is adjusted by installing or removing tapered shims between the forward end of the torque arm and the wheel support lever, Fig. 90. Shims of ½ and 1 degree are available. If more than 1 degree of shimming is required to correct the caster, look for bent parts.

1941-47 Clippers & All 1948-52—To adjust caster, loosen the clamp bolt at the upper end of the steering knuckle support. Remove the lubrication fitting from the front bushing of the eccentric pin at the outer end of the upper control arms. Insert an Allen wrench through the hole from which the lubrication fitting was removed and turn the threaded eccentric pin until the desired caster angle is obtained. Turn the threaded pin on each side of the car clockwise to increase caster and counter-clockwise to decrease caster. Always turn the pin in multiples of one turn so that the camber will not be disturbed. After completing the adjustment, tighten the knuckle support clamp bolts and install the lubrication fittings.

To adjust camber, insert an Allen wrench as described for making a caster adjustment. The camber angle is controlled by the eccentric action of the threaded pin and a half turn gives the maximum adjustment. Changing the camber will change the caster angle slightly but if the pin is not turned more than a half turn the caster angle will still be within limits.

TOE-IN, ADJUST

1935-36 (Except "120")—Toe-in is adjusted by loosening the clamps at either end of the tie rod and turning the rod as required to produce the correct toe-in.

1937-38 Super 8—Loosen the clamp bolts on both ends of each tie rod and turn both tie rods until the toe-in is correct.

1937-39, V12's—When adjusting toe-in, loosen the clamp on both the rods. Rotate one tie rod at a time half the required amount. Rotating the tie rods in the direction of forward wheel rotation increases toe-in and turning them in the opposite direction decreases the toe-in.

1935-39 Six & Eight; 1939 Super 8; 1940-42 Except Clippers—Fig. 91. To adjust toe-in, loosen the clamps on the ends of both tie rods and turn both rods an equal amount. Both rods must be adjusted the same amount in order to maintain the proper relation between the front wheels and the intermediate steering arm. When making an adjustment be careful not to disturb the position of the steering wheel. The distance between the ball sockets on each rod should be the same length within ½". If the difference is greater than ½", with the wheels in their straight ahead position, a bent steering knuckle arm is indicated. Be sure to tighten the clamps when the adjustment is completed.

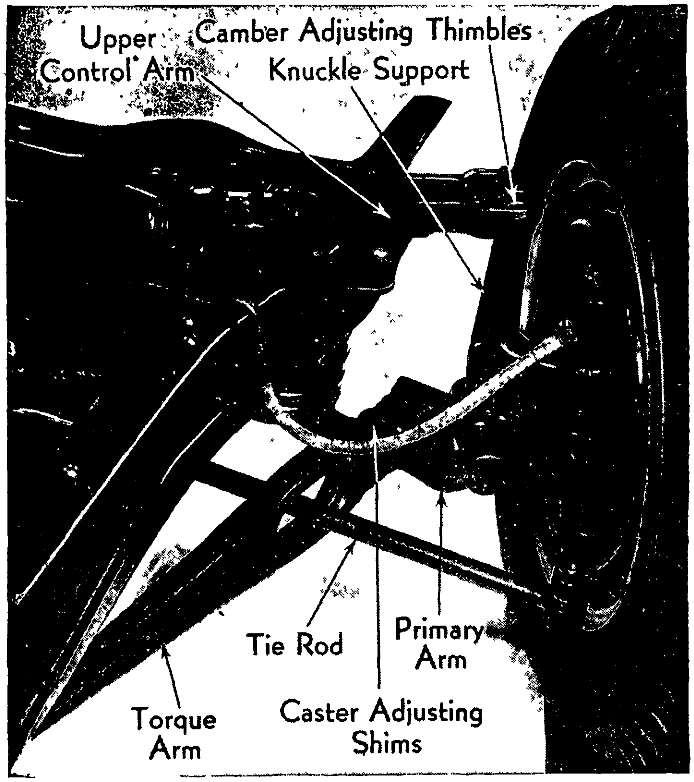


Fig. 90 Camber and caster adjustment, 1935-42 cars with kn e acti n (except Clippers). V12s have shims at base of yok on upper control arm for adjusting camber

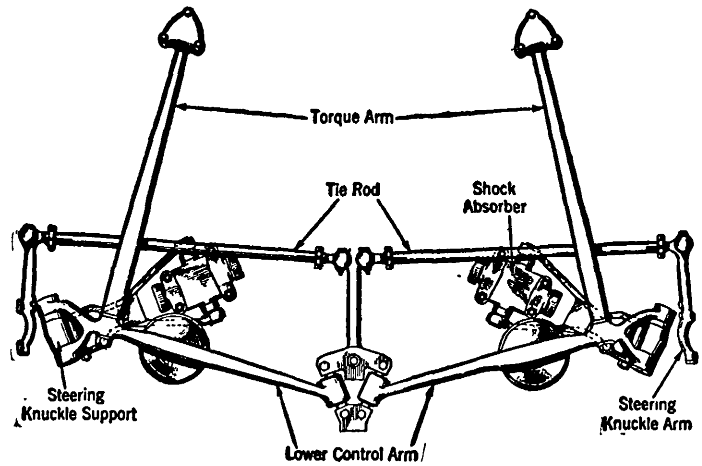


Fig. 91 Steering linkage, 1935-39 Sixes and Eights, 1939 Super Eight, 1940-42 except Clipper models

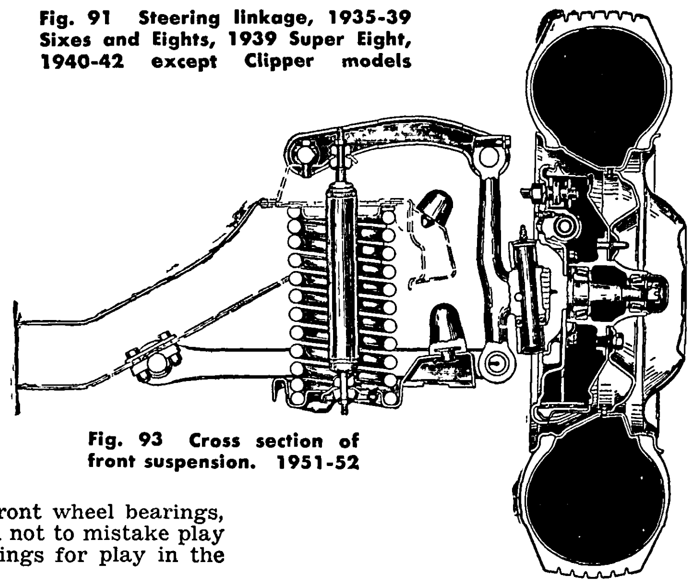


Fig. 93 Cross section of front suspension. 1951-52

1941-47 Clipper & All 1948-52—To adjust the toe-in, loosen the clamps at both ends of the adjustable tubes on each tie rod, Fig. 92. Then turn the tubes an equal number of turns until the toe-in is correct. Turning the tubes in the direction the wheels revolve when the car moves forward decreases the toe-in and vice-versa. Be sure to turn both tubes an equal amount in order to maintain the correct position of the steering wheel. When the adjustment is complete, tighten all clamp screws.

FRONT END SERVICE

1951-52

FRONT WHEEL BEARINGS, ADJUST—Fig. 93. In adjusting the front wheel bearings, first make sure the wheel is all the way on the spindle. Tighten the adjusting nut to 20 ft. lbs. torque to be sure all parts are seated and threads are free. Then back off the nut one castellation to the cotter pin slot.

When adjusting front wheel bearings, care should be taken not to mistake play in the kingpin bushings for play in the wheel bearings.

STEERING KNUCKLE, REMOVE—Fig. 94.

1. Jack up front end of car.
2. Remove front wheel, hub, brake drum and wheel bearings.
3. Remove brake support plate with brake shoes attached. Do not damage hydraulic line which does not have to be removed in this operation.
4. Drive lock pin from steering knuckle support.
5. Remove dust caps at upper and lower knuckle pin holes, and remove steering knuckle and thrust bearing from knuckle support, after removing the kingpin.

KINGPIN BUSHINGS—Use a suitable spacer or length of pipe between the upper and lower knuckle pin holes to prevent the knuckle from being sprung or distorted when the upper needle bearing and lower bushing is driven out.

Clean up the dust plug openings in the top and bottom of the knuckle to free them from burrs. Press the bushing into the lower part of the knuckle. When reaming the bushing, allow .002" for burnishing the bushing to size and expanding it into position.

Press the bearing into the knuckle. This bearing should not be driven into the knuckle by tapping on the bearing shell with a hammer as to do so may cause it to distort and bind the needle bearings.

STEERING KNUCKLE, INSTALL—Assemble the steering knuckle to the knuckle support, using a knuckle pin shim that will give a pull of one to three pounds with a scale attached to the wheel spindle. Shims are available in thickness graduations of .001" and range from .054" to .072".

Before installing a shim between the support and lower end of the knuckle, use a feeler gauge to determine the proper thickness. Lubricate the shim with "Lubriplate" or its equivalent.

Install the knuckle pin, bearing and

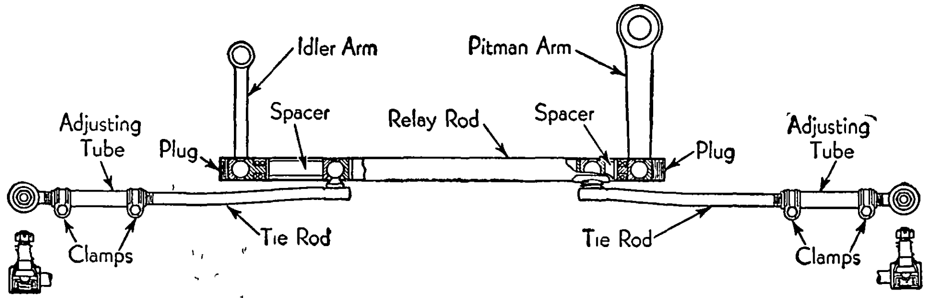


Fig. 92 St ring linkag , 1941-47 Clipp rs and all 1948-52

lock pin. Drive the upper and lower dust caps into place. The cap having the grease fitting hole is installed at the top.

Install the brake support plate and tighten its retaining cap screws to 45-50 lbs. ft. torque.

NOTE—When installing the brake support plate, the retaining screw having the raised head should be installed in the lower rear hole of the plate. This screw acts as a stop, and interchanging it with another will adversely affect the turning radius of the car.

UPPER PIVOT PIN, REMOVAL—

1. Place a jack under lower control arm. Raise chassis and remove wheel assembly.
2. Place a stand jack under the hub of the brake drum or fasten the knuckle support to the upper arm to prevent the support from falling and possibly damaging the brake hose when the pivot pin is removed.
3. Loosen the clamp bolt at the knuckle support.
4. Remove the grease fitting from the front of the upper support arm.
5. Unscrew and remove the inner bushing from the outer upper support arm.
6. Insert an Allen wrench into the opening and unscrew the pivot pin and rubber seal to complete the disassembly.
7. The inner bushing at the rear of the upper support arm may be removed if necessary by unscrewing the threaded bushing.

UPPER PIVOT PIN, INSTALL—

1. Screw the eccentric pivot pin into the knuckle support.
2. Centralize the eccentric in the support.
3. Tighten the clamp bolt to a torque of 25-30 lbs. ft.
4. Slip rubber seals over each end of the eccentric upper pivot pin.
5. Insert the rubber seals through the opening in the upper support arm and over the ends of the pin.
6. Lubricate and thread the inner bushing into the rear face of the upper support arm and onto the eccentric pin.
7. Lubricate and thread the inner bushing into the front face of the upper support arm.
8. Tighten the front and rear bushings to a torque of 90-100 lbs. ft.
9. Check and adjust caster and camber as outlined previously.

UPPER SUPPORT ARM, REMOVE—

1. Disassemble the upper pivot pin as outlined previously.
2. Remove the two attaching bolts from the upper support arm bracket.

UPPER SUPPORT ARM, INSTALL—

1. If the upper support arm has been completely disassembled, insert the bracket into the support arm with the spherical segment (or pimple) toward the wheel.
2. Use support arm spreader tool J-3957 to maintain 8$\frac{1}{16}$" distance between the outer faces of the support arm.
3. Locate the bracket centrally in the support arm.
4. Lubricate the bushings and insert them at each end of the bracket and

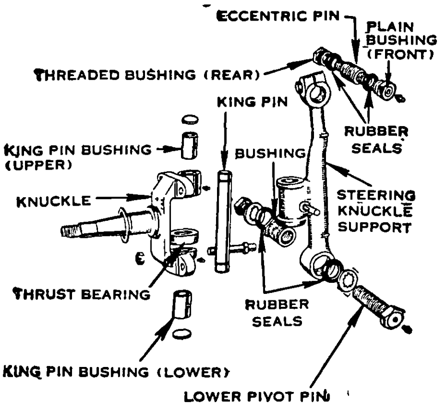


Fig. 94 Upper and lower pivot pin details, 1941-52

torque tighten them to 90-95 lbs. ft.

5. Attach the support arm to the frame cross member.
6. Install attaching screws and torque tighten them to 65-75 lbs. ft.
7. Install upper pivot pin as outlined previously.

LOWER PIVOT PIN, REMOVE—

1. Place jack under support arm as near as possible to outer end of arm.
2. Raise car until wheel is off floor.
3. Remove wheel.
4. Remove pivot pin nut and washer.
5. Screw pivot pin from support arm and bushing.
6. To remove lower pivot pin bushing from knuckle support, place a stand jack under frame side behind suspension unit.
7. Lower jack under support arm until there is sufficient room to use a wrench for removing pivot pin bushing.

LOWER PIVOT PIN, INSTALL—

1. Lubricate bushing and install it and rubber seals in knuckle support.
2. Tighten bushing to 145-155 lbs. ft. torque.
3. Raise lower support arm with jack until holes in outer end of lower support arm are in line with hole in knuckle support.
4. Screw pivot pin through support arm and bushing.
5. Tighten pivot pin to 145-155 lbs. ft. torque.
6. Add washer and nut to opposite end of pivot pin and tighten nut to 85-95 lbs. ft. torque.

LOWER SUPPORT ARM & SPRING, REMOVE—

1. Raise front end of car and place stand jack under frame to rear of suspension cross member.
2. Remove stabilizer-to-frame horn attaching nuts.
3. Disconnect stabilizer end from lower support arm.
4. Remove front shock absorber.
5. Remove front wheel.
6. Place jack under outer end of lower support arm and raise just enough to relieve pressure on lower support arm pivot pin.
7. Remove nut and unscrew pivot pin.
8. Lower jack slowly to allow support arm to go down.
9. Remove coil spring.

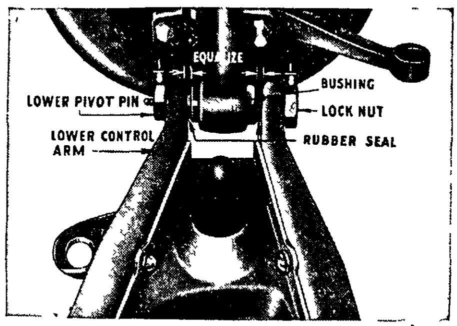


Fig. 95 Lower pivot assembly details, 1941-52

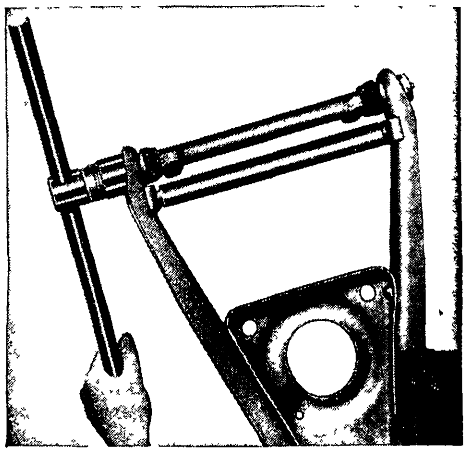


Fig. 96 Using spreader to l t prev nt lower control arms from m ving inward while installing bushings, 1941-52

10. To remove support arm from chassis after spring removal, unfasten it from frame cross member.
11. The lower support arm may be further disassembled by unscrewing the threaded bushings holding the pivot bracket in the support arm.

LOWER SUPPORT ARM & SPRING, INSTALL—

1. Insert support arm spreader tool J-1052 between inner faces of support arm and expand until it reaches a distance of 11½" plus or minus $\frac{3}{64}$" (see Fig. 96). The tool prevents either face of the arm from being pushed inward, maintaining the proper spread as the bushings are being tightened.
2. To assemble, slide rubber seals over each end of support bracket and center bracket between inner faces of support arm.
3. Lubricate bushings and start them on both ends of bracket.
4. Thread bushings into lower support arm until bushing shoulders contact machined surfaces of lower support arm.
5. Tighten bushings evenly to a torque of 145-155 lbs. ft.
6. Check pivot bracket for free movement.
7. Centralize bracket by turning it until center of bolt holes are 1½" from inner face of support arm on each side. Then remove support arm spreader.

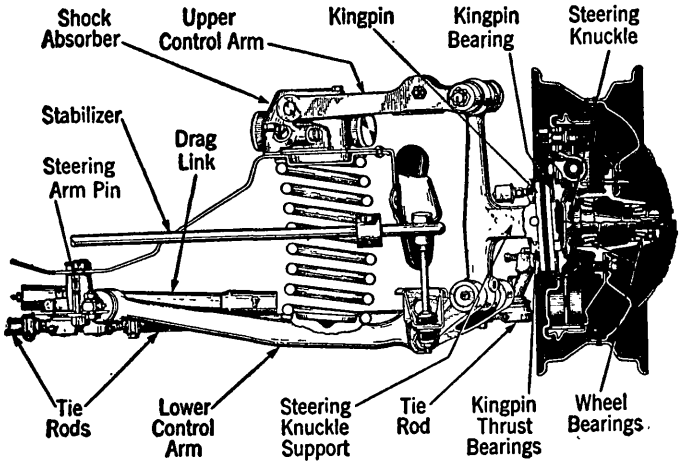


Fig. 97 Front suspension, 1935-42 except Clipper models

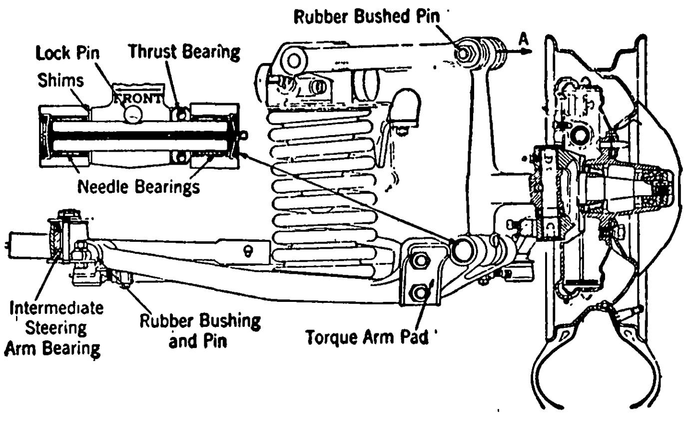


Fig. 98 Front suspension, 1935-42 except Clipper m d ls. Showing detail of lower control arm piv t pin

8. Position support arm on bottom of frame cross member.
9. Insert support bracket bolts from top of frame and add nuts, tightening them to a torque of 55-60 lbs. ft.
10. Position spring in lower support arm with flattened end up.
11. Place a jack under lower support arm near outer end.
12. Raise jack until holes in outer end of support arm are in line with holes in knuckle support lower bushing.
13. Centralize knuckle support in support arm. And as shown in Fig. 95, there should be approximately ⅛″ clearance at points indicated.
14. Install lower pivot pin and torque tighten it to 85-95 lbs. ft.
15. Position end of stabilizer rod in lower support arm.
16. Insert ears of stabilizer attaching clip in holes of support arm and spring clip over bottom edge with tool J-4654.
17. Install shock absorber through bottom opening with extension extending out through top of cross member.
18. Slip rubber grommet and washer over top end of shock absorber and screw on nut.
19. Tighten shock absorber retainer nut to a torque of 12-18 lbs. ft.
20. Install wheel and lower car to floor.

FRONT END SERVICE 1941-47 Clippers & All 1948-50

Except for the upper control arm, which is the shock absorber on these models, service procedure on this type suspension is similar to that described for 1951 models.

FRONT END SERVICE

1935-42 KNEE ACTION (Except Clippers) — On 1937-39 Twelves, the lower control arm outer bearing consists of a tapered roller front bearing, 33 individual needle rollers and a ball thrust bearing. The thrust bearing should be preloaded to a pull of 5 to 6 pounds as measured with a spring scale attached to the knuckle support upper eye with the kingpin and upper eye bolt removed.

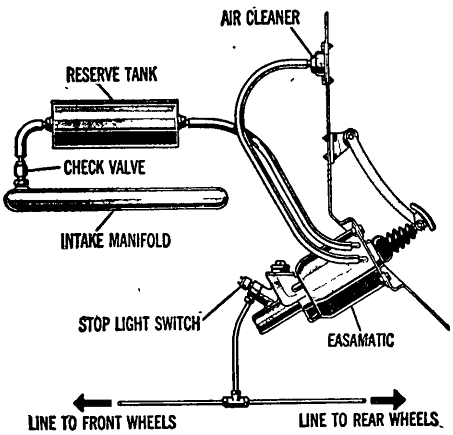


Fig. 99 Easamatic power brake connections. 1952

Adjust the pre-load by means of the hexagon nut and lock nut. Whenever the stamped bearing cap is removed, replace with a new one, Figs. 97 and 98.

On all other models, the thrust bearing should be pre-loaded to a pull of 3 to 8 pounds for 1937 and earlier models. For 1938 to 1942 models, the pre-load should be from 1 to 6 pounds. To preload the bearing, attach a spring scale to the top of the knuckle support upper eye after removing the kingpin and upper eye bolt. If the measurement does not come within these limits, add or remove shims which are available in thickness steps of .001″.

The individual needle bearings which were used on models prior to 1939 can be replaced with the caged type and when this is done, it is necessary to remove the bushings from the lower support arm.

On 1940-42, whenever the lower control arm outer pin or either of the needle bearings is removed, one of the needle bearings *MUST be RENEWED.* This is because the construction is the closed-end design, which involves knocking off one of the grease fittings, which is pressed into the end wall of each bearing, before a drift can be used to remove the pin.

STEERING GEAR

1935-52—To remove the gear without removing the toe boards, proceed as follows: Remove the horn button, unscrew the steering wheel nut and pull off the wheel. Disconnect the horn wire at the lower end of the steering column. On cars so equipped, disconnect the gearshift control rods from the steering gear. Unfasten the steering column from the instrument panel. Use a puller to remove the pitman arm from the gear. Remove the bolts which fasten the steering gear to the frame, and, after taking off the engine splash pan, slide the gear down and out of the chassis.

EASAMATIC POWER BRAKE

1952—This device, Fig. 99, is a combined vacuum and hydraulic unit for power braking, utilizing engine intake manifold vacuum and atmospheric pressure for its operation. It is a self-contained unit having no external rods or levers exposed to dirt and moisture.

The system provides a reduced pedal or treadle travel compared to the conventional braking system. The reduced pedal travel brings the height of the pedal down to approximately that of the accelerator pedal, permitting the driver to shift his toe from one pedal to the other without lifting his heel from the floor. Slightly lighter pedal pressures are also obtained.

Construction of the device is such that, in case of engine failure and consequent loss of vacuum, the brakes will function satisfactorily although with greater driver effort required.

CONSTRUCTION OF POWER BRAKE

The device consists of three operating units built into one assembly, namely, vacuum power cylinder, control valve assembly, and power brake hydraulic section, Fig. 100. The latter section includes a brake fluid reservoir, thus eliminating the need for a conventional master cylinder in the system.

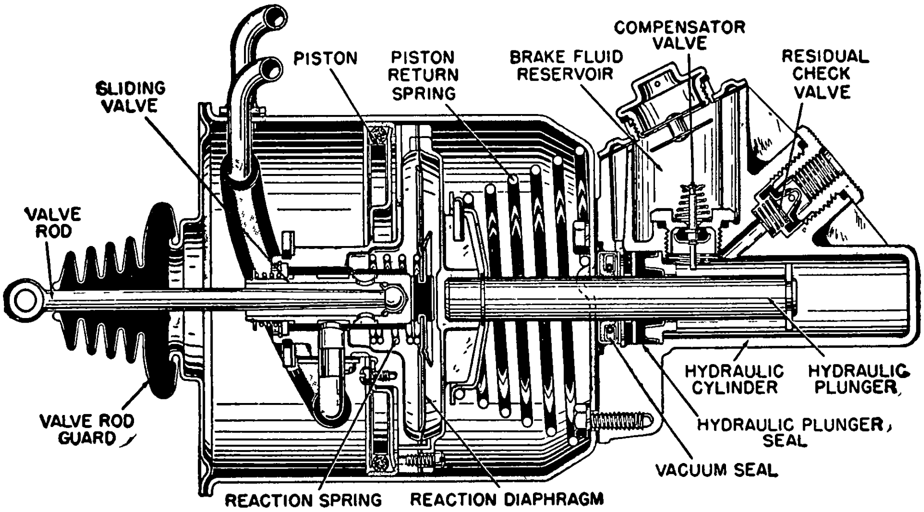


Fig. 100 Cross section of Easamatic power brake. 1952

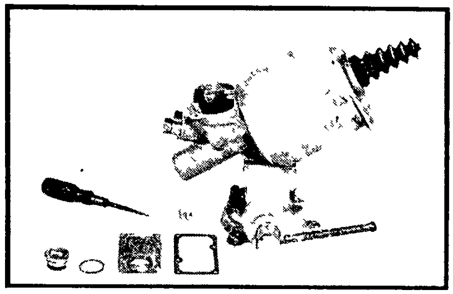


Fig. 101 Fluid res rv ir cover removed

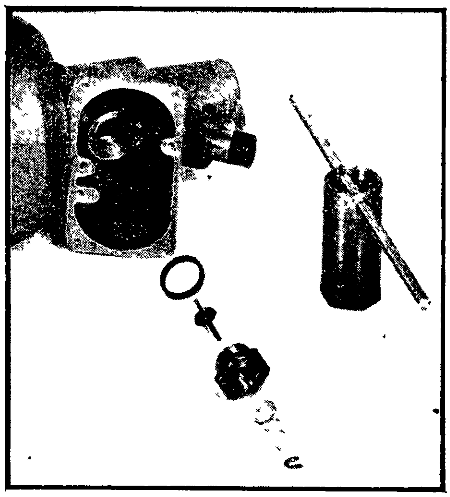


Fig. 102 Compensator port c mp nents

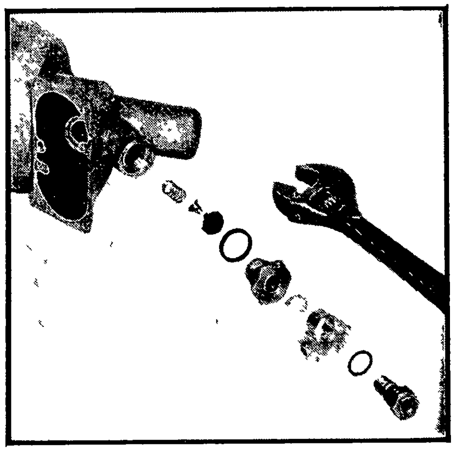


Fig. 103 Residual check valve

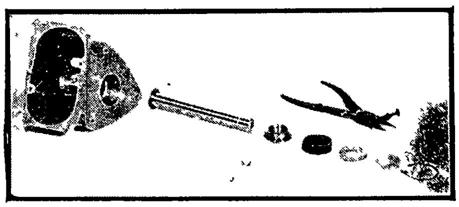


Fig. 104 Sliding valve c mponents

VACUUM CYLINDER—The vacuum power cylinder contains a piston assembly and piston return spring. When the brakes are in the released position, atmosphere is impressed on both sides of the piston in the cylinder and the return spring holds the piston in the off position.

CONTROL VALVE—The control valve assembly contains a sliding valve, reaction diaphragm assembly, a sliding valve (and pedal) return spring, and a diaphragm spring. The control valve assembly is actually integral with the power cylinder piston and moves as the piston moves during operation of the unit.

HYDRAULIC SECTION—The power brake hydraulic section contains a hydraulic cylinder, hydraulic plunger, a rubber seal which prevents the brake fluid from leaking into the vacuum power cylinder, a spring-loaded leather seal to act as an oil wiper and vacuum seal between the hydraulic cylinder and vacuum power cylinder, a brake fluid reservoir, a compensating port and valve, and a residual check valve.

TESTING THE SYSTEM

1. Road test brakes by making a quick application at about 20 mph to determine if vehicle stops evenly and quickly. If pedal has a spongy feel when applying the brakes, air is present in the hydraulic system. Bleed system as described further on.
2. With engine stopped, hand brake applied and transmission in neutral, apply brake several times to destroy all vacuum in the system. Depress brake pedal, hold foot pressure on pedal and start engine. If vacuum system is operating, pedal will tend to fall away under foot pressure, and less pressure will be required to hold pedal in applied position. If no action is felt, vacuum system is not functioning.
3. Stop engine and again destroy all vacuum in system. Depress brake pedal and hold foot pressure on pedal. If pedal gradually falls away under foot pressure, hydraulic system is leaking.
4. If pedal travels to within one inch of toe board, brake shoes require readjustment or relining.

BLEEDING SYSTEM

Bleeding the brake system may be done manually or with a pressure bleeder in the conventional manner as outlined in the *Brake* chapter of this manual. However, the following procedure may be followed:

1. Clean dirt from around hydraulic reservoir filler cap before removing cap.
2. Fill reservoir and keep it filled during bleeding operation.
3. Remove screw from bleeder valve (on wheel cylinder farthest from reservoir) and screw bleeder hose into bleeder valve, placing other end of hose in a container having sufficient fluid to cover end of hose.
4. Open bleeder valve ¾ turn and watch flow of fluid at end of bleeder hose while depressing brake pedal slowly. Close bleeder valve and allow pedal to return slowly to the released position. This operation should be repeated several times.
5. When air bubbles cease to appear, depress brake pedal and close bleeder valve.
6. Repeat the above procedure at the remaining wheel cylinders, bleeding the shortest line last.
7. After bleeding the system, fill the fluid reservoir to within ½" of the filler cap opening and replace the cap. Fluid withdrawn from the system should not be used again.

LUBRICATION

The vacuum cylinder piston packing is lubricated at the time of original assembly and needs no further lubrication. *Do not lubricate the sliding valve.*

SERVICE PROCEDURE

Repair work that may be performed without removing the device from the vehicle includes: (1) Cleaning sliding valve, (2) replacing sliding valve assem-

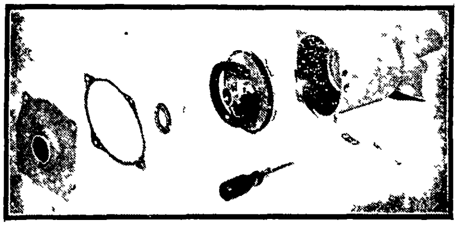


Fig 105 Cylinder end plate and piston parts

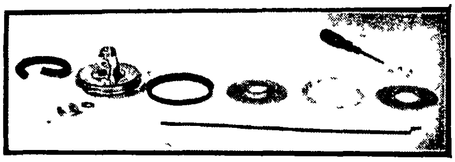


Fig. 106 Piston packing components

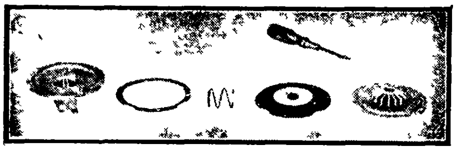


Fig. 107 Reaction diaphragm parts

bly or valve rod guard, (3) checking or replacement of compensator valve and residual check valve.

More extensive repairs may be performed with partial disassembly of the unit in its installed position by removing the toe board panel. These include: (1) Replacement of vacuum hose, (2) reaction diaphragm, (3) counter-reaction spring, (4) piston return spring.

REMOVAL FROM CAR—When extensive repairs are required on the unit, it is advisable to remove it from the car as follows: Disconnect vacuum, atmosphere and hydraulic lines, and stop light switch wires. Remove clevis pin connecting pedal to valve rod. Remove toe board mounting screws and lift toe board plate and power brake from car as a unit. Unfasten power brake unit from toe board plate.

DISASSEMBLY—Figs. 101 to 109 show the various components of the power brake disassembled. In disassembling the unit, scratch alignment marks between cylinder shell and shell end plate,

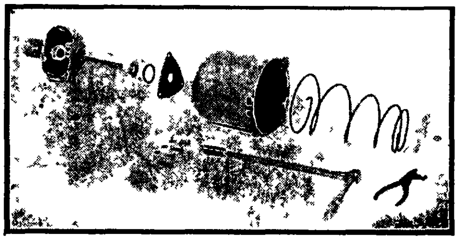


Fig. 108 Return spring and cylinder shell

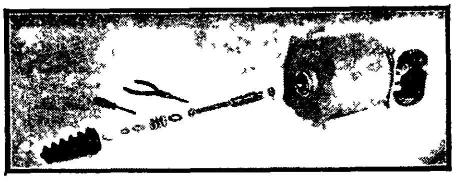


Fig. 109 Hydraulic plunger and seals

between cylinder shell and hydraulic cylinder casting, between reservoir cover and hydraulic cplinder casting, between tube fitting, output fitting and hydraulic cylinder casting, and between front and rear piston plates.

Thoroughly wash all parts in alcohol and wipe dry. Blow dirt and cleaning fluid out of internal passages. If inside of vacuum cylinder is corroded or rusted, clean with fine emery cloth.

It is important that the cleaned parts be placed on clean paper or cloth prior to assembly to prevent the possibility of dirt being assembled into the system.

It is recommended that all parts contained in the Easamatic Repair Kit be used when assembling the unit. These parts include perishable parts such as gaskets and rubber seals as well as parts that probably cannot be used again due to distortion, such as snap rings.

INSPECTION—In addition to the parts contained in the repair kit mentioned above, the following items should be inspected as directed and replaced as necessary:

Cylinder Shell—Inspect shell for scoring, pitting, dents, nicked edges or damaged threads.

Hydraulic Cylinder & Reservoir Casting—Examine bore down one inch from open end. Surface must be satisfactory (free from scores, deep scratches, or corrosion) for sealing with rubber hydraulic seal. Gasket surfaces at reservoir cover, compensator port and hydraulic output fitting must be free of scoring, pitting, dents and nicked edges. Check for cracks or damaged threads.

Hydraulic Output Fitting—Surface on face of small end must be satisfactory (as described above) for sealing with residual check valve rubber cup.

Compensator Port Fitting—Surface on face at end of bore inside threads must be satisfactory for sealing with rubber poppet on compensator valve stem.

Vacuum Inlet Tube—Make sure the braze is secure and the tube and mounting plate are not distorted.

Rear Piston Plate & Tube—Examine plate for cracks or damaged threads. Sleeve must be securely pressed into piston plate. Replace assembly if bore of sleeve has scores, deep scratches or corrosion. **Caution** — Do not refinish sleeve bore as excessive clearance between sleeve and sliding valve will cause serious vacuum leakage.

Hydraulic Plunger & Washer—Inspect plunger for scoring, pits or dents. **Caution**—Do not attempt to refinish plunger as an undersize plunger may cause serious hydraulic leakage.

Sliding Valve & Valve Rod—Rod must pivot freely in valve but without noticeable end play. Inspect valve for scoring, pitting or dents on outside diameter. **Caution**—Do not refinish outside diameter of valve as excessive clearance between valve and sleeve bore will cause serious vacuum leakage.

Shell End Plate—Examine plate for cracks or distortion.

REASSEMBLY—Follow the sequence of assembly according to the parts layouts shown in Figs. 101 to 109, being sure to match the alignment marks made on the various components during disassembly.

Before installing the piston, apply a thin film of vacuum cylinder oil to the inside wall of the cylinder shell. Insert the piston assembly into the shell, holding the vacuum hose against the piston so that about ¼" clearance between hose and cylinder shell is allowed. Align open end of hose with center of elongated hole in cylinder shell. Push piston into shell and into engagement with hydraulic plunger and piston return spring.

PLYMOUTH

Specifications are tabulated on the pages immediately following this index. For service procedure, see the Chrysler chapter, using the index below to find the job with which you are interested

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Six	PJ	113	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
	De Luxe 6	PJ	113	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
1936	Six	P1	113	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
	De Luxe 6	P2	113	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
1937	Six	P3	112	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
	De Luxe 6	P4	112	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600		45 @ 30
1938	Road King 6	P5	112	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600	145 @ 1200	40 @ 20
	De Luxe 6	P6	112	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600	145 @ 1200	40 @ 20
1939	Road King 6	P7	114	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600	148 @ 1200	45 @ 30
	De Luxe 6	P8	114	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	82 @ 3600	148 @ 1200	45 @ 30
1940	Road King 6	P9	117	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	84 @ 3600	154 @ 1200	45 @ 30
	De Luxe 6	P10	117	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	84 @ 3600	154 @ 1200	45 @ 30
1941	Six and De Luxe 6	P11	117	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	87 @ 3800	160 @ 1200	45 @ 30
	Special De Luxe 6	P12	117	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	201.3	6.70	87 @ 3800	160 @ 1200	45 @ 30
1942	De Luxe 6	P14S	117	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.80	95 @ 3400	172 @ 1200	45 @ 30
	Special De Luxe 6	P14C	117	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.80	95 @ 3400	172 @ 1200	45 @ 30
1946–48	De Luxe 6	P15S	117	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.60	95 @ 3600	172 @ 1200	40 @ 20
	Special De Luxe 6	P15C	117	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.60	95 @ 3600	172 @ 1200	40 @ 20
1949	De Luxe 6	P17	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	De Luxe 6	P18	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217 8	7.00	97 @ 3610	175 @ 1200	45 @ 45
	Special De Luxe 6	P18	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
1950	De Luxe 6	P19	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	De Luxe 6	P20	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Special De Luxe 6	P20	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
1951	Concord 6	P22	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Suburban 6	P22	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Savoy 6	P22	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Cambridge 6	P23	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Cranbrook 6	P23	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
1952	Concord 6	P22	111	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Cambridge 6	P23	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45
	Cranbrook 6	P23	$118\frac{1}{2}$	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	7.00	97 @ 3600	175 @ 1200	45 @ 45

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note A	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935–38	All	AL-A7B	.025	.020	35–38	153624	C	Positive	475		65–70
1939–42	All	AL-A7B	.025	.020	35–38	153624	B	Positive	475		65–70
1946–48	All	AL-A5	.025	.020	35–38	153624	B	Positive	475		65–70
1949	All	AL-AR5	.035	.020	35–38	153624	B	Positive	475		65–70
1950–52	All	AL-AR8	.035	.020	35–38	153624	B	Positive	475		65–70

A—Plus or minus .002".
B—"DC" or "O" mark on vibration damper.
C—Fourth line after "DC" or "O" mark on crankshaft pulley.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935–40	All	.006H	.008H	.011	45	B	8	34@1¾	.001–.003	.002–.004	.3405	.3405
1941–52	All	.010H	.010H	.014	45	12	6	40@1¾	.001–.003	.002–.004	.3405	.3405

A—BTDC means before top dead center; ATDC means after top dead center.
B—Six degrees after top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935–36	All	Above	.0015	10 to 15	.007	.007	.002–.004	.002–.003	C	D
1937–41	All	Above	.002	6 to 9	.007	.007	.002–.004	.001–.0025	C	D
1942	All	Above	.0015	10 to 15	.007	.007	.002–.004	.001–.0025	C	D
1946–52	All	Above	B	B	.007	.007	.002–.004	.001–.0025	C	D

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Piston fitted properly when it has a slight drag in the bore, yet free enough to fall slowly through of its own weight with parts clean and dry.
C—Floating type. Pins retained by snap rings in piston bosses.
D—Thumb push fit in piston and rod but with piston heated.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1935-41	All	.002–.006	.001–.003	1.9365–1.9375	.001–.002	.006–.011	45–50	2.249–2.250	.001–.002	.003–.007	75–80
1942	P14	.002–.006	.001–.003	2.0615–2.0625	.001–.002	.006–.011	45–50	2.499–2.500	.001–.002	.003–.007	75–80
1946-48	P15	.002–.006	.001–.003	2.0615–2.0625	.001–.0015	.006–.011	45–50	2.499–2.500	.001–.0015	.003–.007	75–80
1949-52	All	.002–.006	.001–.003	2.0615–2.0625	.0005–.0015	.006–.011	45–50	2.499–2.500	.0005–.0015	.003–.007	75–80

A—Thrust taken by rear bearing.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil: Above +32°F.	Grade of Oil: Above +10°F.	Grade of Oil: Above −10°F.	Capacity, Pounds or Pints	Grade of Oil: Summer	Grade of Oil: Winter	Capacity, Pounds or Pints	Grade of Oil: Summer	Grade of Oil: Winter
1935–36	All	15	15	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	140	90
1937	P3, P4	15	16	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	90H	90H
1938	P5, P6	14	16	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	90H	90H
1939	P7, P8	14	18	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	90H	90H
1940–41	P9, P10	14	17	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	90H	90H
1942–48	All	15	17	5	20	20W	10W	$2\frac{3}{4}$	90	90	$3\frac{1}{4}$	90H	90H
1949–50	All	15	17	5	30	20W	10W	$2\frac{3}{4}$	80①	80①	$3\frac{1}{4}$	90H	90H
1951–52	All	13	17	5	30	20W	10W	$2\frac{3}{4}$	80①	80①	$3\frac{1}{4}$	90H	90H

H—Hypoid gear lubricant. ① 10W engine oil may be used under conditions of extreme cold.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-36	All	.006–.008	Shims	Shims	.003–.008
1937-52	All	.006–.010	Shims	Shims	.003–.008

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	All	+2	+ $\frac{1}{2}$	$\frac{1}{16}$	$9\frac{1}{2}$
1936	All	+2	+ $\frac{3}{8}$	$\frac{1}{16}$	$9\frac{1}{2}$
1937–38	All	+2	+ $\frac{3}{8}$	$\frac{1}{16}$	5
1939	All	Zero	+ $\frac{3}{8}$	$\frac{1}{16}$	$5\frac{7}{8}$
1940–41	All	Zero	+ $\frac{3}{8}$	$\frac{1}{16}$	$5\frac{3}{8}$
1942–50	All	Zero	+ $\frac{3}{8}$	$\frac{1}{32}$	$5\frac{3}{8}$
1951–52	All	Zero	Zero	Zero	$5\frac{3}{8}$

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches			Brake Pedal Free Play, Inches
			Length	Width	Thickness	
1935-37	All	Molded	$19\frac{11}{16}$	2	$\frac{3}{16}$	$\frac{3}{8}$
1938-42	All	Molded	18	2	$\frac{3}{16}$	$\frac{3}{8}$
1946-52	All	Molded	(A)21 (B)$18\frac{1}{2}$	2	$\frac{3}{16}$	$\frac{3}{8}$

A—Front wheel.
B—Rear wheel.

FIRST SERIAL NUMBER

LOCATION—1935-42: On right front door pillar. 1946-52: On left front door pillar.

Year	Model	Serial Number
1935	PJ Six	2397601(1) 3910401(2)
	PJ De Luxe	1039101(1) 3910401(2) 3151501(2)
1936	P1	1111701(1) 3157151(2) 9000101(3)
	P2	2641401(1) 3040601(2) 9025101(3)
1937	P3	1184001(1) 3101401(2) 9025101(3)
1937	P3	1184001(1) 3101401(2) 9085551(2)
	P4	10101001(1) 3162501(2) 9950001(3)
1938	P5	1240001(1) 3105301(2) 9097601(3)
	P6	10470001(1) 3206001(2) 20001001(3)
1939	P7	1298001(1) 3110001(2) 9150401(3)
	P8	10630001(1) 3222001(2) 20027001(3)
1940	P9	1378001(1) 3114801(2) 9062201(3)
	P10	10883001(1) 3242501(2) 20063001(3)
1941	P11	15000101(1) 3121501(2) 22001001(2)
1941	P12	11123001(1) 3269301(2) 20105101(3)
1942	P14S	15135501(1) 3134501(2) 22037001(3)
	P14C	11399501(1) 3297001(2) 20148001(3)
1946	P15S	15154001(1) 22042001(3) 26000001(2)
	P15C	11496001(1) 20165001(3) 25000001(2)
1947	P15S	15206936(1) 22053040(3) 26003589(2)
	P15C	11643104(1) 20185186(3) 25009753(2)
1948	P15S	15252279(1) 22063370(3) 26010840(2)
	P15C	11854386(1) 20233168(3) 25035586(2)
1949	P17	18000101(1) 26000101(2) 24000101(3) 28500101(4)
	P18 De Luxe	15300001(1) 26025001(2) 22080001(3) 26500101(4)
	P18 Special De Luxe	12120001(1) 25075001(2) 20304001(3) 26500101(4)
	P 18 Special De Luxe	12120001(1)
1949	P18 Special De Luxe	25075001(2) 20304001(3) 25500101(4)
1950	P19	18041001(1) 28004001(2) 24012001(3) 28503501(4)
	P20 De Luxe	15359501(1) 26030501(2) 22097001(3) 26504001(4)
	P20 Special De Luxe	12384501(1) 25097501(2) 20367001(3) 25511001(4)
1951	P22	18126001(1) 28011001(2) 24042001(3) 28513001(4)
	P23 Cambridge	15460001(1) 26040001(2) 22132001(3) 26512001(4)
	P23 Cranbrook	12635001(1) 25112001(2) 20435001(3) 25531001(4)
1952	P22	18192501(1) 28519101(4) 28015701(2) 24056701(3)
	P23C	12906701(1) 25546101(4) 25125301(2) 28485001(3)
	P23S	15577801(1) 26518201(4) 26045701(2) 22159601(3)

(1)—Detroit, Mich. (2)—Los Angeles, Cal. (3)—Evansville, Ind. (4)—San Leandro, Cal.

FIRST ENGINE NUMBER

LOCATION—On left front side of cylinder block.

Year	Model	Engine Number
1935	All	PJ-1001
1936	All	P2-1001
1937	All	P4-1001
1938	All	P6-1001
1939	All	P8-1001
1940	All	P9-1001
1941	P11	P11-1001
	P12	P12-1001
1942	All	P14-1001
1946	All	P15-1001
1947	All	Note A
1948	All	Note A
1949	All	P18-1001
1950	All	P20-1001
1951	All	P22-1001
1952	All	Note A

A—Continued from previous year.

PONTIAC

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Master 6	6–35	112	In Block	$3\frac{3}{8}$ x $3\frac{7}{8}$	208.0	6.20	80 @ 3600	150 @ 1600	30 @ 30
	De Luxe 6	6–35	112	In Block	$3\frac{3}{8}$ x $3\frac{7}{8}$	208.0	6.20	80 @ 3600	150 @ 1600	30 @ 30
	Eight	8–35	$116\frac{5}{8}$	In Block	$3\frac{3}{16}$ x $3\frac{1}{2}$	223.4	6.20	84 @ 3800	153 @ 1600	30 @ 30
1936	Master 6	6–36	112	In Block	$3\frac{3}{8}$ x $3\frac{7}{8}$	208.0	6.20	80 @ 3600	150 @ 1600	35 @ 40
	De Luxe 6	6–36	112	In Block	$3\frac{3}{8}$ x $3\frac{7}{8}$	208.0	6.20	80 @ 3600	150 @ 1600	35 @ 40
	Eight	8–36	$116\frac{5}{8}$	In Block	$3\frac{1}{4}$ x $3\frac{1}{2}$	232.3	6.20	87 @ 3800	161 @ 1600	35 @ 40
1937	Six	6–37	117	In Block	$3\frac{7}{16}$ x 4	222.7	6.20	85 @ 3520	161 @ 1600	35 @ 40
	Eight	8–37	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.20	100 @ 3800	172 @ 1600	35 @ 40
1938	Six	6–38	117	In Block	$3\frac{7}{16}$ x 4	222.7	6.20	85 @ 3520	161 @ 1600	35 @ 40
	Eight	8–38	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.20	100 @ 3700	172 @ 1600	35 @ 40
1939	Quality 6	39–25	115	In Block	$3\frac{7}{16}$ x 4	222.7	6.20	85 @ 3520	161 @ 1600	35 @ 40
	De Luxe 6	39–26	120	In Block	$3\frac{7}{16}$ x 4	222.7	6.20	85 @ 3520	161 @ 1600	35 @ 40
	De Luxe 8	39–28	120	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.20	100 @ 3700	172 @ 1600	35 @ 40
1940	Special 6	40–25	117	In Block	$3\frac{7}{16}$ x 4	222.7	6.50	87 @ 3520	164 @ 1400	35 @ 40
	De Luxe 6	40–26	120	In Block	$3\frac{7}{16}$ x 4	222.7	6.50	87 @ 3520	164 @ 1400	35 @ 40
	De Luxe 8	40–28	120	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	100 @ 3700	175 @ 1600	35 @ 40
	Torpedo 8	40–29	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	100 @ 3700	175 @ 1600	35 @ 40
1941	Custom Torpedo 6	41–24	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3200	175 @ 1400	35 @ 40
	De Luxe Torpedo 6	41–25	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3200	175 @ 1400	35 @ 40
	Streamliner Torpedo 6	41–26	122	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3200	175 @ 1400	35 @ 40
	De Luxe Torpedo 8	41–27	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	103 @ 3500	190 @ 2200	35 @ 40
	Streamliner Torpedo 8	41–28	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	103 @ 3500	190 @ 2200	35 @ 40
	Custom Torpedo 8	41–29	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	103 @ 3500	190 @ 2200	35 @ 40
1942	Torpedo 6	42–25	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3200	175 @ 1400	35 @ 40
	Streamliner 6	42–26	122	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3200	175 @ 1400	35 @ 40
	Torpedo 8	42–27	119	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	103 @ 3500	190 @ 2200	35 @ 40
	Streamliner 8	42–28	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	103 @ 3500	180 @ 2200	35 @ 40
1946	Torpedo 6	46–25	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	175 @ 1400	35 @ 40
	Streamliner 6	46–26	122	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	175 @ 1400	35 @ 40
	Torpedo 8	46–27	119	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2000	35 @ 40
	Streamliner 8	46–28	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2000	35 @ 40
1947	Torpedo 6	47–25	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	175 @ 1400	35 @ 40
	Streamliner 6	47–26	122	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	175 @ 1400	35 @ 40
	Torpedo 8	47–27	119	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2000	35 @ 40
	Streamliner 8	47–28	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2000	35 @ 40
1948	Torpedo 6	48–25	119	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	178 @ 1200	35 @ 40
	Streamliner 6	48–26	122	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	178 @ 1200	35 @ 40
	Torpedo 8	48–27	119	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2200	35 @ 40
	Streamliner 8	48–28	122	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	107 @ 3700	190 @ 2200	35 @ 40
1949	Silver Streak 6	49–25	120	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	93 @ 3400	178 @ 1200	35 @ 40
	Silver Streak 8	49–27	120	In Block	$3\frac{1}{4}$ x $3\frac{3}{4}$	248.9	6.50	106 @ 3800	190 @ 2200	35 @ 40
1950	Silver Streak 6	50–25	120	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	90 @ 3400	178 @ 1200	35 @ 40
	Silver Streak 8	50–27	120	In Block	$3\frac{3}{8}$ x $3\frac{3}{4}$	268.2	6.50	108 @ 3600	208 @ 1800	35 @ 40
1951	Silver Streak 6	51–25	120	In Block	$3\frac{9}{16}$ x 4	239.2	6.50	96 @ 3400	191 @ 1200	35 @ 40
	Silver Streak 8	51–27	120	In Block	$3\frac{3}{8}$ x $3\frac{3}{4}$	268.2	6.50	116 @ 3600	220 @ 2000	35 @ 40
1952	Silver Streak 6	52–25	120	In Block	$3\frac{9}{16}$ x 4	239.2	A	B	189 @ 1400	35 @ 40
	Silver Streak 8	52–27	120	In Block	$3\frac{3}{8}$ x $3\frac{3}{4}$	268.2	A	C	222 @ 2200	35 @ 40

A—With synchromesh transmission 6.8 to 1; with Hydra-Matic 7.7 to 1.
B—With synchromesh transmission 100 @ 3400; with Hydra-Matic 102 @ 3400.
C—With synchromesh transmission 118 @ 3600; with Hydra-Matic 122 @ 3600.

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees Note C	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935–48	Six	AC-45	.025	.022	31–37	153624	A	Negative	450	375	60
	Eight	AC-45	.025	.016	21–30	16258374	A	Negative	450	375	60
1949–52	Six	AC-44-5	.025	.022	31–37	153624	B	Negative	450	375	60
	Eight	AC-44-5	.025	.016	21–30	16258374	B	Negative	450	375	60

A—IGN mark on flywheel.

B—IGN mark on vibration damper on early 1949 models. On late 1949 and 1950-52 cars, the first line that comes under the pointer on the vibration damper is for standard cylinder heads, the second line is for high compression heads, and the third line indicates upper dead center.

C—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is a shown.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1938–49	All	.012H	.012H	.015	C	5	5	56@1 29/32	B	B	.3105	.3105
1950–52	Six	.012H	.012H	.015	C	5	5	56@1 29/32	B	B	.3105	.3105
	Eight	.012H	.012H	.015	C	5	5	59@1 23/32	B	B	.3105	.3105

A—BTDC means before top dead center; ATDC means after top dead center.

B—Valve guides taper .001″ to the inch and when started in the guide the valve should fall through by its own weight.

C—Intake 30, exhaust 45.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
					Ring Gap, Minimum (Note A)		Clearance in Groove			
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Compression	Oil	Compression	Oil	Type	Fit
1935–38	All	Above	.002	10 to 20	.007	.007	.0015–.003	.001–.0025	B	C
1939–42	All	Above	.0015	10 to 20	.007	.007	.0015–.003	.001–.0025	B	C
1946–52	Six	Above	.0015	10 to 20	.009	.009	.0015–.003	.001–.0025	B	C
	Eight	Above	.0015	10 to 20	.012	.012	.0015–.003	.001–.0025	B	C

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.

B—Locked in piston.

C—Tight hand push fit in rod and piston with parts at 70° (normal room temperature).

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-36	Six	.002–.005	.0015–.0025	1.9975–1.9985	.0005–.0015	.007–.012	45–50	B	.001–.003	.003–.008	80–90
	Eight	.002–.005	.0015–.0025	1.9987–1.9997	.0005–.0015	.007–.012	45–50	E	.001–.003	.003–.008	80–90
1937-38	Six	.002–.005	.0015–.0025	1.9975–1.9985	.0005–.0015	.007–.012	45–50	C	.001–.003	.003–.008	80–90
	Eight	.002–.005	.0015–.0025	1.9987–1.9997	.0005–.0015	.007–.012	45–50	F	.001–.003	.003–.008	80–90
1939-42	Six	.002–.005	.0015–.0025	2.1237–2.1247	.0005–.0015	.007–.012	45–50	D	.001–.003	.003–.008	80–90
	Eight	.002–.005	.0015–.0025	1.9987–1.9997	.0005–.0015	.007–.012	45–50	F	.001–.003	.003–.008	80–90
1946-48	Six	.002–.005	.0015–.0025	2.1237–2.1247	.0005–.002	.007–.012	45–50	D	.0003–.0023	.003–.008	80–90
	Eight	.002–.005	.0015–.0025	1.9987–1.9997	.0005–.002	.007–.012	45–50	F	.0003–.0023	.003–.008	80–90
1949	Six	.003–.007	.0015–.0025	2.1237–2.1247	.0001–.0021	.007–.012	45–50	D	.0003–.0023	.003–.008	95(H)
	Eight	.003–.007	.0015–.0025	1.9987–1.9997	.0001–.0021	.007–.012	45–50	F	.0003–.0023	.003–.008	95(H)
1950-52	Six	.003–.007	.0015–.0025	2.1237–2.1247	.0001–.0021	.007–.012	45–50	D	.0003–.0023	.003–.008	95(H)
	Eight	.003–.007	.0015 .0025	1.9987–1.9997	.0001–.0021	.007–.012	45–50	G	.0003–.0023	.003–.008	95(H)

A—Thrust taken by rear intermediate bearing.

B —Front, 2.2455 to 2.2465
No. 2, 2.2767 to 2.2777
No. 3, 2.308 to 2.309
Rear, 2.3705 to 2.3715

C —Front, 2.3725 to 2.3735
No. 2, 2.4037 to 2.4047
No. 3, 2.4662 to 2.4672
Rear, 2.4975 to 2.4985

D —Front, 2.4982 to 2.4992
No. 2, 2.5294 to 2.5304
No. 3, 2.5919 to 2.5929
Rear, 2.6232 to 2.6242

E —Front, 2.2455 to 2.2465
No. 2, 2.2767 to 2.2777
No. 3, 2.308 to 2.309
No. 4, 2.3393 to 2.3403
Rear, 2.3705 to 2.3715

F —Front, 2.3732 to 2.3742
No. 2, 2.4044 to 2.4047
No 3, 2.4357 to 2.4367
No 4, 2.4669 to 2.4679
Rear, 2.4982 to 2.4992

G—Front, 2.3732–2.3742
No. 2, 2.4044–2.4054
No. 3, 2.4357–2.4367
No. 4, 2.4669–2.4779
Rear, 2.6232–2.6242

H—Rear main bearing cap
120 lbs. ft.

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935	All	Molded	23 1/16	1 3/4	3/16	5/8
1936-38	All	Molded	23 1/16	1 3/4	3/16	1/2
1939	All	Molded	21 5/16	1 3/4	3/16	1
1940-42	All	Molded	21 5/16	1 3/4	3/16	A
1946-48	All	Molded	21 5/16	(B)2 (C)1 3/4	3/16	A
1949-52	All	Molded	21 5/16	(B)2 1/4 (C)1 3/4	3/16	A

A—Adjust brake pedal so its pad is even with clutch pedal pad.
B—Front wheel. C—Rear wheel.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	Master	+1 1/4	+1	1/16	7 1/6
	Deluxe	Zero	+1 1/2	1/32	7 1/6
1936	Master	+1 1/4	+1	1/16	7 1/6
	Deluxe	Zero	Zero	1/32	8 3/4
1937–38	All	–1	+ 1/4	1/32	4 3/4
1939	All	– 3/8	+ 1/4	1/32	4 3/4
1940	All	– 3/4	+ 1/4	1/32	4 7/8
1941–47	All	– 3/4	Zero	1/32	4 5/8
1948	All	– 3/4	Zero	1/32	5
1949–52	All	– 3/4	Zero	1/32	5

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-36	All	.003–.012	Shims	None	.000–.014
1937-47	All	.003–.012	Shims	None	.000–.008
1948-52	All	.003–.012	Shims	Nut	.000–.008

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil Above +32°F.	ENGINE: Grade of Oil Above +10°F.	ENGINE: Grade of Oil Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil Summer	TRANSMISSION: Grade of Oil Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil Summer	DIFFERENTIAL: Grade of Oil Winter
1935	Six	15	15	6	20	20W	10W	2½	80EP	80EP	4½	90EP	90EP
	Eight	15½	18	7	20	20W	10W	2½	80EP	80EP	4½	90EP	90EP
1936	Six	16	15	6	20	20W	10W	1¾	80EP	80EP	4½	90EP	90EP
	Eight	19	18	7	20	20W	10W	1¾	80EP	80EP	4½	90EP	90EP
1937-38	Six	16	18	6	20	20W	10W	1¾	80EP	80EP	3	90EP	90EP
	Eight	19	18	7	20	20W	10W	1¾	80EP	80EP	3	90EP	90EP
1939	Six	16	16	6	20	20W	10W	1¾	80EP	80EP	3	90H	90H
	Eight	19	16	7	20	20W	10W	1¾	80EP	80EP	3	90H	90H
1940	Six	17	16	6	20	20W	10W	1¾	80EP	80EP	3	90H	90H
	Eight	19	16	6	20	20W	10W	1¾	80EP	80EP	3	90H	90H
1941	Six	18	17	6	20	20W	10W	1¾	80EP	80EP	3¼	90H	90H
	Eight	19½	17	6	20	20W	10W	1¾	80EP	80EP	3¼	90H	90H
1942-47	Six	18	17	5	20	20W	10W	1¾	80EP	80EP	3¼	90H	90H
	Eight	19½	17	5	20	20W	10W	1¾	80EP	80EP	3¼	90H	90H
1948	Six	18	17	5	20	20W	10W	1¾ (A)	80EP	80EP	3¼	90H	90H
	Eight	19½	17	5	20	20W	10W	1¾ (A)	80EP	80EP	3¼	90H	90H
1949-52	Six	18	17½	5	20	20W	10W	1¾ (A)	80EP	80EP	3¼	90H	90H
	Eight	20	17½	5	20	20W	10W	1¾ (A)	80EP	80EP	3¼	90H	90H

A—For Hydra-Matic, 12 qts. of Hydra-matic fluid. EP—Extreme pressure (mild) lubricant. H—Hypoid gear lubricant.

ENGINE

ENGINE REMOVAL

1935-36—To remove the engine with the clutch and transmission, proceed as follows: Drain the cooling system, remove the hood and disconnect the radiator tie rods at the front. Remove the headlamps and release the wiring from the clips at the fenders and fender skirts.

Remove the front bumper, disconnect the fenders from the running boards and body. Remove the two nuts which extend through the center of the front cross member which will disconnect the front fender and radiator support from the frame. Lift off the radiator and fenders as an assembly and remove the horns and hood tie rods.

Remove the gearshift lever and floor boards. Disconnect the gas line at the fuel pump, the oil pressure gauge line, the throttle control rods, the wiring at the generator, starter, etc., the windshield wiper tube at the manifold, the heat indicator at the cylinder head, the engine ground strap, the clutch control countershaft at the flywheel housing, the front end plate from the front end support (6 bolts), and the exhaust pipe at the manifold.

Remove the intermediate engine mountings and the intermediate cross member. Then attach a chain hoist to the engine and remove the bolt from the rear engine support free of the rear engine support cross member. Remove the engine from the frame, pulling forward to slide the universal joint and ball from the torque tube.

Reverse the operations to install the power plant assembly and aim the headlamps, adjust the clutch pedal free travel, tune the engine and install two new exhaust pipe gaskets.

NOTE—On early 1935 Sixes and all 1935-36 Eights, the intermediate engine mountings should be adjusted as follows: With the engine bolted down, front and rear, gauge with a feeler the open space between the mountings and the brackets and insert shims sufficient to compress the rubber mountings no less than 1/32" nor more than 3/32". Fully compress the spring at the rear stabilizer as much as possible, then back off ½-turn and insert a cotter pin.

Later production intermediate mounting on 1935 Sixes is adjusted by loosening the upper nut to permit the lower insulator to expand. Then the upper nut should be tightened to compress the lower insulator 3/16" before installing the assembly in the car.

1937-40—It is not necessary to remove the fenders, bumper, side panels or light wires to take the engine out of the chassis. The procedure is as follows: Remove the hood and disconnect the usual controls, such as throttle controls, generator leads, battery cables, etc. Unfasten the transmission from the flywheel housing. Remove the radiator and then the engine mounts. With a chain hoist attached to the engine in the proper manner, take the weight of the engine off the chassis, slide the engine forward off the clutch spline shaft and raise the engine up and out of the chassis. Reverse the above operations to replace the engine.

1941-52—It is not necessary to take off the fenders and front end sheet metal; remove radiator core only. To take out the engine with the clutch and transmission, proceed as follows: Drain the cooling system and remove the hood. Disconnect the headlamp wires. Remove the radiator core as described under that heading.

NOTE—Remove the bar across the front fender support by drilling out four rivets—which will be replaced with bolts, nuts and lockwashers upon re-assembly.

Disconnect all of the following: the engine front insulator at the engine, the

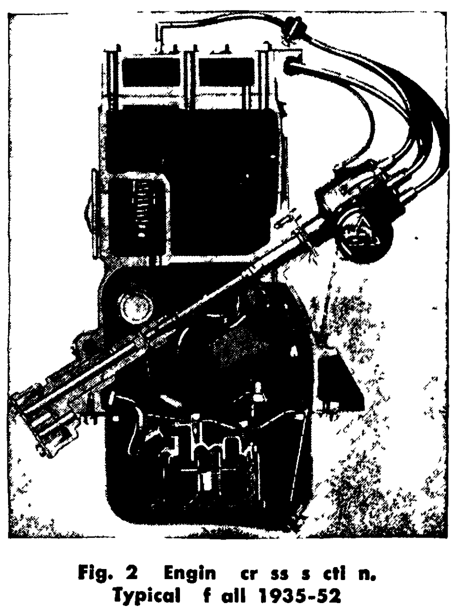


Fig. 2 Engin cr ss s ctl n. Typical f all 1935-52

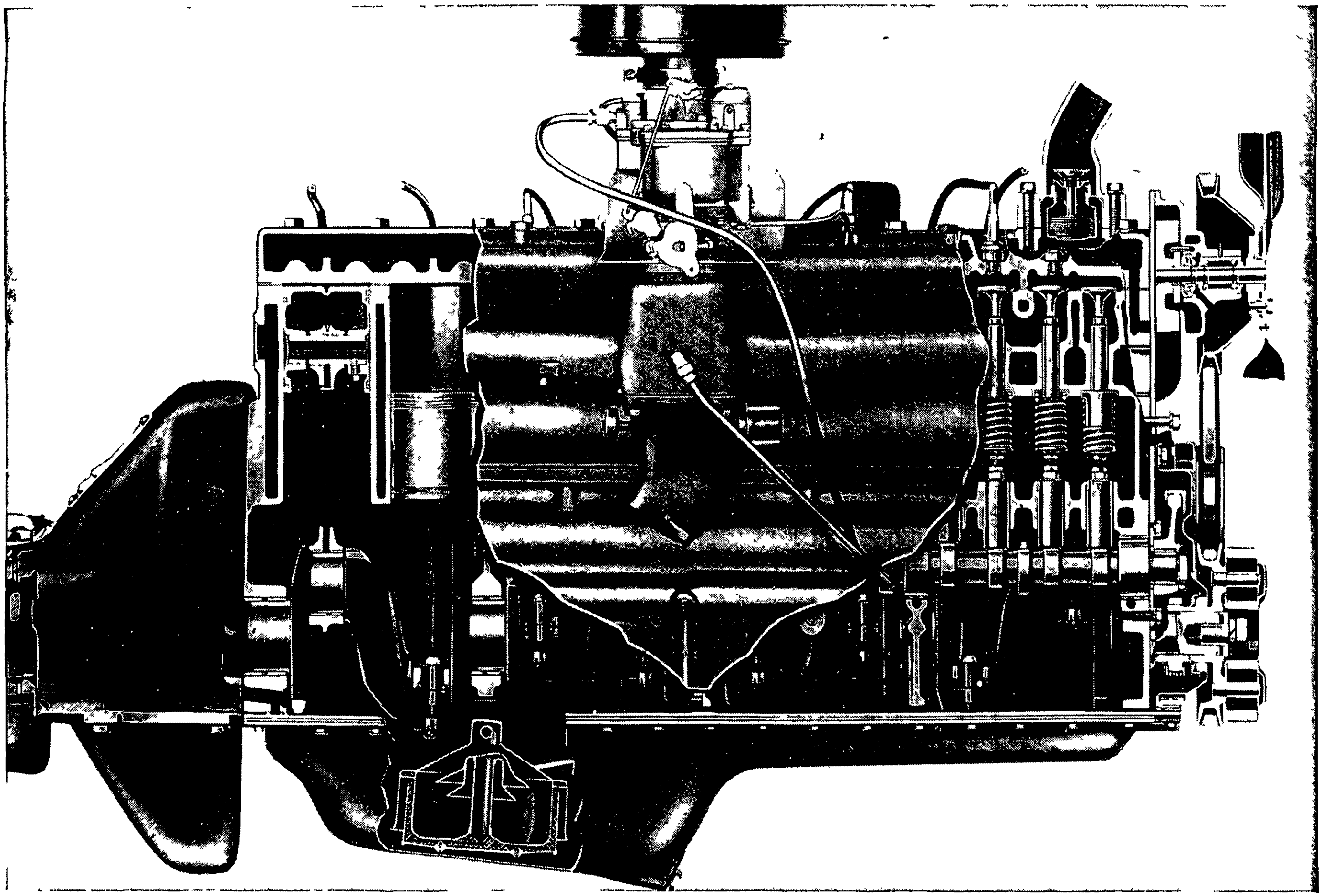


Fig. 1 Section of eight-cylinder engine. Typical of all 1941-52

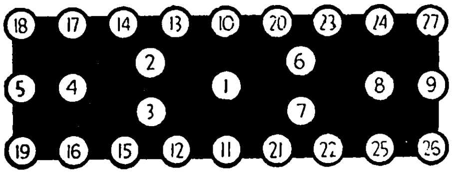


Fig. 3 Head tightening, 1935-52 Sixes

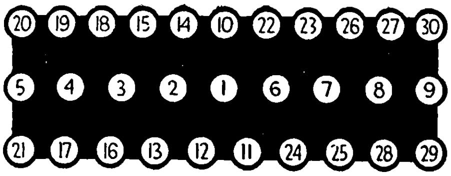


Fig. 4 Head tightening, 1935-52 Eights

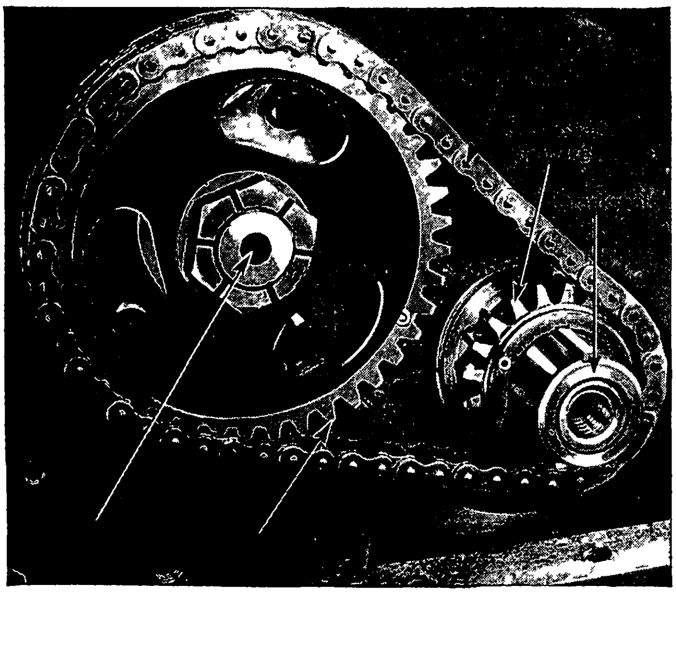


Fig. 5 1935-52 valve timing. Marks on sprockets should be opposite each other and in line with center of both shafts

gearshift selector control rod at the transmission, the outer lever from the transmission shift shaft, gasoline line at the fuel pump, oil pressure gauge line, throttle control rods, wiring at generator, starter, etc., windshield wiper tube at manifold, heat indicator at the cylinder head, engine ground strap, clutch control bracket at the flywheel housing, clutch throwout fork, speedometer cable from transmission, the front end support (2 bolts), exhaust pipe at the manifold, and disconnect the rear universal joint and drop propeller shaft.

Attach a chain hoist to the engine and remove the bolts from the rear engine mountings. Then lift the engine free of the rear support cross member, and pull the engine forward out of the chassis.

Reverse the above operations to install the engine assembly and adjust the clutch pedal free play, gearshift controls and throttle range.

CYLINDER HEAD

1935-52—The general procedure for removing a cylinder head is as follows:

1. Drain radiator and remove upper water hose.
2. Remove air cleaner.
3. On Hydra-Matic equipped cars, re-

FIRST SERIAL NUMBER

LOCATION—1935-38: On top of frame just ahead of steering gear bracket. 1939-40: On front frame cross member just below generator. 1941-52: On left side of dash under hood. 1942-48 serial numbers are also located on a raised pad at the front of the left hand side of the cylinder block.

Year	Model	Serial
1935	6-35 Master	6AB-1001
	6-35 De Luxe	6AA-1001
	8-35	8AA-1001
1936	6-36 Master	6BB-1001
	6-36 De Luxe	6BA-1001
	8-36	8BA-1001
1937	6-37	6CA-1001
	8-37	8CA-1001
1938	6-38	6DA-1001
	8-38	8DA-1001
1939	39-25	6EA-1001
	39-26	6EB-1001
	39-28	8EA-1001
1940	40-25	6HA-1001
	40-26	6HB-1001
	40-28	8HA-1001
	40-29	8HB-1001
1941	41-24	6JC-1001
	41-25	6JA-1001
	41-26	6JB-1001
	41-27	8JA-1001
	41-28	8JB-1001
	41-29	8JC-1001
1942	42-25	6KA-1001
	42-26	6KB-1001
	42-27	8KA-1001
	42-28	8KB-1001
1946	46-25	6LA-1001
	46-26	6LB-1001
	46-27	8LA-1001
	46-28	8LB-1001
1947	47-25	6MA-1001
	47-26	6MB-1001
	47-27	8MA-1001
	47-28	8MB-1001
1948	48-25	6PA-1001
	48-26	6PB-1001
	48-27	8PA-1001
	4828-	8PB-1001
1949	49-25	6RS-1001
	49-25	6RH-1001
	49-27	8RS-1001
	49-27	8RH-1001
1950	50-25	6TS-1001
	50-25	6TH-1001
	50-27	8TS-1001
	50-27	8TH-1001
1951	51-25	6US-1001
	51-25	6UH-1001
	51-27	8UH-1001
	51-27	8US-1001
1952	52-25	6WS-1001
	52-25	6WH-1001
	52-27	8WS-1001
	52-27	8WH-1001

NOTE: A prefix letter will be found ahead of the serial number; this letter denotes the assembly plant at which the car was produced. Letters "S" and "H" in serial numbers on 1949-52 models denotes cars with Standard and Hydramatic Transmissions.

FIRST ENGINE NUMBER

LOCATION—1935-41: On pad at left front of cylinder block just below cylinder head gasket. 1942-48: On pad at rear of left hand side of cylinder block. 1949-52: Top left hand front corner of cylinder block.

Year	Model	Engine
1935	6-35	6-1001
	8-35	8-1001
1936	6-36	6-84001
	8-36	8-44001
1937	6-37	6-220001
	8-37	8-83001
1938	6-38	6-399501
	8-38	8-140001
1939	39-25	6-486201
	39-26	6-486201
	39-28	8-159601
1940	40-25	6-595801
	40-26	6-595801
	40-28	8-194401
	40-29	8-194401
1941	41-24	6-761501
	41-25	6-761501
	41-26	6-761501
	41-27	8-246501
	41-28	8-246501
	41-29	8-246501

NOTE: 1942-52 engine numbers same as serial numbers.

move accelerator linkage on cylinder head.

4. Disconnect temperature gauge wire from unit in head.

5. Remove cylinder head bolts and lift off head.

6. Clean gasket surface of both head and block.

7. Place new gasket on block and install head bolts finger tight after coating bolt threads with white lead and oil. Clean bolt threads before applying sealer.

8. Tighten head bolts with a torque wrench to the values given in the *Tune Up Chart* and in the sequence shown in Figs. 3 and 4.

9. On Hydra-Matic equipped cars, the throttle linkage and idle speed should be checked and adjusted if necessary after the installation has been completed.

10. Run the engine at operating temperature and retighten the head bolts with a torque wrench. Repeat after 500 miles of operation.

VALVES, ADJUST

1935-52—The clearances shown in the *Valve Data* chart should be maintained at all times. Run the engine until normal operating temperature is reached. Remove the valve covers and with engine idling, adjust valves within specifications.

If desired valves may be adjusted while the engine is at normal room temperature with engine not running. Make this initial adjustment by setting the clearance .001 in. more than the specified hot setting. Be sure the valves are fully closed while adjusting the clearance by this method. After the engine has reached normal operating temperature, recheck the clearances and adjust as necessary to conform to the specifications given in the *Valve Data* chart.

VALVES & SPRINGS

1935-52—To remove the valves, drain the water from the cooling system and remove the cylinder head and gasket. Take off the valve cover plates and plug the holes in the cylinder block around the valve tappets so that the valve locks will not fall into the oil pan when the locks are removed. Compress the valve spring, remove the valve locks and lift out the valve.

NOTE—Whenever valve springs are removed, they should be checked for proper tension according to the specifications given in the *Valve Data* table. If not within the limits specified, they should be replaced.

VALVE STEM GUIDES

1935-52—When installed at the factory, valve guides taper .001" to the inch with the larger diameter at the top which permits a closer fit at the bottom where less clearance is desirable and, at the same time, provides sufficient clearance at the upper end to allow for expansion of the parts, resulting from the heat developed during operation.

Valves should fit in the guides so that when started in the guide, the valve should just fall through by its own weight. If the fit is too loose, new service guides, which have straight holes, should be installed and reamed to provide this clearance.

NOTE—When necessary to install new guides, first measure the position of a guide not yet removed to determine the correct depth of the guide being installed. For example, when installing an intake guide, measure from the top of an intake guide to the top of the block of an intake guide not yet removed and install the new guide accordingly. Similarly, this procedure should be followed when installing an exhaust guide.

VALVE LIFTERS & GUIDES

1935-52 — Standard and .005" oversize lifters are available for service replace-

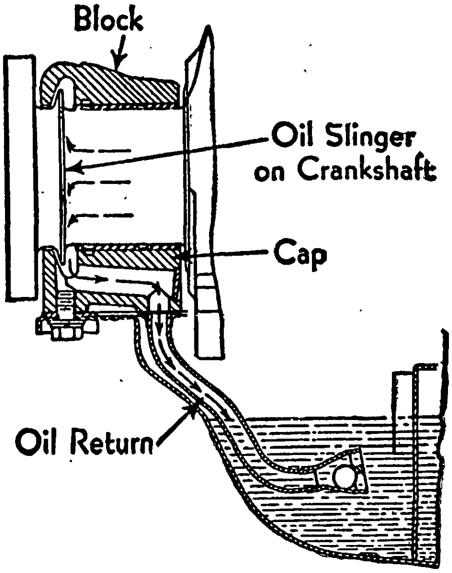


Fig. 6 Rear main bearing oil slinger and drain. All 1936-38 m dels and 1939-49 Eights

ment. The lifters operate in guides which are cast integral with the cylinder block. When necessary to replace lifters, remove the cylinder head and valves and pick the lifters out of the guides and remove them from the valve compartment.

When installation of an oversize lifter is needed, a special pilot reamer is required to ream the guide hole straight so that it is in perfect alignment with the valve lifter hole and the valve stem. Select a new lifter to give as close a fit in the reamed hole as possible, yet allowing the lifter to be removed freely with the fingers.

TIMING CASE COVER

1935-52—To remove the cover, lift off the radiator and front fenders. Remove the fan and vibration damper, using a special starter nut wrench and puller. Support the front end of the engine with a jack and remove the front engine support, after which disconnect the cover from the block and lift it off.

NOTE—When replacing the cover, make sure that the machined surface where the oil seal is mounted is flat within .015". To center the cover properly, it is recommended that special centering tool No. J1546 be used. If this tool is not available, use a sleeve which is the same size as the hub of the vibration damper, slipping it over the front end of the crankshaft to act as a guide when replacing the cover.

TIMING CHAIN & SPROCKETS

1935-52—The timing chain has no adjustment for wear. To remove the chain or sprockets, follow the procedure given above under *Timing Case Cover,* then take off the timing chain and sprockets, as required.

To assemble, Fig. 5, place the chain over the sprockets so that when the camshaft sprocket is bolted to its hub, the timing marks on both sprockets are opposite each other and in line with the centers of both the camshaft and crankshaft.

CAMSHAFT & THRUST PLATE

1935-52—To remove the camshaft and thrust plate, follow the procedure given under *Timing Case Cover,* then remove the cylinder head, valve covers, oil pump, fuel pump and distributor, after which block up the valves and lifters with clamps or rubber bands and withdraw the camshaft.

If the end play between the sprocket hub and the thrust plate is in excess of .005", install a new thrust plate.

To install the camshaft, reverse the foregoing operations, using new gaskets. Reset the ignition timing and check the valve clearance with the engine at normal operating temperature.

CAMSHAFT BEARINGS

1935-52—If the camshaft bearing clearance is excessive, new bearings may be pressed in place after the camshaft and old camshaft bearings have been removed.

When replacing the bearings, be sure that the oil holes line up with the holes drilled in from the oil gallery. These holes come through at the bottom of the camshaft bearing holes. After the bearings are installed, they must be line-reamed to the clearance given in the *Engine Bearing Data* table.

PISTONS & RODS, REMOVE

1935-52—On all engines, the piston and rod assemblies are removed from the top of the block. Although regular production rods are marked with the cylinder number in which they were originally installed, replacement rods are not; therefore, unmarked rods should be suitably identified with punch marks as they are removed.

PISTON & RODS, ASSEMBLE

1935-52—For 1935-36 Eights, the rods are offset, and when replacing, the narrow side of the rod should be placed toward the nearest main bearing. On all other models, the rods are not offset.

PISTONS

1935-52—Pistons are available in standard and the following inch oversizes: .005, .010, .020 and .030.

Before any attempt is made to fit new pistons, cylinder bores should be carefully measured and refinished. Cylinders which are not badly scored but need a "cleaning up" to bring them within satisfactory working limits may be reconditioned with a hone. The bores should be checked with an accurate gauge to determine whether or not they are out-of-round or tapered.

A good job should show measurements of not more than .0005" out-of-round or taper. If cylinders are scored badly or out-of-round excessively, they should be bored first with a reliable boring tool and then polished with a hone.

CAUTION—When reconditioning cylinders, the crankshaft and main bearings should be covered to prevent cuttings and abrasives from getting into the bearings and timing case. After completing the reconditioning job, the engine should be cleaned thoroughly, being sure to remove all traces of chips, dirt or other foreign matter from the cylinder walls.

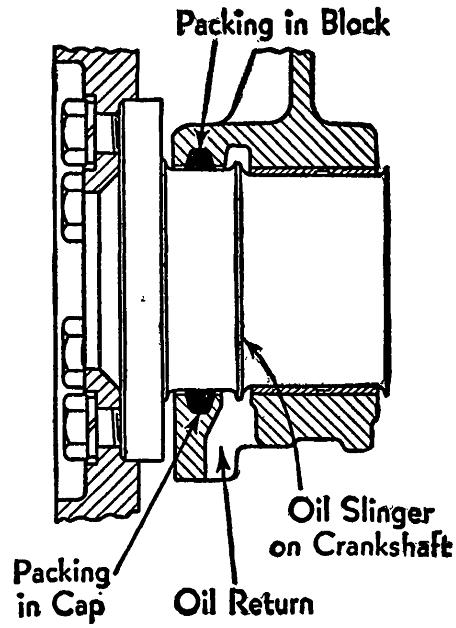


Fig. 7 Rear main bearing il s al, 1939-49 Sixes and all 1950-52

When fitting pistons, use feeler stock of the thickness given in the *Piston & Ring* table. The feeler should be about ½" wide and long enough to extend down into the bore for the full length of the piston. Insert the piston into the bore upside down and place the feeler stock between the piston and the cylinder wall on the thrust side of the piston. Hook the gauge to a spring scale and withdraw the feeler by pulling it out of the cylinder with the scale. The piston is fitted properly if the amount of pounds pull registered on the scale comes within the limits given in the table.

PISTON RINGS

1935-52—Rings are furnished in standards and oversizes of .005, .010, .020 and .030 inch. Always use standard size rings in cylinders that are standard at the bottom, regardless of the amount of taper. Rings may have ample clearance in the upper part of the cylinder but at the bottom of the piston stroke the ends jam, causing the rings to buckle and distort. Always see that the end gap is within specifications at the *bottom of the cylinder.* When fitting rings on new pistons, be sure the rings are free in the grooves so they will fall from side to side when installed in the piston.

Before removing pistons, the ridge at the top of each cylinder should be cut away with a ridge reamer. This eliminates the danger of breaking ring lands which might be the result if the rings were driven past the ridges. To prevent the possibility of undercutting the cylinder wall, never try to remove the last traces of the ridge; this can be done afterward by honing.

New rings should be fitted according to the instructions given with the ring package. Ring grooves must be clean

and free from carbon and must show no perceptible wear. Oversizes ordered must be determined by the measurement of the smallest portion of the bore.

PISTON PINS

1935-52—Pins are furnished in standard and oversizes of .001, .003 and .005 inch. When fitting pins, the insides of both bosses should first be coated with graphite grease. The pin should then be assembled in the piston with the slotted end entering first into the lock boss.

CONNECTING RODS

1935-52—Rod bearings are available in standard, .001 and .002 in. undersizes. If bearing clearances exceed .00225 in. when checked with Plastigage, install undersize bearings.

Upper and lower bearing halves are not interchangeable because of oil holes in the upper bearing for the connecting rod oil passages. Always make sure the upper half is installed correctly in the rod, or no oil will reach the piston pins.

MAIN BEARINGS

1935-52—Main bearings are available in standard, .001 and .002 in. undersizes. If bearing clearances exceed .0025 in. when checked with Plastigage, install undersize bearings. No attempt should be made to shim, file or otherwise take up worn bearings.

To install new bearings, remove the cap and take out the worn lower shell. Rotate the crankshaft in the reverse direction to turn the upper shell out of the crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.

Place a new upper shell on the crankshaft journal with the locating lug in the correct position, and rotate the shaft to turn the shell in place. Install the lower shell in the cap and install the cap.

CRANKSHAFT END THRUST

1935-52—Crankshaft end thrust is controlled by flanges on a bearing. Through normal wear, this end play will seldom become excessive but whenever new bearings are fitted, check the end play by forcing the crankshaft to the limit of its travel and insert a shim between the bearing flange and crankshaft fillet, noting the thickness of shim required to take up all play. The permissible end play is given in the table, with the minimum figure desired.

If the clearance is insufficient, the bearing flanges may be dressed down, but if the clearance is too great, install a new bearing.

REAR MAIN BEARING OIL SEAL

1935 — A ball check oil drain-back is used in the rear main bearing lower cap with the opening to the front. The angle of the tapered hole is downward and unless the car is on an incline greater than 10 degrees, the ball check is forward in the open position and the oil returns to the oil pan in the conventional manner past the ball check.

However, when the front of the car is elevated to an angle greater than 10 degrees, the ball rolls back and seats in the tapered hole, thereby preventing loss of oil at the rear main bearing.

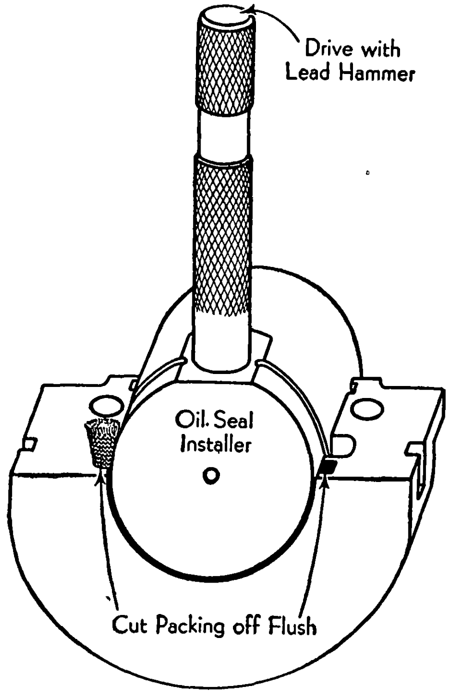


Fig. 8 Installing rear main bearing oil seal, 1939-49 Sixes and all 1950-52

1936-38 ALL; 1939-49 EIGHT—Oil sealing at the rear main bearing is controlled by an oil slinger, Fig. 6, integral with the crankshaft, running in a groove leading into the oil pan. The end of the rear main bearing pipe extends below the level of the oil in the oil pan to prevent crankcase pressure from interfering with the return of the oil.

1939-49 Six & All 1950-52—The asbestos oil seal packing which is compressed in the groove in the block and rear main bearing cap can be replaced without removal of crankshaft. The procedure which follows applies to all models with either Hydra-Matic or synchromesh transmissions.

1. Remove oil pan and oil cleaner, flywheel lower cover and transmission.
2. Remove rear center main bearing cap and upper half of the bearing insert. This will eliminate damaging thrust surfaces of bearing and will also allow crankshaft to be lowered more easily.
3. Remove all connecting rod bearing caps.
4. Remove rear main bearing cap and loosen remaining main bearing caps sufficiently to allow crankshaft to be lowered approximately ⅜ in. at the rear.
5. With crankshaft lowered to provide clearance, remove upper half of rear main bearing oil seal.
6. With rear main bearing cap on bench, remove oil seal ring and bearing insert.
7. Install new seal, using tool shown in Fig. 8. Use a sharp razor blade to trim the packing flush as shown.
8. Carefully remove seal from cap and slide it into groove in block over crankshaft, taking particular care to install seal so that end which was at locking recess will meet locking recess when cap is installed.
9. Install rear center main bearing cap and tighten it with a torque wrench to 95 lbs. ft. to properly seat crankshaft against new oil seal. Make a visual inspection to make sure that seal is just flush with edge of block. If inspection shows the seal to be of improper length, remove and discard it. Then install a new seal, allowing for the improper length of the first seal. The cause for the packing trimmed in the cap not fitting in the block in some cases is that the machining of the packing groove cannot always be held exactly concentric with the crankshaft bearing center or exactly on the block and cap split line.
10. Install a new seal in the cap and trim as shown in Fig. 8.
11. Replace the bearing insert, install the cap and tighten it to 120 lbs. ft. torque.
12. Remove the cap again and inspect the break line between the cap and block to be certain that none of the seal material has been compressed between the two. If inspection shows material between cap and block surface, scrape it off to insure proper seating of metal surfaces.
13. Re-install bearing cap and tighten to 120 lbs. ft. torque. Then drive new wooden wedge oil seals into the grooves between cap and block.
14. Complete the job by installing other parts removed.

ENGINE OILING

OIL PAN

1935-40—To facilitate oil pan removal, turn engine to locate No. 1 piston at the top of its stroke. On 1935-36, remove the front center cross member and disconnect one end of the steering tie rod.

On the 39-28 and 40-28, it is necessary to remove the engine front insulator support assembly and rest the engine on a block to facilitate removal of the front oil pan screws.

For the 40-29 model, remove the screws which fasten the front support insulator to the radiator and engine support bracket. Jack up the engine and let it rest on a one-inch board, which will provide the space necessary to remove the front oil pan screws.

1941-48—The oil pan on the six cylinder engine is removed in the conventional manner. On the eight cylinder engine, remove the aprons which are attached to the front cross member and radiator support, which will permit access to the attaching screws at the front end of the pan.

The right and left aprons, after removing and attaching screws, may be lifted out from inside the engine compartment.

1949-52—After draining crankcase and radiator, proceed as follows:

1. Remove radiator hose water pump and cylinder head.
2. Remove two bolts holding steering idler arm support to frame so as to allow steering kinkage to drop down for clearance in removing oil pan.

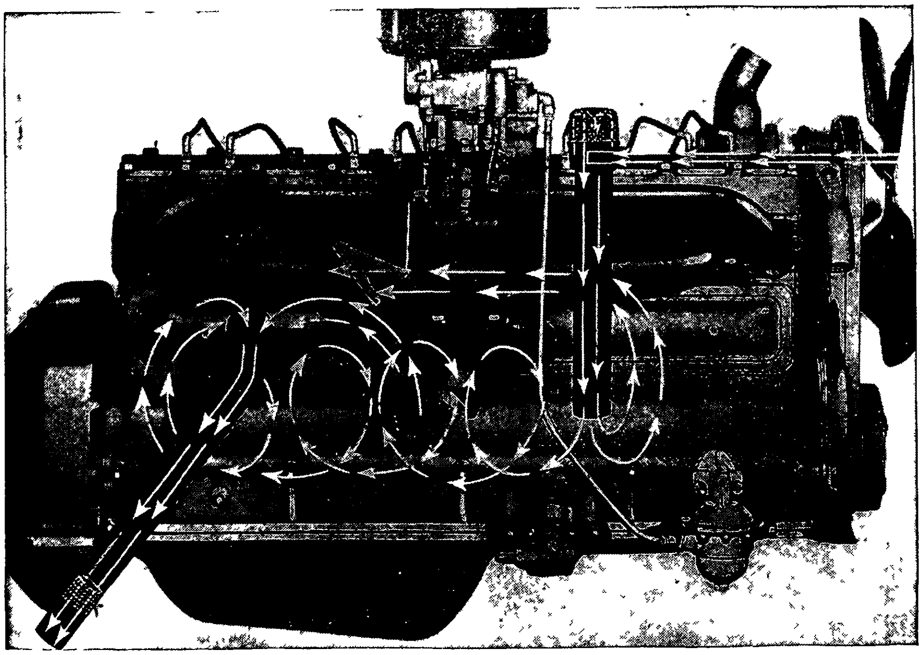


Fig. 9 Crankcase ventilation, 1935-52

3. Remove front cross member to radiator cross member apron.
4. Remove two self-locking nuts holding front engine insulator to engine support.
5. Place wooden block on floor jack pad and position under oil pan.
6. Raise engine about one inch above insulator and then remove insulator and clamp. It is not absolutely necessary to remove the mount from the frame but by so doing slightly more clearance is obtained for reaching the front pan capscrews.
7. Place a block approximately 2½ in. high between frame and engine support (if insulator was left on frame, use a one inch block between insulator and engine support) and lower engine so it rests securely on wood block at front.
8. Remove flywheel housing lower cover.
9. Remove oil pan. In some cases it may be necessary to remove one of the engine side aprons to give sufficient clearance for removing oil pan.

OIL PUMP

1935-52—To remove the pump, lift off the distributor cap and rotate the crankshaft until the distributor rotor is in the position to fire No. 1 cylinder. Keep the engine in this position while the pump is off.

NOTE—On 1935-36 cars with solid front axle, it is necessary to jack up the frame before the pump can be lifted out. On 1939-40 Sixes and all 1941-48 models, disconnect and drop the steering idler arm. On all models, remove the engine side pan.

Continue on all models by removing the cap screws in the pump body, drop the pump, remove the pump cover and oil pump idler gear. Drive out the pin from the oil pump and distributor drive gear, pull the shaft out of the housing and press the drive gear from the shaft.

NOTE—Reverse the operations to assemble and install the pump. If, for any reason, the crankshaft has been moved while the pump was off, rotate the crankshaft to bring No. 1 cylinder on the firing position. Set the distributor rotor on No. 1 and install the oil pump, being sure that the prick-punch mark is down when the gear is meshed with the camshaft gear and the distributor rotor is not moved from the No. 1 firing position. Finally, replace the engine side pan and reset the ignition.

OIL PRESSURE REGULATOR

1935-52—Oil pressure is automatically maintained by a spring-loaded relief valve built into the pump and is not adjustable. For ordinary driving speeds, the pressure should show from 20 to 30 pounds for 1935 cars, and from 35 to 45 pounds for 1936-52 models—for warm oil.

NOTE—If high or low oil pressure is indicated on the gauge, and the correct amount and proper viscosity of oil is in the crankcase, look for the following as being the cause: Broken oil lines or tubes or leaky connections. Defective oil gauge. Clogged oil pump or oil strainer screen. Worn oil pump gears. Loose main or connecting rod bearings. Improper viscosity of oil. Thick pump cover gasket. Oil pressure relief valve plunger sticking.

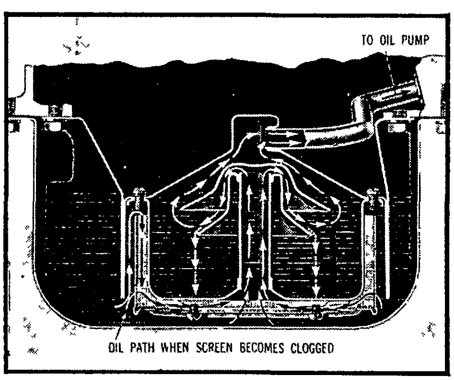


Fig. 10 Oil cl aner. Typical f all 1941-52

OIL CLEANER SERVICE

1941-52—The efficiency of the cleaner, Fig. 10, is dependent upon the controlled flow of oil. Therefore, it is important that the parts be not bent or otherwise altered in such a manner as to impair its efficiency.

The capacity of the settling chamber is ample enough so that it should never be necessary to clean the chamber. However, when the oil pan has been removed it is well to clean out the chamber.

To disassemble the cleaner, disconnect the oil suction pipe and remove the cleaner, bracket and suction pipe from the engine. Disconnect the bracket and pipe from the cleaner. Remove the snap ring from the bottom of the cleaner and remove the oil screen.

Disconnect the cleaner head from the housing shell. Remove the chamber from the housing shell and wash all the parts in gasoline, scraping the bottom of the chamber, if necessary, to dislodge the sediment.

To assemble, reverse the order of disassembly, but be sure that all the gaskets are in good condition. To assemble the chamber and housing shell to the cleaner head, turn the head and shell upside down, insert two screws and place the gasket inside the shell. Place the chamber in position and insert the screws sufficiently to start the threads. This will hold the parts in the proper relation when the assembly is turned right side up for the balance of the assembly.

Complete the assembly and install on the engine.

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-36—Remove the hood and radiator brace rods. Remove fan belt and vibration damper. If the damper is tight enough to require the use of a puller, remove the front fenders and radiator grille as an assembly and then remove the core.

If a puller is not required to remove the damper, proceed as follows: Remove water pump assembly, radiator support bolts and disconnect the core from the shell and lift out core.

1937-38 — Drain radiator and block, remove the hood and hood tie rods and disconnect the radiator hose. Remove the water pump assembly and the two bolts which hold the radiator core to the radiator support at the bottom; remove the bolts which hold the radiator core in the radiator shell. Move the radiator core backward and downward, then lift straight up to remove.

1939-40—After draining the cooling system, disconnect the core from the shell and lift the core up and out.

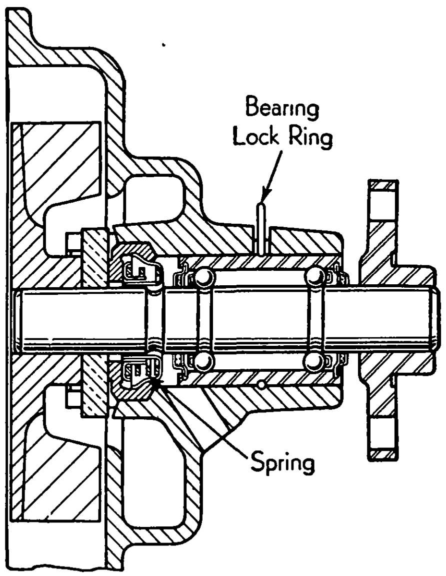


Fig. 11 Water pump. Typical of all 1938-52

1941-48—Drain the system and disconnect the upper and lower hose. Remove the three cap screws on each side of the core and tip the fan shroud back against the engine. Lift the core up and out of the shell, rotating the fan so as to clear the radiator water outlet connection.

1949-52—Drain radiator and cylinder block. Remove fan belt, upper and lower hoses from radiator and also heater return from lower tank. Disconnect headlight wiring from right junction block and wire loom from top of fan shroud. Unfasten fan shroud from radiator and radiator from its support. Turn fan so blades will miss hose outlet connection on radiator lower tank and remove radiator from support.

WATER PUMP, REMOVE

1935-52—Drain the cooling system, remove the fan belt and disconnect the hose. Remove the bolts which hold the pump to the cylinder block and lift off the assembly.

WATER PUMP, OVERHAUL

1935-37 Packing Type—Take off fan and pulley and remove cover plate. Loosen packing nut and packing and press pump shaft out of impeller. Press out the bushings. Install new bushings and ream them to provide from .0005 to .002 inch clearance. Install the shaft and packing nut and press on the impeller, bringing the end of the shaft flush with the impeller hub. Install new packing and replace the cover plate. Lubricate the bushings with engine oil.

1938-52 Seal Type—Fig. 11. Take off the fan and pulley and remove the cover plate. Release the bearing lock ring and press the shaft and bearing out of the impeller. Take out the seal parts.

To assemble, position the seal in the retainer and spring in the order shown in Fig. 11. Install the seal assembly in the body and replace the shaft and bearing, aligning the groove in the bearing

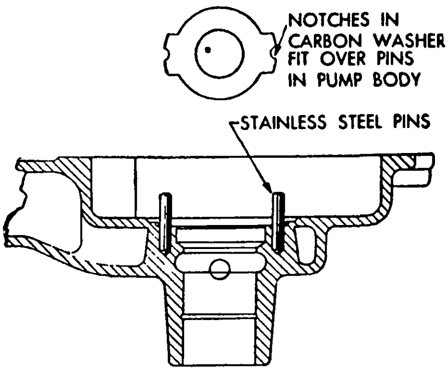


Fig. 12 1946-52 water pump. Pins keep carbon washer from turning

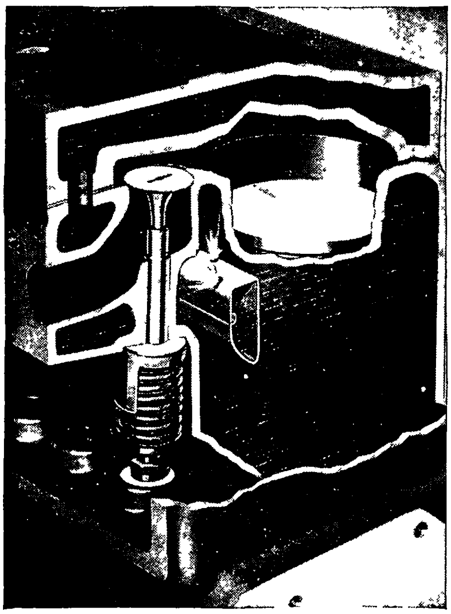


Fig. 13 Showing how water is sprayed through holes in distributor tube to cool exhaust valve seats, 1935-52

with the retainer hole in the body. Install the carbon washer with the polished side toward the impeller. Press the impeller on the shaft, allowing 9/64 inch clearance between the impeller and a straight edge placed across the cover mounting face. Install the bearing lock ring and cover plate.

NOTE—The 1946-52 carbon washer, Fig. 12, is kept from turning by two steel pins pressed into the pump body.

WATER DISTRIBUTOR TUBE

1935-52—The tube, Fig. 13, is located between the cylinders and valve ports near the top of the cylinder block, and is used to direct water against the valve ports. One end of the tube is closed and the other is open. The closed end goes to the rear of the block.

NOTE — When over-heating is experienced on cars with high mileages, remove the tube and check for rust or corrosion. It is good practice to replace the tube whenever the engine has had a complete overhaul.

ELECTRIC SYSTEM

IGNITIO TIMING

1935-52—With the 'eaker gap set to the clearance givi in the *Tune Up Chart,* crank the e ine to bring No. 1 piston up on its co)ression stroke and stop when the ign)n mark is in line with the pointer ;e *Tune Up Data* table for location timing mark).

Locate No. 1 spa(plug wire on the distributor cap, place the cap in position on the distributor and mark the housing opposite No. 1 terminal so that its relative position will be known when the cap is removed.

With the octane selector set midway between advance and retard, loosen the distributor body clamp and rotate the distributor until the points close. Then rotate the distributor in the opposite direction until the points just begin to open, after which, tighten the clamp bolt.

NOTE — For best results, use a Neon timing light or a suitable test lamp to check the timing. Advance or retard the octane selector to compensate for the grade of fuel being used. For best performance and fuel economy, this setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-36—The clearance should be ⅝" away from the underside of the pedal felt retainer board. Pedal lash should be 1".

1937-38 — Adjust the pedal stop screw to obtain ½" clearance between the pedal shank and the under side of the pedal felt retainer on the toe board. Turn the nut on the pedal adjusting link to obtain ¾" to 1¼" pedal lash.

1939-40—Adjust the pedal stop screw to obtain 1" clearance between the pedal shank and the under side of the pedal felt retainer on the toe board. Adjust the clutch fork adjusting nut to obtain ⅞" to 1⅛" pedal lash.

1941-48—Fig. 14. With the clutch pedal against its stop, adjust the screw so that the distance between the under side of the pedal and the floorboard is 4¾" for the 25 and 27 models, and 5 1/16" for all others.

Set the clutch pedal adjusting link so as to obtain from ⅞" to 1⅛" free movement of the pedal.

1949-52—Pedal height should be adjusted at pedal stop screw to give 4⅝ to 4⅝ in. from bottom side of pedal to floor mat. Pedal lash should be adjusted at clutch fork link to give ⅞ to 1⅛ in. free travel.

CLUTCH, REMOVE & REPLACE

1935-42—Remove the transmission, being sure that its weight is not allowed to rest on the hub of the clutch disc. Remove the clutch housing bottom cover.

On the 1941-42 models, remove the control shaft inner bracket.

On all models, unhook the clutch pedal pull back spring and remove the clutch fork ball support, the clutch fork and the clutch throwout bearing.

Mark the flywheel and clutch cover so that assembly may be made in the same relative position. Then unfasten the cover from the flywheel and lower the clutch through the bottom of housing.

Assemble in the reverse order. being sure to align the flywheel and clutch cover marks before fastening these parts.

1946-52—A ball bearing clutch release bearing, which is piloted by a tubular support, concentric with and enclosing the transmission main drive gear, is used on these models.

When removing the transmissions preparatory to taking down the clutch, avoid damage to the release bearing support while the transmission is being pulled back to free the main drive gear.

With the transmission out, remove the clutch bearing support spring washer, clutch housing bottom cover and control shaft inner bracket. Remove the release bearing support and bearing, tapping the bearing support from inside the clutch housing. Mark the flywheel and cover so that the clutch may be assembled in the same position. This is necessary because there is no locating pin for guidance on reassembly. Unfasten the cover from the flywheel. Move the clutch away from the flywheel at the bottom and take out the clutch disc. Then lower the clutch through the bottom of the clutch housing. Assemble in the reverse order.

NOTE — Do not degrease the release bearing or wash it in any solvent. To do so will remove the lubricant packed in the ball races during manufacture and cause failure when reinstalled. Before assembling, try the release bearing on the bearing support to make sure no binding exists.

SYNCHROMESH TRANSMISSION

TRANSMISSION REMOVAL

1935 Early Production—This transmission is used before Serial Nos. 6AB-23423 on Master 6; 6AA-19858 on De Luxe 6, and 8AA-26175 on the 8's.

Remove front seat cushion. Take out the floor and toe boards. Disconnect the hand brake lever and speedometer cable. Remove the gearshift lever and transmission cover assembly. Disconnect the rear engine support from the transmission. Remove the rear cross member. Disassemble the universal joint ball and slip the ball housing back on the torque tube. Split the universal joint and lower the torque tube so that it rests on the frame cross member. Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper mounting holes. Pull the transmission straight back until the main drive gear shaft is free of the clutch disc hub. Lift the assembly out through the driver's compartment.

Replace in the reverse order, but when assembling the universal joint, use a suitable tool to hold the universal front yoke in place. Tool No. HM-178 is available for this purpose.

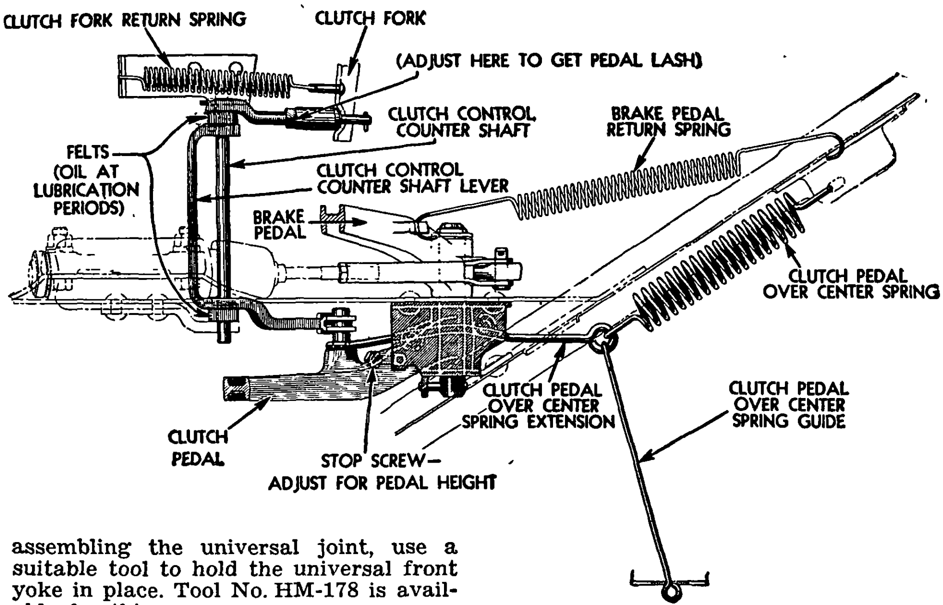


Fig. 14 Clutch pedal linkage, 1941-48

LATE 1935 & All 1936—This unit is used on 1935 cars after the serial numbers given above.

Since the seat cushion is not removable, it is necessary to remove the front seat as an assembly. Take out the floor and toe boards. Disconnect the universal joint. Remove the rear engine support cross member. Before removing the rear engine mounting on 6-cylinder cars, support the engine with a jack. Block up the torque tube until it touches the body cross sill. Slide the universal joint yoke and ball back as far as possible and place the yoke in a horizontal position. Disconnect the speedometer cable. Remove the gearshift lever. Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. Pull the assembly straight back until the main drive gear shaft is free of the clutch disc hub and lower the transmission to the floor by passing it below the torque tube.

NOTE—If there is not sufficient clearance for the transmission to pass below the torque tube, additional space can be obtained on the 6-cylinder cars by lowering the jack which is supporting the engine. On 8-cylinder cars, additional clearance can be obtained by removing the screws which attach the body sill to the body main sill, after which, remove the body sill.

Replace the transmission in the reverse order of removal. Tool No HM-178 is available to hold the universal joint ring in place when assembling the universal joint.

1937-38 — Take out the floor mat and floor center panel. Remove front seat assembly. Uncouple the speedometer cable. On 1938 cars with steering gearshift, disconnect the selector control cable from the selector plate hook and from the transmission case, then remove the cable from the case. Detach the outer lever from the transmission cover shift shaft. Disconnect the rear universal joint. Unbolt the propeller shaft housing from the transmission. Unfasten the rear engine support and jack up the engine at the rear to allow the transmission drain plug to clear the frame cross member. Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. Pull the transmission backward until the main drive gear is free of the clutch disc hub. Then push it forward and upward at the front to remove the transmission and coupling from the front propeller shaft and housing. Lift the assembly out through the floor opening.

Replace in the reverse order and see the *Gearshift* heading for service instructions on 1938 cars.

1939—Take out the floor mat and floor center panel. Disconnect the speedometer cable. Detach the gearshift controls from the transmission. Uncouple the rear universal joint and take out the propeller shaft. Remove bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. Slide the transmission straight back on the pilot studs until the main drive gear shaft is free of the clutch disc hub, then push it forward and upward at the front and lift the unit out through the floor opening.

NOTE — On 1939 eights, the transmission cannot be moved back far enough to clear the clutch housing due to interference of the frame X member. Therefore, it is necessary to remove the transmission rear bearing retainer and mainshaft after setting the gear in high speed position. Replace the unit in reverse order.

1940-52—The transmission may be removed from the chassis from below as follows:

1. Disconnect speedometer cable, gearshift selector rod and control rod from transmission.
2. Disconnect rear universal joint, using a wire or rubber band to prevent

trunnions from slipping off universal joint spider.

3. Remove propeller shaft by sliding it to the rear off the transmission mainshaft spline.

4. On 1948-52 models, remove transmission shifter lever spring yoke and extension to obtain working clearance when removing upper capscrew holding transmission to clutch housing. To avoid damage to shifter levers on shaft inside of transmission, remove shifter lever screw while holding shifter lever in neutral (center position). Then take off the shift lever.

5. On all models, remove the transmission upper capscrews and install two transmission guide pins. These pins can be made by cutting the heads off two transmission capscrews and sawing a screwdriver slot in the ends.

6. Remove lower capscrews and move transmission to the rear.

7. On 1949-52 models, bring the rear bearing extension into the intersection of the frame "X" members until main drive gear is free.

8. On all models, lower transmission to floor.

TRANSMISSION, OVERHAUL

1935-38—Figs. 16 and 17. After taking off the cover, disassemble as follows:

1. Unfasten mainshaft rear bearing retainer and twist it out of the countershaft notch.

2. Drive countershaft out through rear, allowing cluster gear to lie in case.

3. Hold first speed gear and withdraw mainshaft and rear bearing retainer through rear.

4. Remove front bearing retainer and snap ring and withdraw main drive gear.

5. Lift out cluster gear and thrust washers.

6. Remove lock screw, drive out reverse idler shaft and lift out gear.

7. To disassemble mainshaft, remove sliding sleeve and springs, and sychronizing drum. Press mainshaft out of bearing retainer and remove second speed gear.

8. To disassemble main drive gear, remove thrust nut (left-hand thread) and bump shaft on wooden block to remove bearing.

ASSEMBLY NOTES — Shielded side of main drive gear bearing faces gear. Make certain there are no nicks in the synchronizing cones as proper synchronization will be prevented.

TRANSMISSION, OVERHAUL

1939-52—Figs. 18 and 19. Disassemble as follows:

1. Remove external shift parts and take off cover.

2. Unfasten rear bearing retainer and withdraw mainshaft assembly.

3. Remove internal shifter parts.

4. Drive countershaft out through rear, allowing cluster gear to lie in case.

5. Release snap ring and push main drive gear into case and lift out.

6. Remove cluster gear.

7. Drive in the retaining pin, push out reverse idler shaft and lift out gear.

8. To disassemble mainshaft, expand wire retainer and slide second speed drum from shaft. Release snap ring and thrust washer and slide off second speed gear.

9. To disassemble the main drive gear, expand wire retainer and remove synchronizing drum. Release snap ring and washer and bump the shaft of a wooden block to remove bearing.

NOTE—On 1946-52 models, the main drive gear shaft, Fig. 20, is undercut to accommodate the main drive gear oil seal. An oil slinger is installed next to the transmission front bearing and held in place by a spring washer and snap ring. When the transmission is installed, the oil slinger extends over the flared end of the clutch release bearing support.

ASSEMBLY NOTES — When replacing the main drive gear bearing, make sure that the shielded side is placed toward the gear. Press the bearing firmly in place, using a tube placed over the gear shaft and pressing on the inner race of the bearing.

Make sure that the high and second speed clutch slides freely on the mainshaft. The synchronizing drums must be smooth and free from scores. They must also show the heaviest contact on their large diameters for best results when synchronizing. Make sure that the oil grooves are cleaned.

To assemble the countergear, insert a dummy shaft in place of the regular countershaft and insert 25 needle rollers at each end of the gear, Fig. 21, after using a libertal supply of vaseline or lubriplate to hold them in position. Coat the bearing retainers and thrust washers with lubricant and position them at each end of the cluster.

Lay the countergear assembly in the bottom of the case until the main drive gear is installed. When this has been done, position the cluster gear assembly and install the countershaft from the rear of the case, pushing the dummy shaft out through the front. Align the slots in the case and the shaft and insert the lock ball before driving the countershaft to its final position.

When installing the idler shaft pin, its outer end should be ¾" from the outside of the transmission case.

HYDRA-MATIC DRIVE

A step-by-step pictorial service procedure is given in the *Hydra-Matic* chapter in this book. The following material covers external adjustments.

Fig. 16 Transmission gears, 1935-38

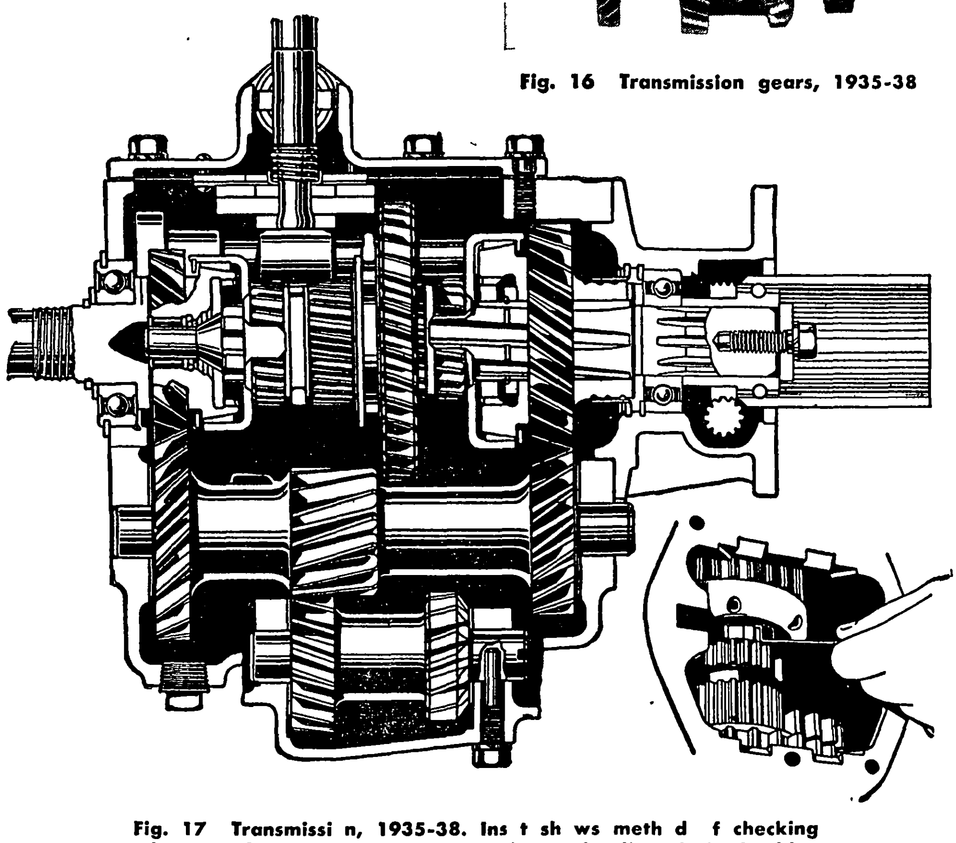


Fig. 17 Transmissi n, 1935-38. Ins t sh ws meth d f checking cl arance between synchr nizer spring and spline shaft sh ulder

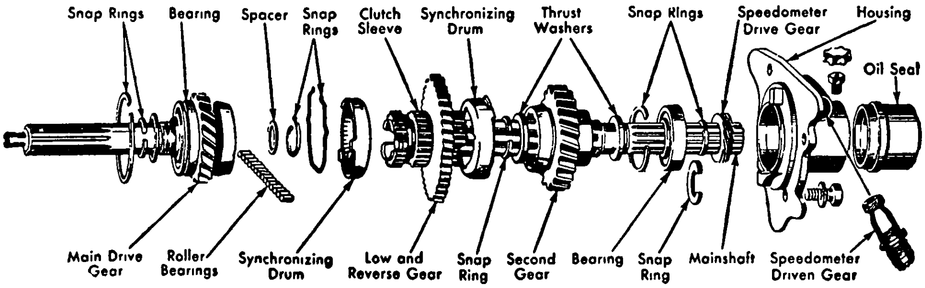


Fig. 18 Synchromesh transmission main drive line, 1939-52

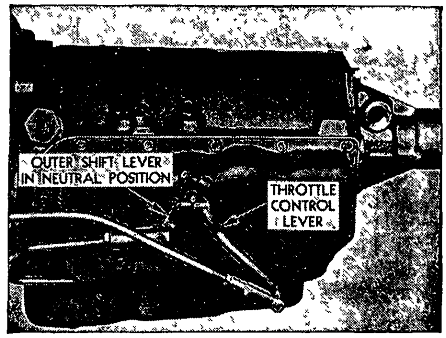


Fig. 22 1948 Hydra-Matic c ntr l levers

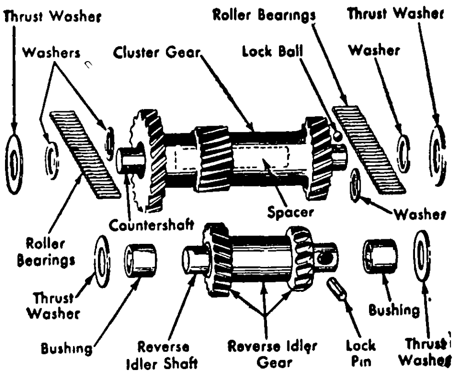


Fig. 19 Synchromesh transmission clust r gear and reverse idler g ar d tails, 1939-52

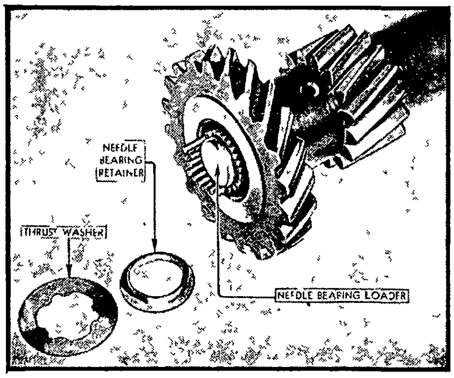


Fig. 21 Assembling countershaft rollers on synchromesh transmission, 1939-51

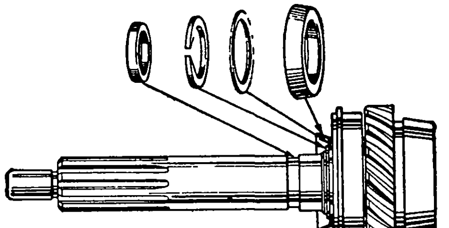


Fig. 20 Oil seal and slinger n synchr mesh transmission main drive gear, 1946-52

1948 ADJUSTMENTS

Throttle Control Linkage—Linkage operation will not be satisfactory if binding or excessive wear exists. To adjust the linkage, proceed as follows:

1. Disconnect the throttle control lever at the side of the transmission, Fig. 22.

2. Adjust engine idle speed to 375 RPM with engine warm, transmission warm, and control lever in neutral.

3. On 8-cyl. disconnect carburetor throttle rod from lever on cross shaft. On 6-cyl. disconnect carburetor throttle rod from throttle control intermediate lever.

4. Install linkage adjusting pin through holes in lever and bracket at A, Figs. 23 and 24.

5. Adjust carburetor throttle rod at trunnion so that trunnion will enter lever on cross shaft (8-cyl.) or intermediate lever (6-cyl.) while idle adjusting screw is seated against its stop. Tighten trunnion jam nut securely and assemble trunnion to lever. *Leave adjusting pin installed.*

NOTE—On 6-cyl. models the carburetor throttle rod should be positioned with the bend in the rod upward away from the ignition wires before the trunnion jam nut is tightened.

6. Install adjusting pin through holes in levers and bracket at B, Fig. 25. If pin does not enter freely, adjust throttle control rear rod at trunnion in throttle control idler lever. Tighten the trunnion jam nut securely and assemble trunnion to idler lever. *Leave adjusting pin installed.*

7. Install adjusting pin through holes in lever bracket at C, Fig. 26. If pin does not enter freely, adjust transmission throttle front rod.

8. Remove three gauge pins from A, B and C.

9. Tighten clamp bolt in transmission throttle outer lever, Fig. 22, and check its position as follows:

10. Clean machined surface at back of transmission case, Fig. 27, and place the gauge shown flat against the surface with the edge of the gauge against the transmission side cover.

11. With the outer lever held against the stop (toward rear of transmission) move gauge upward toward the clevis pin installed in the lever. When moved upward the notch in the gauge should pass over pin on the inside face of the throttle control lever (toward transmission) and should just touch the outer side face of the gauge.

12. If the gauge does not pass over the pin freely, bend the lever with the tool shown in Fig. 28. Avoid twisting lever or springing shaft during bending operation. Recheck the position of the lever with the gauge.

NOTE—The rear transmission throttle rod must operate freely. Bend rod if necessary to secure proper alignment with transmission throttle lever without bind at front end of rod.

13. Adjust the rear transmission throttle rod clevis with transmission throttle lever toward rear, against stop in transmission. When clevis pin enters the holes, shorten the clevis *one turn.* Connect rod to lever and tighten jam nut.

Shift Control Linkage—Linkage operation will not be satisfactory if binding or excessive wear exists. To adjust the linkage, proceed as follows:

1. Tighten the gearshift shaft upper bracket clamp screw while holding the hand control lever firmly down in the LO position.

2. Move control lever to the R position.

3. Back up trunnion jam nuts at top of front shift rod.

4. Tighten gearshift control shaft lower bracket.

5. Disconnect rear shift rod from lever at side of transmission.

6. Tighten transmission shift lever clamp bolt.

7. Install linkage adjusting pin through holes in lever and bracket at D, Fig. 29.

8. Move transmission shift lever to reverse position toward rear of transmission. Rotate propeller shaft by hand to insure complete engagement of the reverse anchor and teeth on reverse internal gear.

9. Adjust clevis of rear shift rod so that clevis pin will pass freely through clevis and lever. Tighten clevis jam nut securely and assemble rod to transmission lever.

10. Remove adjusting pin from point D, Fig. 29.

11. Move shift lever at side of transmission to LO position (first detent in front of reverse position).

12. Place hand control lever against stop (LO position) which prevents movement into reverse position without raising control lever.

13. Turn lower jam nut on front shift rod up until it contacts trunnion, Fig.

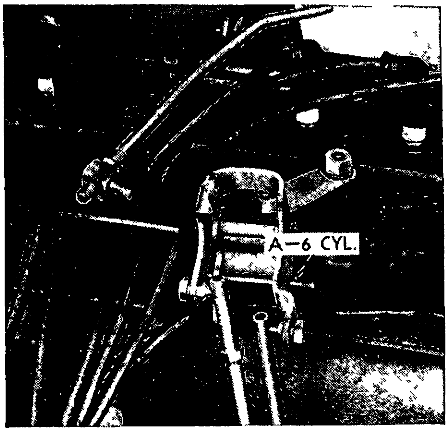


Fig. 23 Adjusting pin installed at A n 6-cylinder 1948-49 Hydra-Matic

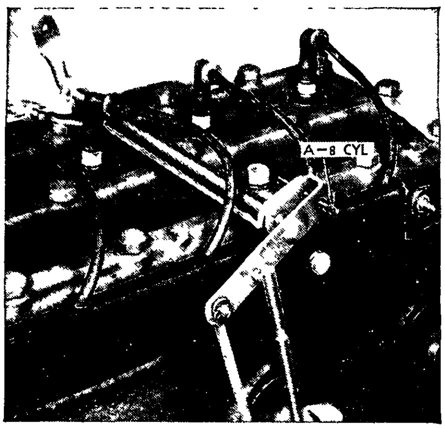


Fig. 24 Adjusting pin installed at A n 8-cylind r 1948-49 Hydra-Matic

30. Turn *one* more turn against trunnion.

14. Tighten upper jam nut down on trunnion.

Starter Interlock — This adjustment is necessary on 1948 models with foot-controlled starter switch.

1. Disconnect battery cable from starting motor.
2. Tighten two bolts which attach gearshift neutralizer lever to starter lever.
3. With starter lever pedal depressed all the way down against stop in switch, adjust length of interlock rod by means of adjusting nuts so that the shift indicator (under steering wheel) is returned from any shift position to exact neutral position when starter pedal is fully depressed, Fig. 31.
4. Lengthen interlock rod one full turn of trunnion nuts and lock trunnion nuts securely.

Throttle Cracker — This adjustment is necessary on 1948 models with foot-controlled starter switch.

1. Disconnect battery lead at starter motor.
2. With fast idle cam (on carburetor) in "Hot" position, place .115" shim (8-cyl.) or .138" (6-cyl.) between end of idle adjusting screw and its stop.

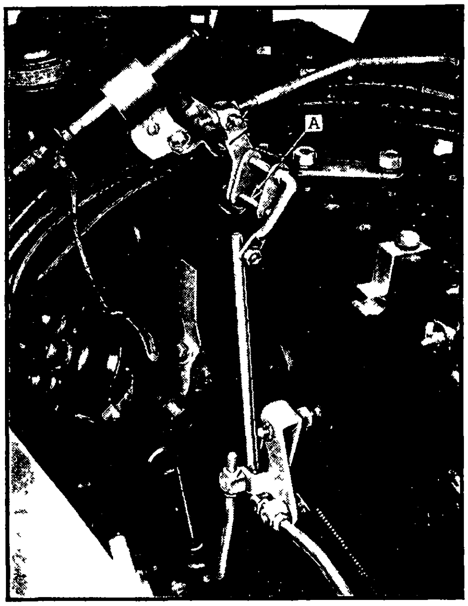


Fig. 24A Adjusting pin installed at "A." 1950-52 Six Hydramatic

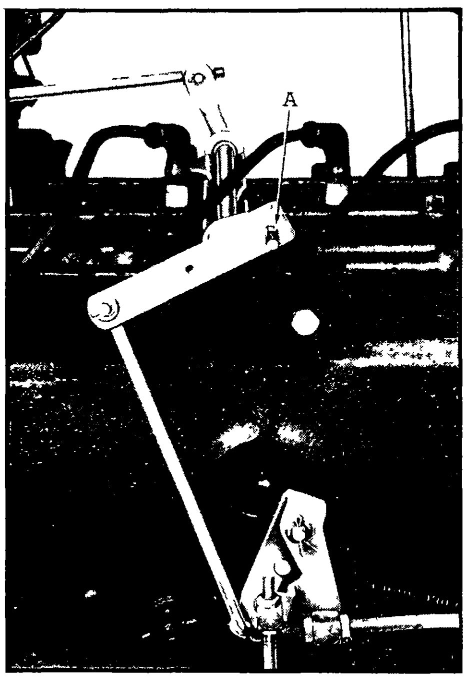


Fig. 24B Adjusting pin installed at "A." 1950-52 Eight Hydramatic

3. Depress starter pedal to full starting position and adjust starter pedal throttle cracker lever A, Fig. 32, to take up clearance between lever and pin B.

NOTE—Be sure end of pin B does not rub against the throttle control lever to which lever A is fastened.

1949-51 ADJUSTMENTS

Throttle Control Linkage—Linkage operations will not be satisfactory if binding or excessive wear exists. Take corrective measures and then adjust as follows:

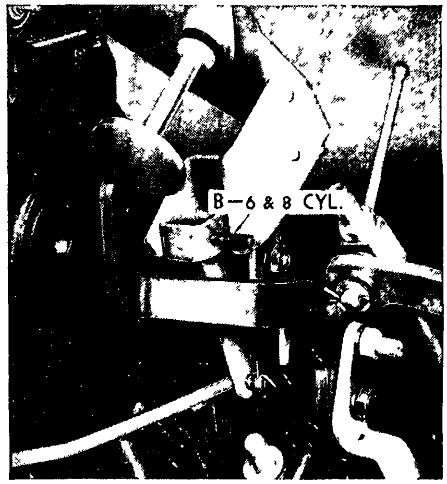


Fig. 25 Adjusting pin install d at B on 1948 Hydra-Matic

Fig. 26 Adjusting pin install d at C on 1948 Hydra-Matic

1. Remove cotter pin and washers from trunnion on transmission throttle (rear) rod at transmission throttle control outer lever.
2. Adjust engine idle speed to 365-385 RPM with engine temperature 150-160 degrees, transmission warm and control lever in neutral.
3. Install linkage adjustment gauge pin through holes in lever and bracket at "A',, Figs. 23, 24, 24A, 24B.
4. With idle screw seated against its stop, adjust length of carburetor throttle rod (at carburetor rod lock nuts) so that adjustment gauge pin is free in hole "A". Leave pin installed. Tighten lock nuts securely.
5. Install second linkage adjustment gauge pin through transmission throttle rod idler lever and bracket in hole marked "B", Figs. 33 and 33A.
6. If pin does not enter hole "B" freely, adjust transmission front rod at trunnion. Tighten lock nuts securely.
7. On 1949 models, leave both gauge pins installed. Then loosen the front check nut on rear throttle rod. Turn rear check nut to force dash rocker lever lightly against stop at "C", Fig. 34.

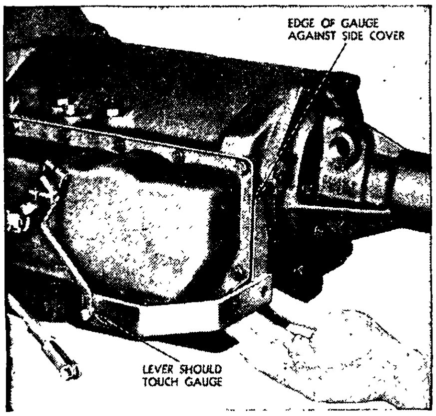


Fig. 27 Checking position of throttle contr l lever n 1948-52 Hydra-Matic

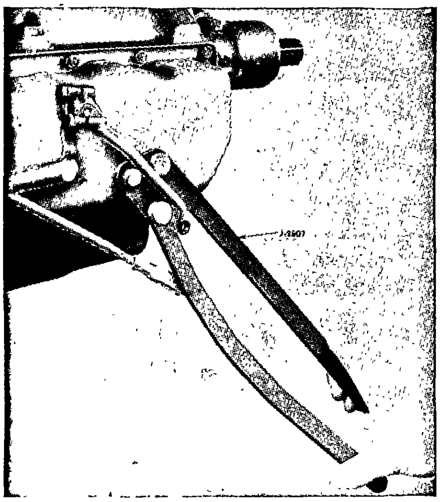


Fig. 28 B nding throttle control lever on 1948-52 Hydra-Matic

Back off rear check nut three full turns and tighten front check nut back to lock both check nuts securely.

8. On 1949-52 models, remove gauge pins from "A" and "B".

9. On 1950-52 models, with carburetor in full open position, adjust accelerator pedal rod trunnion at throttle control idler lever so that accelerator pedal clears floor mat by approximately ¼ in. at closest point. Tighten lock nuts at trunnion securely.

10. On 1949-52 models, tighten clamp bolt in transmission throttle control outer lever 12-15 lbs. ft. torque. Then check position of outer throttle lever as follows: (A) Clean machined surface at back of transmission case and place throttle lever checking gauge at shown in Fig. 27. (B) Back off rear check nut at throttle rod trunnion. With outer lever held against stop (toward rear of transmission) move gauge upward toward trunnion pin installed in lever. When gauge is moved upward, notch in gauge should pass over pin and inside face of throttle control lever should just touch outer face of gauge, Fig. 27. (C) If gauge does not pass over pin freely, bend lever, using tool shown in Fig. 28. (D) Recheck

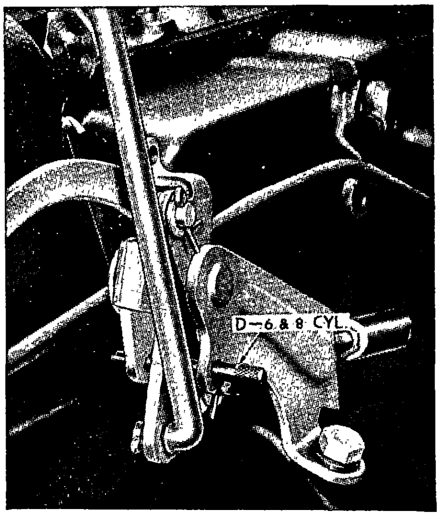


Fig. 29 Adjusting pin installed at D on 1948 Hydra-Matic

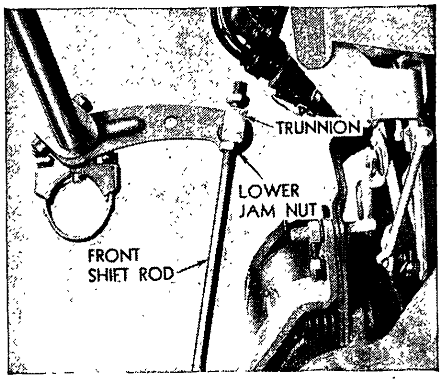


Fig. 30 Lower jam nut contacting trunnion, 1948 Hydra-Matic

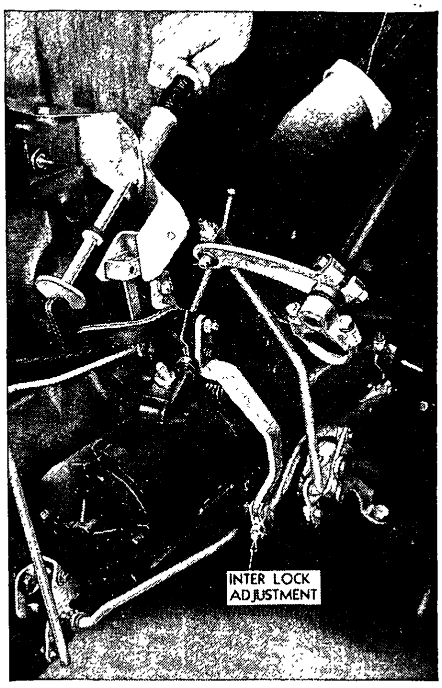


Fig. 31 Start r int rl ck adjustment, 1948 Hydra-Matic

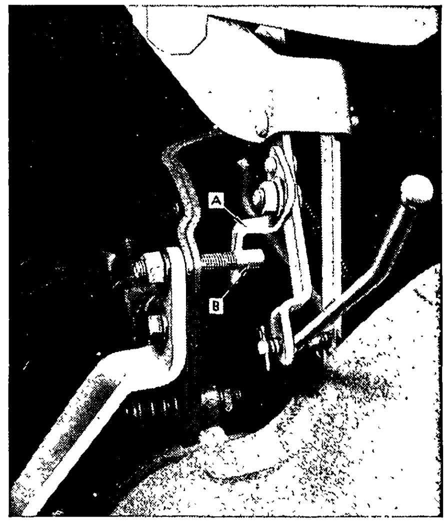


Fig. 32 Throttle crack r adjustm nt, 1948 Hydra-Matic

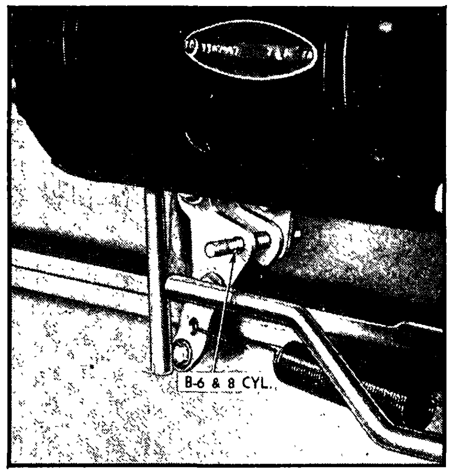


Fig. 33 Gauge pin install d at B on 1949 Hydra-Matic

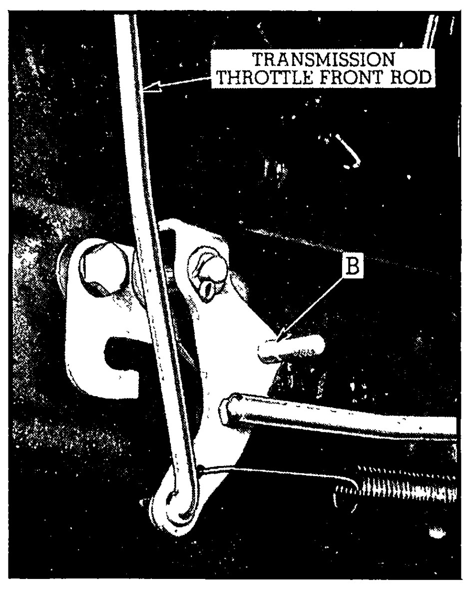


Fig. 33A Adjusting pin installed at 'B." 1950-52 Hydramatic

Fig. 34 Stop at C on 1949 Hydra-Matic

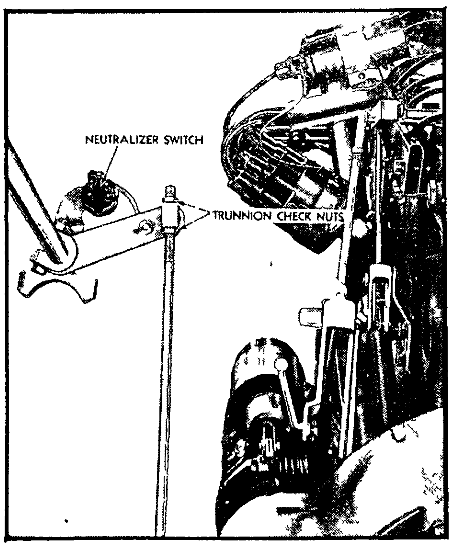


Fig. 35 Shift control adjustment, 1949-52 Hydra-Matic

adjustment, making corrections as required.

11. With transmission throttle lever toward rear, lightly against stop in transmission, adjust rear transmission throttle rod to length by moving check nuts. Shorten rod length by turning check nuts one full turn forward. Lock check nuts securely.

12. Install spring washer, flat washer, and cotter key in transmission rear throttle rod trunnion.

Shift Control Linkage—

1. Tighten gearshift control shaft upper bracket clamp screw while holding control lever (under steering wheel) firmly down in LO position.

2. Back off both trunnion check nuts at top of shift control rod, Fig. 35.

3. Make sure transmission outer shift lever is in LO detent position (second position from rear).

4. With both control levers in LO position, turn lower check nut against trunnion finger tight. Lengthen rod by turning lower check nut one additional full turn. Lock check nuts securely.

Neutralizer Switch—

1. Place manual control lever in DR position.

2. Loosen switch bracket clamp screw, Fig. 36.

3. Adjust neutralizer switch bracket to a position where starter will not operate when starter button on dash is depressed.

4. Place manual control in N position.

5. Make certain that neutralizer switch arm does not touch stop on switch bracket.

6. Tighten clamp screw securely.

HYDRA-MATIC ADJUSTMENTS

1952—Except for slight changes in the selector lever linkage adjustment and the neutralizer switch adjustment, all adjustments with the transmission on the car are the same as in 1951. The new procedures for adjusting the selector lever and neutralizer switch linkage are necessary because of the new indicator head.

SELECTOR LEVER LINKAGE—

1. If the gearshift control shaft upper bracket is loose, tighten the clamp screw while holding the selector

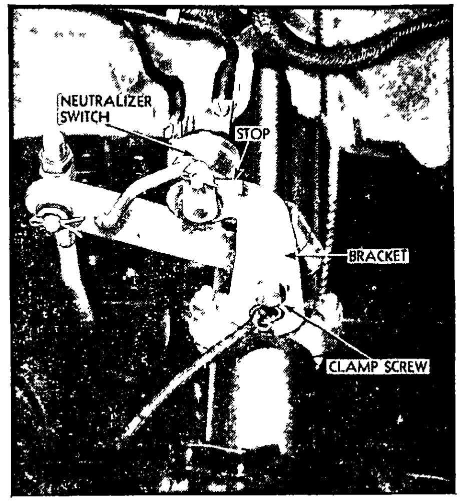


Fig. 36 Neutralizer switch adjustment, 1949-52 Hydra-Matic

lever firmly against the stop between the right hand drive position and LO.

2. Place selector lever in right hand drive position (DR▲) which prevents accidental shift to LO.
3. Back off both gearshift control rod trunnion lock nuts.
4. See that transmission outer shift lever is in the three-speed drive position (third position from front or rear).
5. Turn lower trunnion nut against trunnion (finger tight) to remove clearance in linkage. Then lengthen rod by turning rear trunnion one full turn. Tighten upper lock nut securely.

NEUTRALIZER SWITCH—The neutralizer switch linkage should be adjusted the same as on 1951 models except that in Step 1 the selector should be positioned over the left arrow (four-speed range) in drive range (▲DR).

GEARSHIFT

GEARSHIFT, ADJUST

1938—To maintain the position of the hand control lever, two adjustments are provided, namely: selector position and engagement position. To adjust the selector position, set the hand control

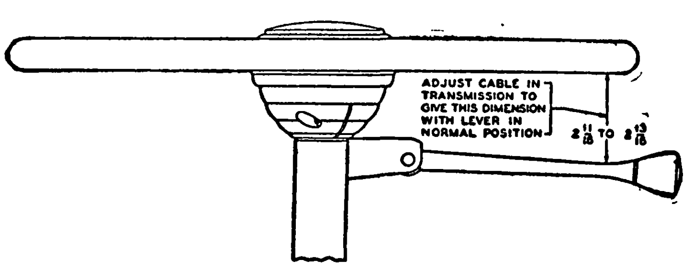


Fig. 37 G arshift lever p sition, 1938

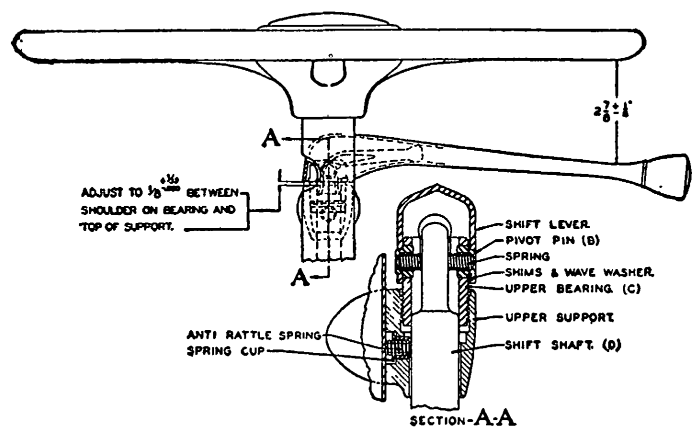


Fig. 38 G arshift lever adjustment, 1940-48 with synchr m sh transmissi n

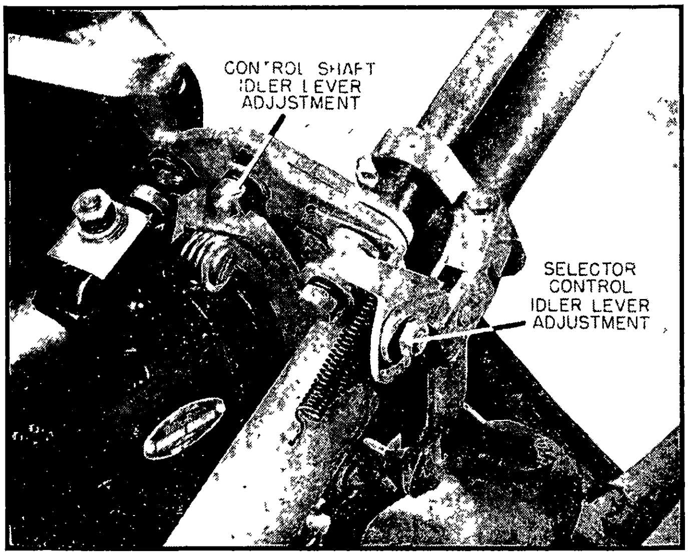


Fig. 39 Gearshift lever adjustment. 1939-48 with synchromesh transmission

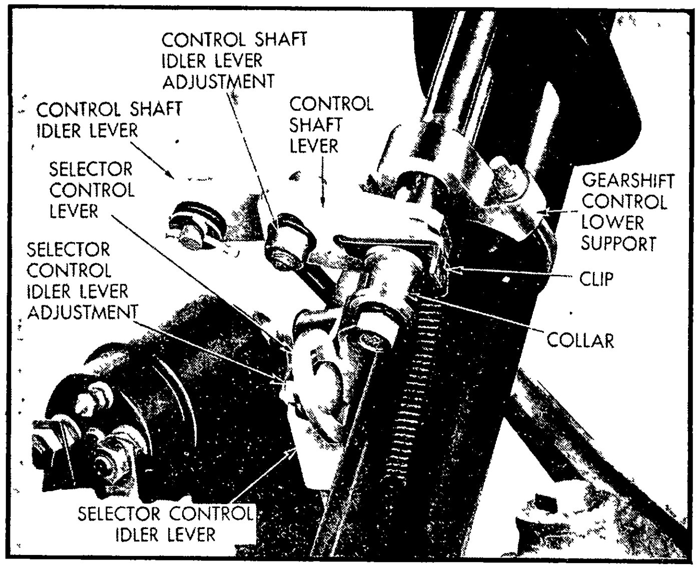


Fig. 39A Details of lower gearshift contr ls. 1949-52 with synchromesh transmissi n

lever and transmission gears in neutral. Take out the front floor center plate. Remove the inspection hole cover from the transmission cover. There are two lock nuts at the end of the selector cable where it is attached to a hook on the selector plate inside the transmission case. Turn the lock nuts in the desired direction until the distance between the hand control lever and the rim of the steering wheel is as shown in Fig. 37. Turning the nuts toward the end of the control cable increases the distance. Tighten the lock nuts securely and replace the inspection hole cover and center floor plate.

To adjust the engagement position, loosen the lock nut on the eccentric ball stud located at the transmission outer lever. Turn the stud until the shift lever is in a horizontal position. Tighten the ball stud lock nut securely.

NOTE—If the shift control rod has been disassembled, assemble the parts and screw the end plugs firmly against their seats and back off from 1/8 to 3/8 turn and install cotter pins.

1939-48—A clearance of 1/8" must be maintained between the shoulder on the control shaft upper bearing and the top of the support so there will be no interference at this point when selecting gears. Screwing the bearing out of the support 1/2 turn increases this clearance 1/32".

On 1939 cars, adjustment of the shift lever position with relation to the steering wheel rim is provided by a screw at the lower end of the control shaft, below the idler lever. This screw is swiveled on the end of the selector cable and has a rubber cover. Backing out this screw raises the lever, and screwing it in, lowers the lever. The distance between the shift lever and the rim of the steering wheel should be from 2 7/8" to 3 1/8", and is measured in the same manner as shown in Fig. 37 for 1938 cars. When this dimension is obtained, tighten the lock nut securely and replace the rubber cover.

On 1940-48 cars, the shift lever position should be adjusted as shown in Fig. 38. To make the adjustment loosen the adjusting bolt which clamps the selector control lever to the idler lever. Move the shaft lever to the desired position while holding the selector rod in the second and high position, then tighten the bolt.

On all 1939-48 models, the control lever may be lowered a maximum of 1 1/2" from the horizontal—measured from the control lever knob. To move the lever toward or away from the driver, loosen the clamp bolt which holds the idler lever to the control shaft lever, Fig. 39. Then move the control lever to the desired position and tighten the bolt.

1949-52—A clearance of 1/8 in. must be maintained between the shoulder of the control shaft upper bearing and the top of the support so there will be no interference at this point when selecting gears. Screwing the bearing out of the support 1/2 turn will increase this clearance 1/32 in. To do this the pivot pins and shift lever will have to be removed from the upper bearing while the adjustment is made.

The neutral shift lever position with respect to the distance from the steering wheel should be 2 3/4 in. (plus or minus 1/8 in.). To adjust, loosen the adjusting bolt, Fig. 39A, which clamps the selector control and idler levers together and move the shift lever to the desired position while holding the selector rod in its rearmost position (which is normal position for second and high gear). Tighten bolt and recheck position with lever in neutral.

The gearshift lever, if correctly adjusted, is approximately horizontal when in neutral. To adjust the shift lever in the plane of rotation about the steering column, loosen the clamp bolt holding the control shaft idler lever to the short idler lever, Fig. 39A, and move the shift lever to the desired position. Retighten clamp bolt.

REAR AXLE

REAR AXLE SERVICE

1935-36—Fig. 40. The pinion is adjusted by a thick spacer and shims between the front double-row bearing and the differential carrier shoulder. The drive pinion is splined and pressed in the propeller shaft, and end movement is prevented by a pin riveted through the shaft coupling and the propeller shaft. The double-row bearing is built with no looseness or end play, nor is it adjustable for end play. If there is any looseness between the race and cone, it is probably caused by abrasive matter in the lubricant which wore down the balls.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, riveting or bolting on the ring gear, checking ring gear and pinion backlash and other differential case operations is given in the *Rear Axle Chapter*.

To replace the pinion and bearings, it is necessary to take out the rear axle assembly, unbolt the differential carrier from the axle housing, remove the axle shafts and, after removing the differential bearing caps and adjusting nuts, lift the differential from the carrier.

PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, take out the three tapered bearing retaining screws from the side of the housing. Jar the carrier so that the splined end of the propeller shaft will strike on a wooden block and the propeller shaft will slide out. Remove the bearing adjusting shims from the inside of the torque tube, noting their number and total thickness.

To disassemble the drive pinion from the propeller shaft, file off one head of the straight pin which fastens these parts together, and drive out the pin. Pull the pinion shaft from the propeller shaft. Remove the pinion bearing lock

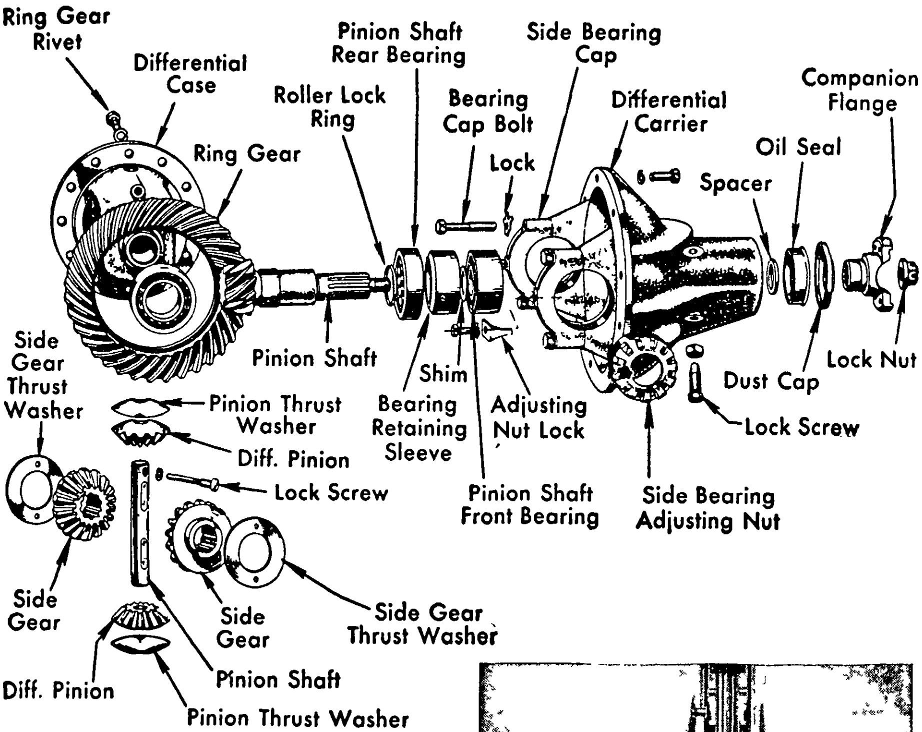


Fig. 42 Rear axle, 1937-46

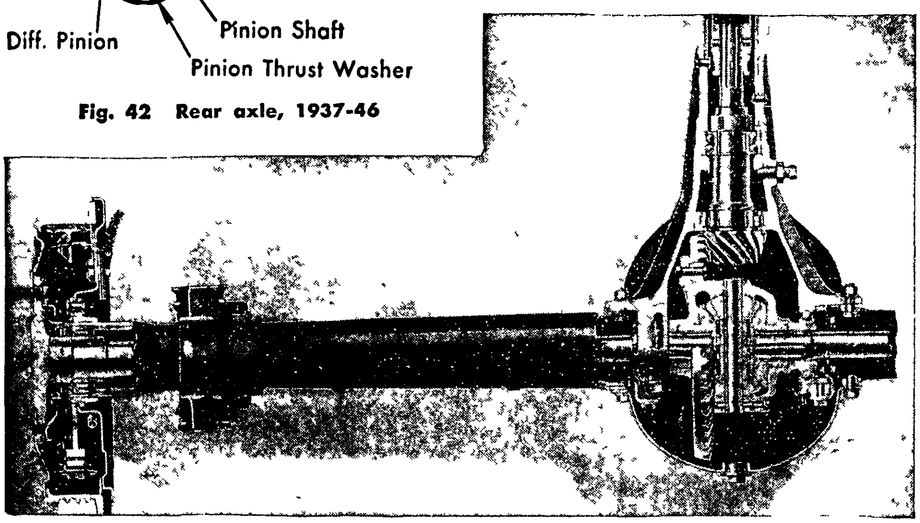


Fig. 40 Rear axle, 1935-36

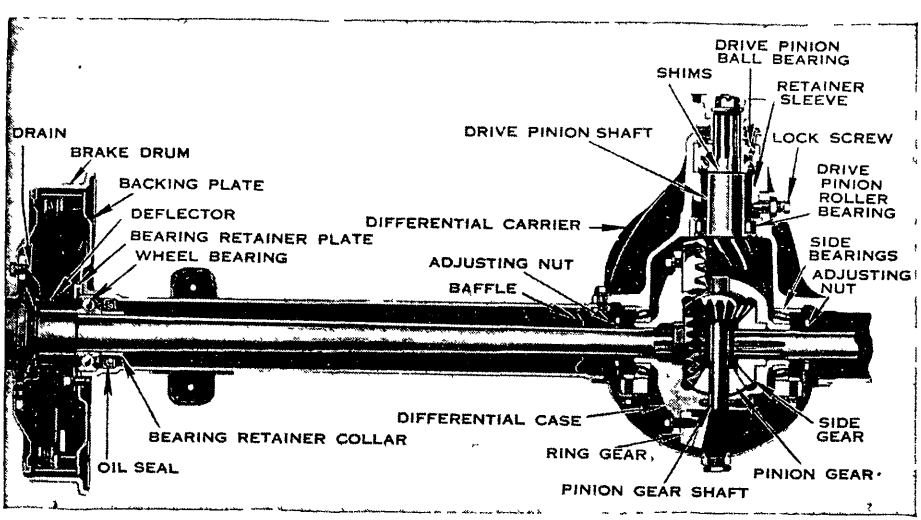


Fig. 41 R ar axle, 1937-46

nut and press the bearing from the pinion. Take out the bearing lock sleeve and, after releasing the rear bearing lock ring, remove this bearing.

To assemble, install the rear bearing on the pinion shaft and fit the lock ring in its groove in the shaft. Place the lock sleeve with its beveled side toward the pinion. Press the front (double-row) bearing on the pinion shaft and install the lock nut.

The pinion assembly may now be assembled to the propeller shaft by pressing the splined end into the coupling on the end of the propeller shaft so that the rivet hole in both shafts line up Insert a new rivet and peen over both ends. Tighten the bearing lock nut and lock it in the milled slot in the pinion shaft.

PINION & PROPELLER SHAFT, ASSEMBLE—Install the same thickness of shims in the counterbore of the torque tube that were removed when the assembly was dismantled. Make sure the shims are flat in the counterbore and not cocked. Shims are available in several thicknesses so that a suitable combination may be selected to replace the original ones if they are damaged, or if another combination is needed to secure proper location of the pinion if a new gear set is installed. If a new gear set is to be used, one .015 and one .018 inch shim should be installed as this is the standard set-up. A .188 inch spacer is used in conjunction with the shims.

Lubricate the bearings thoroughly and coat the bearing surface of the lock sleeve with rear axle lubricant. Install the propeller shaft, driving it down until the bearings are seated in the housing. Check through the lock screw holes in the side of the housing to make sure that the lock sleeve is up against the back of the double-row bearing. Install the three tapered screws, drawing them down evenly and tightly, then tighten the lock nuts.

If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the parts and, if the pinion is to be moved toward the center of the axle, add shims; if it is to be moved away from the center of the axle, remove shims.

If no pinion setting gauge is available, assemble the differential unit and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*. When the adjustment is correct, set it securely with the lock screws and lock nuts.

REAR AXLE SERVICE

1937-46—Figs. 41 and 42. The pinion is adjusted by shims between the shoulder of the pinion shaft and the inner race of the double-row ball bearing. This bearing is built with no looseness or end play, nor is it adjustable for end play. If there is any looseness between the race and cone, it was probably caused by abrasive matter in the lubricant which wore down the balls.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash, and

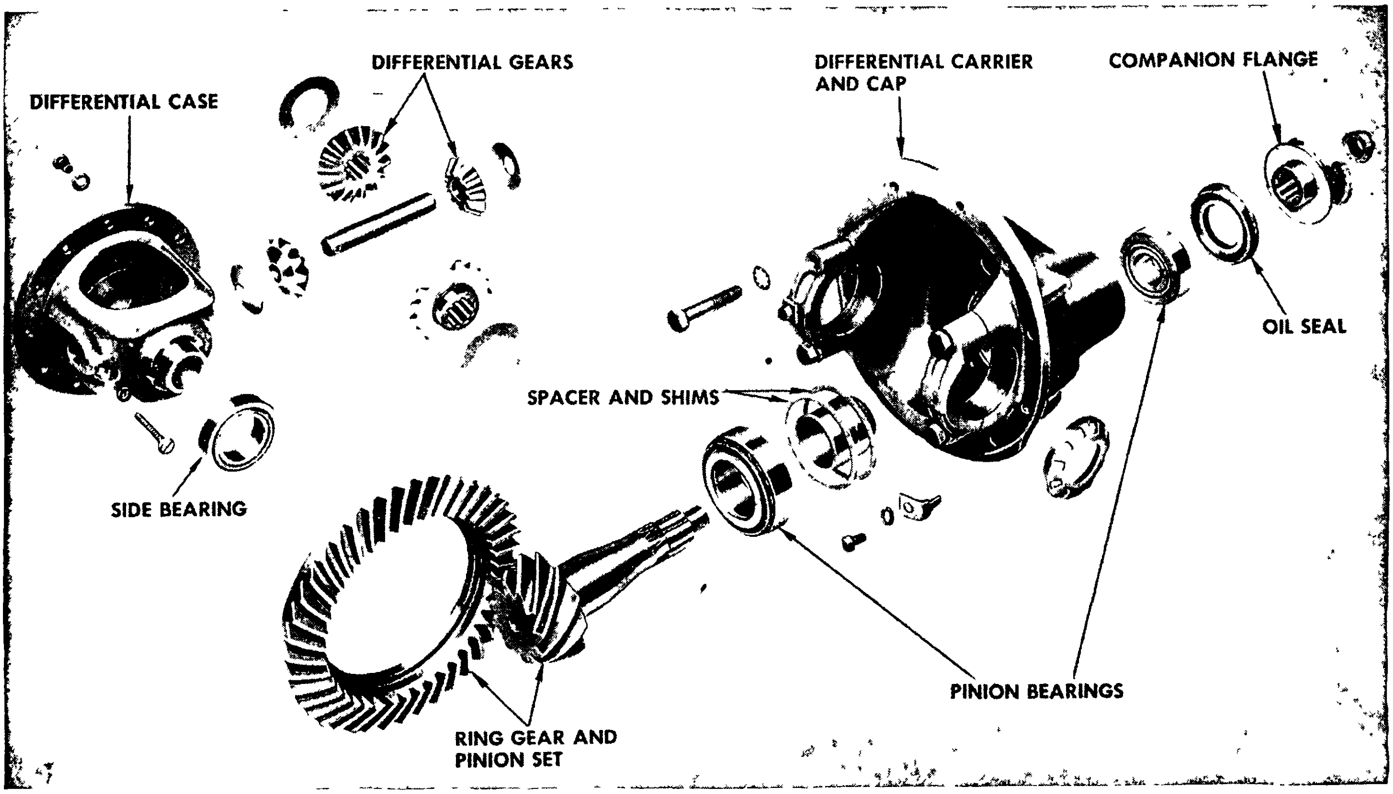


Fig. 45 Rear axle, 1947-52

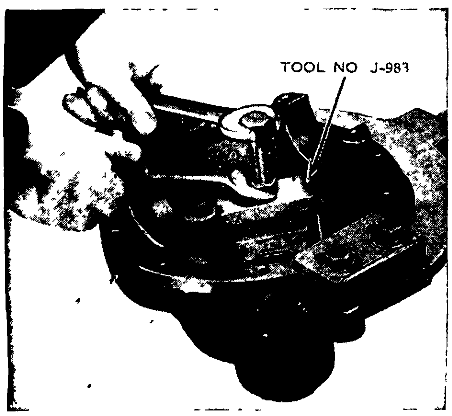


Fig. 43 R moving drive pinion b aring uter race, 1937-46

other differential case operations, is given in the *Rear Axle Chapter.*

PINION & BEARINGS, REPLACE—The inner race of the double-row bearing is a press fit on the pinion shaft and the outer race is locked in the differential carrier by three pointed screws which bear against a sleeve. The outer race of the rear roller bearing is pressed into the differential carrier. An inner race is not necessary as the hardened and ground shaft furnishes a race for the rollers.

To remove the drive pinion, disconnect the rear universal joint, unbolt the differential carrier from the axle housing, take out the axle shafts and, after removing the differential bearing caps and adjusting nuts, lift the differential from the carrier.

Fasten the carrier in a vise or fixture and, after removing the pinion flange nut, pull off the flange. Mount the carrier in an arbor press and force the pinion shaft back through the bearing. After removing the pinion, make note of the total thickness of shims used so that, if necessary, the pinion may be replaced in its original position. The snap ring, which acts as a spacer between the pinion head and the rear bearing rollers, should *not* be removed from the shaft.

NOTE—After the rear bearing rollers have been running for some time under load, they may be removed singly from the race. When this is possible, the roller bearing race may be removed from the carrier with the tool shown in Fig. 43. However, if the rollers cannot be taken out singly, the bearing assembly may be removed after loosening the three pointed screws from the carrier casting. The bearing may then be pressed through the rear of the differential carrier by applying force to the bearing race under an arbor press. The double-row bearing may be removed by taking out the three lock screws. Then, after removing the lock sleeve, tap the bearing from the housing.

NOTE—The diameter of the roller path on the pinion shaft should be checked with a micrometer. If the micrometer reading shows more than .0007 inch undersize when compared with the unused portion of the shaft (just ahead of the roller path) a noisy gear will probably result. If a micrometer is not available, mount the pinion in the carrier with the original shims. If excessive radial clearance is observed in the

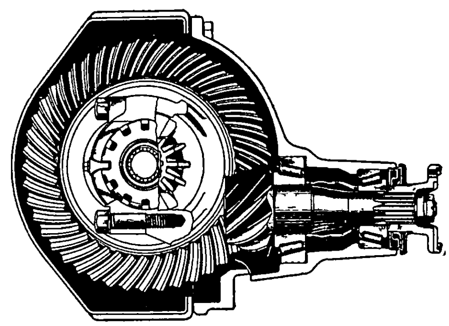


Fig. 44 Rear axle, 1947-52

roller bearing when the pinion is forced up and down by hand, the gears will not run quietly. Excessive radial clearance may be due to undersize rollers or wear on the pinion shaft at the roller path. If the roller path does not show excessive wear, a new bearing may correct the condition. If the excessive clearance is caused by a worn pinion shaft, a new ring gear and pinion must be installed.

To assemble the drive pinion, push the double-row bearing into the housing, tapping lightly on its outer race, if necessary. With the tapered end of the bearing lock sleeve toward the rear, slide the sleeve up against the outer race of the ball bearing and lock in place with the three pointed screws.

Drive the outer race of the rear roller bearing into the housing. Coat the rollers with heavy grease and slip them in the race. Install the original thickness of shims that were removed when the assembly was dismantled. Make sure the shims are flat and not cocked. Shims are available in several thicknesses so that a suitable combination may be

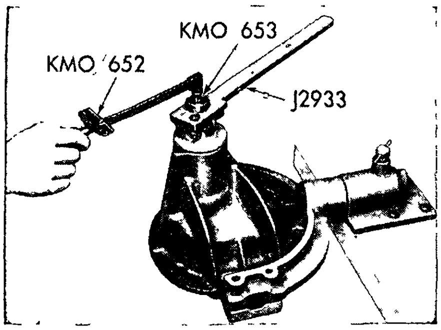


Fig. 46 M asuring pinion bearing preload with t rqu wrench, 1947-52

selected to replace the original ones if they are damaged, or if another combination is needed to secure proper location of the pinion if a new ring gear set is installed.

Install the pinion in the carrier, replace the pinion flange and tighten the retaining nut securely. Do not install the oil seal until the drive pinion is located properly.

If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, press out the pinion shaft and, if the pinion is to be moved toward the center of the axle, add shims; if it is to be moved away from the center of the axle, remove shims.

If a pinion setting gauge is not available, assemble the differential unit in the carrier, adjust the bearings and backlash, and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*. When the adjustment is correct, remove the pinion flange, install the oil seal, replace the flange and tighten the nut securely. Be sure the three pointed screws are tight and their lock nuts secure.

REAR AXLE SERVICE

1947-52—This axle, Figs. 44 and 45, is similar to the 1946 axle except for changes to permit the use of tapered roller pinion bearings.

The splined companion flange is fastened to the pinion stem with a special nut which seats directly on a counterbore in the flange. The nut is retained by staking the end of the pinion stem into two slots milled on top of the nut.

The drive pinion is mounted on preloaded taper roller bearings. Adjustment of the pinion along its axis is obtained by shims placed between the rear bearing outer race and a shoulder in the carrier. Adjustment of preload of the two bearings is obtained by tightening the companion flange nut which compresses a sleeve over the pinion stem between the bearings. Both bearing outer races are pressed into the carrier, the rear race against pinion adjusting shims, the front race against the shoulder in the carrier. The rear bearing inner race is pressed onto the pinion stem to a shoulder at the pinion end. The front bearing is a light press to a close sliding fit on the pinion stem.

The threaded nut type of differential bearing adjustment is used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing a ring gear, checking ring gear and pinion backlash and other differential case operations, is given in the *Rear Axle Chapter.*

PINION & BEARINGS, REPLACE—After removing the differential unit from the carrier, unscrew the pinion flange retaining nut and pull off the flange. Press the pinion out of the front bearing and through the rear end of the carrier. The rear bearing cone and bearing spacer will come out with the pinion. The bearings may then be removed and installed with suitable pulling equipment.

Reverse the operations to assemble and, after pressing on the pinion flange, slip on the washer and nut. Tighten the nut until the bearings have a preload drag of 27 to 37 inch pounds on new bearings or 10 to 12 inch pounds on used bearings to rotate the pinion shaft.

To adjust the preload, draw up the nut until the spacer starts to buckle. Check the pull as shown in Figs. 46 or 47, depending upon the equipment available. This adjustment must be made every time the flange nut is removed or loosened. If the adjustment is to be made with the differential unit in the carrier, the rear wheels must be jacked off the floor.

The pinion can be moved in toward the center of the axle by removing the required thickness of shims from between the spacer and the carrier. If it is to be moved away from the center of the axle, add shims.

NOTE—A new spacer is required between the pinion bearings when a new ring gear and pinion set is installed, either outer or inner members of either pinion bearing is changed, a new carrier casting used, or pinion adjusting shim thickness is increased. When the same pinion flange is removed and reinstalled as when an oil seal is replaced, checking for pinion bearing preload with a torque wrench is not necessary if care is taken to tighten the nut to exactly its previous position. Should a new pinion flange be required, a torque wrench reading should be taken before loosening the nut and the nut tightened to the same torque wrench reading.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-36—To remove an axle shaft, drain the oil from the differential and take off the axle housing cover. Remove the differential pinion shaft screw, differential pinion shaft and axle shaft spacer. Push the axle shafts in toward center of the axle and remove "C" washers from the ends of the axle shaft. Remove the shaft.

Before replacing, examine oil seals. Slide the axle shaft into place, being careful that the splines do not cut the leather seal and that they engage with the splines of the differential gears. Replace the "C" washers on the end of the shaft and pry the shaft ends apart so that the "C" washers are seated in the counterbore in the differential side gears. Select the proper spacer so that there is a free fit to .014" clearance between the ends of the axle shafts. Assemble the pinion shaft and lock it in place with the special screw and lockwasher. Replace the axle housing cover with a new gasket and fill with lubricant. Reassemble wheels and brake drums, seeing that the shaft with the left hand threaded studs goes on the left side of the car.

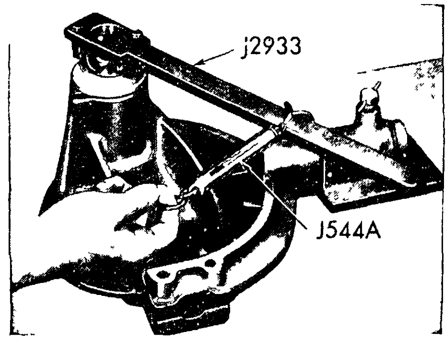


Fig. 47 Measuring pini n bearing preload with spring scale, 1947-52

1937-52—Remove wheel and brake drum. Remove nuts from the four bolts attaching the brake backing plates to the housing. Withdraw the shaft. Before replacing, examine the oil seals and renew if damaged. Slide the shaft into place and take care not to injure the oil seals. The shaft with the left hand wheel studs goes to the left side of the car. Enter the splines of the shaft into the splines in the differential side gear and slide the shaft home, seating the shaft bearing to the shoulder in the housing. Clean the surfaces at the backing plate and oil guard and coat these surfaces with liquid seal and install a new gasket. Install the static ground brush. Tighten the bearing retainer bolt nuts. Replace the brake drum and wheel.

WHEEL ALIGNMENT

CASTER & CAMBER, ADJUST

1935-36 SOLID AXLE—Caster up to about two degrees can be adjusted by tapered caster shims between the spring seat and the spring. To increase caster, place the thick side of the shim toward the back of the car and to decrease caster, place the thick side toward the front. When the caster is out more than two degrees the axle should be straightened to change the angle of the spring seat.

The only camber adjustment is bending the axle.

1935-36 KNEE ACTION—If the camber is out of adjustment it usually indicates a bent spindle and the knee action unit must be replaced. On high mileage cars the camber may be out because of worn kingpin bearings and in this case the bearing should be replaced.

Caster and kingpin inclination can only be corrected by bending the knee action unit.

1937-48—To adjust caster, Fig. 48, loosen the clamp bolt at the upper end of the steering knuckle support. Remove the lubrication fitting from the front bushing of the eccentric pin at the outer end of the upper control arms. Insert an Allen wrench through the hole from which the lubrication fitting

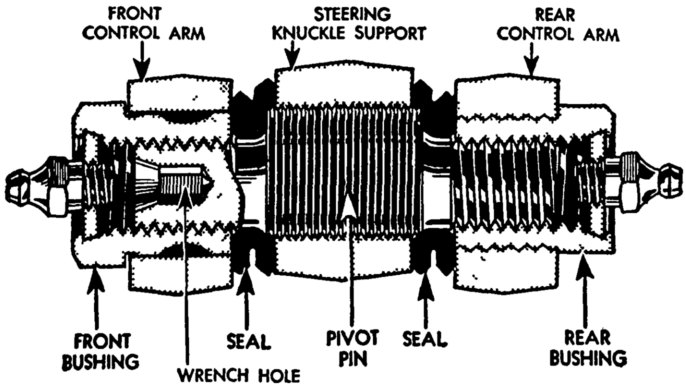


Fig. 48 Camber and caster adjustment is obtained by turning eccentric upper pivot pin, 1937-48

was removed and turn the threaded eccentric pin until the desired caster angle is obtained Turn the threaded pin on each side of the car clockwise to increase caster and counter-clockwise to decrease caster Always turn the pin in multiples of one turn so that the camber will not be disturbed After completing the adjustment, tighten the knuckle support clamp blots and install the lubrication fittings This procedure should only be used to change the caster less than 3 degrees

To adjust camber, insert an Allen wrench as described for making a caster adjustment The camber angle is controlled by the eccentric action of the threaded pin and a half turn gives the maximum adjustment Changing the camber will change the caster angle slightly but if the pin is not turned more than a half turn the caster angle will still be within its limits

1949-52—Caster adjustment must always be made before camber adjustment To set caster, loosen the eccentric bushing clap bolt and turn eccentric bushing to give the correct caster setting at each wheel

When correct caster setting has been obtained, tighten the clamp bolt only enough to prevent changing the adjustment and proceed with camber adjustment.

To adjust camber, again loosen the clamp bolt and turn the eccentric bushing to get the correct camber setting at each wheel It is never necessary to turn the eccentric bushing more than ½ turn to obtain the maximum adjustment possible on the eccentric bushing Additional camber may be obtained by removing the two upper control arm shaft mounting bolts, turning the shaft over and reinstalling in this position on the frame Tighten shaft mounting bolts to 60-65 lbs ft torque

Tighten eccentric bushing clamp bolt to 35-40 lbs ft torque

TOE-IN, ADJUST

1935-36—Toe-in is adjusted by loosening the clamps at either end of the tie rod and turning the rod in the desired direction to obtain the correct measurement

1937-38 — Both tie rods are the same length To adjust toe-in, loosen the clamps on the ends of both tie rods and turn both rods an equal amount Both rods must be adjusted the same amount in order to maintain the proper relation between the front wheels and the intermediate steering arm When making an adjustment be careful not to disturb the position of the steering wheel The distance between the ball sockets on each rod should be the same length within ½" If the difference is greater than ½" with the wheels in their straight ahead position, a bent steering knuckle arm is indicated Be sure to tighten the clamps when the adjustment is completed

1939-52—To increase toe-in, Fig 49, turn the right adjusting tube in the direction of wheel rotation forward and the left adjusting tube in the direction the wheels revolve when the car is going rearward Be sure to turn both tubes an equal amount in order to maintain the correct position of the steering wheel When the adjustment is complete, tighten all clamp screws.

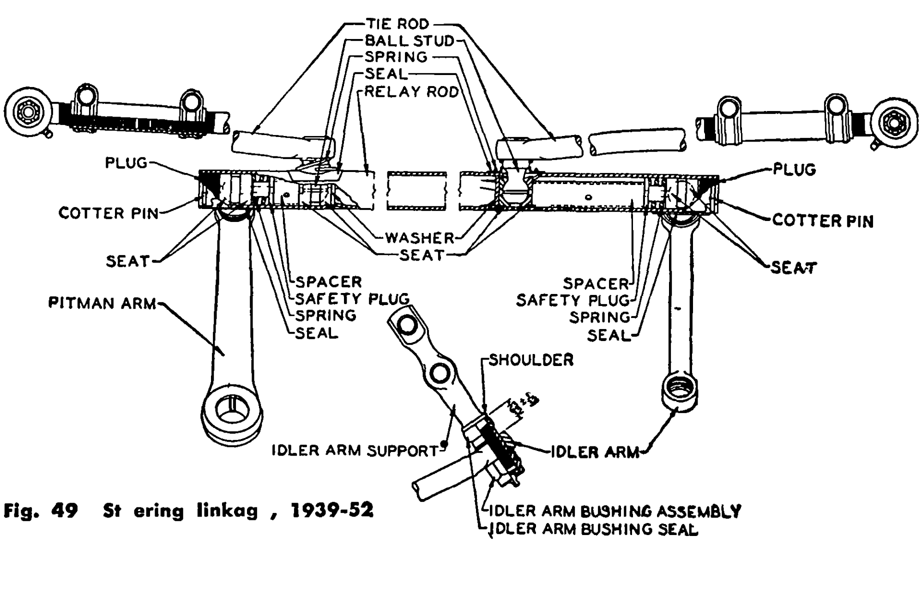


Fig. 49 St ering linkag , 1939-52

FRONT END SERVICE

1937-52

Front Wheel Bearings, Adjust—

1 Jack up wheel placing jack pad or stand under lower control arm Remove wheel dust cap

2 Eliminate play of kingpin by inserting wooden wedge between knuckle and kingpin yoke on steering knuckle support.

3 Tighten bearing adjusting nut with an 8 or 10 in wrench only enough to insure that parts are properly seated

4 Back off the nut until the first perceptible looseness is felt in the bearing when tested by grasping the tire at top and bottom and shaking

5 Tighten nut until a slot of nut lines up with one of cotter pin holes in knuckle

6 Insert new cotter pin and clinch, cutting off excess length to make sure ends of pin will not interfere with static brush in front wheel dust cap

7 Remove wedge, replace dust cap and lower car

Front Shock Absorber, Replace. 1949-52—Front shock absorbers may be removed from the top or bottom To remove from the top, proceed as follows

1 Raise car on hoist, or jack up front end so weight of car is fully off front wheels

2 Loosen and remove two nuts from bottom stud on shock absorber Shock absorber must not turn while loosening nuts If necessary, use pliers inserted through coils of front spring to hold shock absorber tube from turning

3 Remove grommet retainer and grommet from lower stud

4 Remove two nuts holding shock absorber upper bracket to frame

5 Remove shock absorber with upper bracket upward out through hole in frame

Removing Front Shock Absorber From Below—

1 Jack up front end so weight of car is fully off front wheels

2 Loosen and remove nuts from shock absorber upper stud If shock absorber cannot be kept from turning by lightly holding the shock absorber dust shield at the upper bracket, remove shock absorber from the top as outlined previously

3 Remove shock absorber and lower bracket from below.

Upper Pivot Pin & Eccentric Bushing, Replace. 1949-52—

1. Place jack under lower control arm,

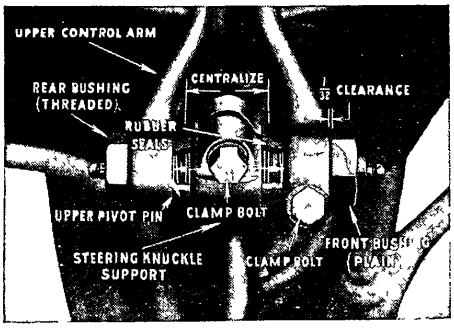


Fig. 50 Upper pivot details, 1937-48

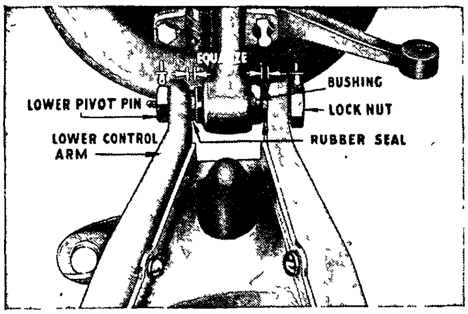


Fig. 51 L wer pivot details, 1937-52

raise wheel off floor and remove wheel.

2. Remove nut from rear end of upper pivot pin.
3. Remove threaded pivot pin.
4. Loosen clamp bolt and remove eccentric bushing from knuckle support.
5. Double back each rubber seal on itself and then slip each seal over the cupped threaded portion of the upper control arm into which the pivot pin screws. Seal should be placed so ends of seal are toward control arm.
6. Install new eccentric bushing in knuckle support so it is centralized.
7. Position bushing with knuckle support in forked end of upper control arm and install pivot pin and lockwasher after coating threads of pin with chassis lubricant.
8. See that pivot pin bolt head is turned up tightly against surface of control arm and tighten to 40 lbs. ft. torque.
9. Install pivot pin nut and lockwasher and tighten nut securely against surface of control arm with 40 lbs. ft. torque. Make visual inspection to see that bolt head and nut are turned up securely against metal of control arm to insure firm seating. If not, apply additional torque to seat parts properly.
10. Strip back rubber seals so threaded portion of pivot pin is covered.
11. Install front wheel, lower car, lubricate pivot pin and check front wheel alignment.

Upper Pivot Pin & Bushings, Replace. 1937-48—

1. Unscrew clamp bolt and two bushings and remove rubber seals.
2. Loosen clamp bolt in knuckle support and remove pivot pin.
3. Hold knuckle support in line with hole through control arm and screw new pivot pin into support having wrench hole in pin toward front of car.
4. Screw pin in until it is centralized and tighten clamp bolt, Fig. 50.
5. Assemble seals over pin.
6. Centralize knuckle support in control arm and start rear bushing on pin and into control arm.
7. Start front bushing on pin before locking rear bushing up tight.
8. After tightening rear bushing, screw up front bushing until there is 1/32 in. clearing between bushing and control arm as shown in Fig. 50.
9. Replace and lock control arm clamp bolt, install front wheel, lower car, lubricate pivot pin and check front wheel alignment.

Lower Pivot Pin & Bushing, Replace. 1937-52—

1. Place jack under lower control arm, raise wheel off floor and remove wheel and brake drum assembly.
2. If knuckle support lower bushing is to be replaced, remove brake backing plate from knuckle. Omit this operation if only the pin is to be replaced.
3. Remove nut from pivot pin and remove pin.
4. If knuckle support lower bushing is to be replaced, remove upper pivot pin. Omit this operation if lower pivot pin only is to be replaced.
5. If lower bushing is to be replaced, clamp knuckle support in vise, remove old bushing and install new one. Bushing must be firmly in knuckle support so there is no clearance between bushing shoulder and knuckle support.
6. If upper pivot pin was removed, reinstall it as previously outlined.
7. Position rubber seals at lower pivot pin bushing. Hold bushing with knuckle support in a central position in lower control arm and install lower pivot pin and lockwasher after coating threads on it with chassis lubricant. Lower pin must be installed with clearances shown in Fig. 51.
8. With hex head of pivot pin firmly tightened against control arm, install nut and lockwasher and tighten until securely seated against metal of control arm.
9. Reinstall brake backing plate if it was removed. Then install wheel and brake drum.
10. Lower car, lubricate pivot pins, and check wheel alignment.

Front Spring Replace. 1949-52 — This operation requires use of a chain hoist and a car stand. If a chain hoist is not available the operation can be performed by using three car stands and a hydraulic floor jack. The latter method should not be attempted unless the hydraulic jack has a positive control over slowly lowering a load.

Using Chain Hoist—

1.Lift car with hoist so wheels are 8 in. off floor and place a car stand under inner side of lower control arm spring pad from which spring is to be removed.
2. Lower car until it touches top of car stand. Remove wheel.
3. Remove shock absorber.
4. Disconnect stabilizer link at lower control arm.
5. Remove lower pivot pin from bushing.
6. Raise car slowly with chain hoist and remove spring.
7. When installing spring, have car elevated on chain hoist and place bottom of spring in seat on lower control arm. Top of spring may be identified since it is flattened and bottom end is not. End of coil at bottom of spring must index with hole provided in spring seat in lower control arm.
8. Lower chain hoist gradually, checking to see that spring is correctly seated top and bottom.
9. Install lower pivot pin and connect stabilizer link.
10. Install shock absorber and front wheel. Lower car, lubricate pivot pin and check wheel alignment.

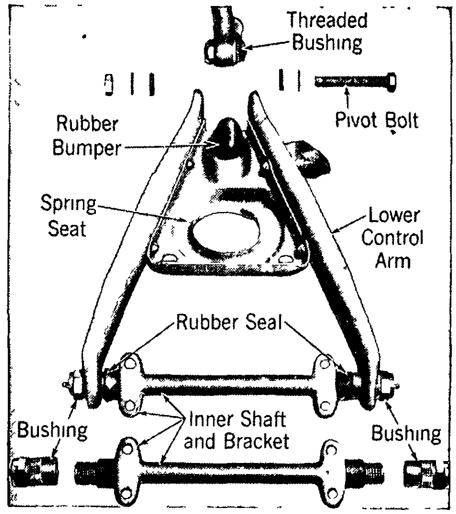


Fig. 52 Lower control arm d tails, 1937-52

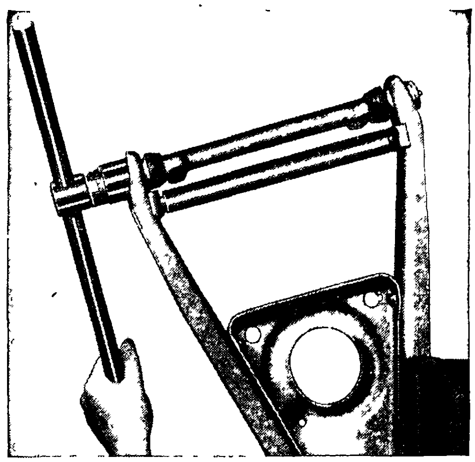


Fig. 53 Using spreader t l t pr vent lower control arms from m ving inward while installing bushings, 1937-52

Using Floor Jack—

1. Raise front end of car until wheels are about 10 in. above floor and place a car stand under frame side member on each side forward of front door hinge pillar so car will be firmly supported.
2. Place a car stand under the lower control arm of the spring which is *not* to be replaced.
3. Place floor jack under lower control arm spring seat from which spring is to be removed and raise jack until it touches spring seat.
4. Remove wheel on side of car from which spring is to be removed.
5. Remove shock absorber and disconnect stabilizer link at lower control arm.

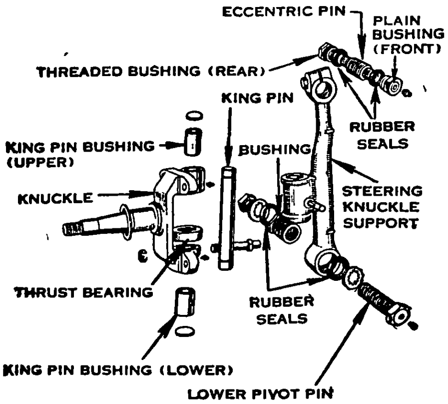


Fig. 54 Steering knuckle and related parts. 1937-48

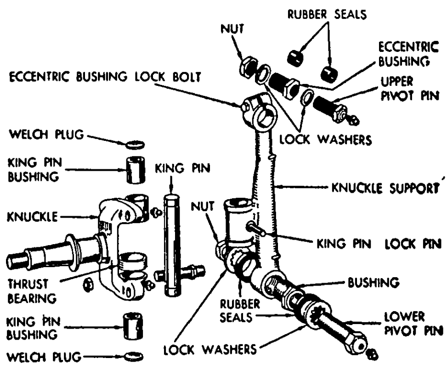


Fig. 55 Steering knuckle and related parts. 1949-52

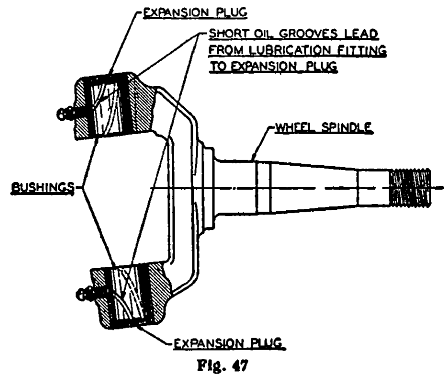


Fig. 56 Correct assembly of bushings in knuckle. 1937-39

6. Remove lower pivot pin.
7. Slowly lower jack until spring is fully extended and remove spring.
8. To install spring, have jack pad under spring seat and place spring in seat on lower control arm with end of coil at bottom of spring indexing with hole in spring seat.
9. Raise jack gradually, checking to see that spring is correctly seated top and bottom.
10. Install lower pivot pin and connect stabilizer to lower control arm.
11. Install shock absorber and front wheel. Lower car, lubricate pivot pin and check wheel alignment.

Front Spring, Replace. 1937-48—The procedure for removing a spring on these models is the same as for later models except that the shock absorber—which forms part of the upper control arm—need not be removed.

Lower Control Arm & Shaft, Replace. 1937-52—

1. Remove front spring.
2. Unfasten lower control arm shaft from frame cross member and remove control arm and shaft.
3. When installing a new lower control arm, it is necessary to cut a thread for the bushing in the arm. The shaft bushing has threads on the inside and outside so that as the bushing threads onto the pivot shaft, the outside thread on the bushing cuts its own thread in the control arm. The distance between the inside face of the inner ends of the lower control arms when assembled must be 11½ in. (plus or minus $\frac{1}{32}$ in.) so it is necessary to use a steel block, wood or the special tool shown in Fig. 53 to prevent the arms from being forced together while the bushing is forming a thread during installation.
4. To install the pivot shaft in a new arm, place the spreader tool in position and expand it until distance between inner faces of arms is 11½ in.
5. Place pivot shaft with rubber seals in position in control arm, Fig. 52.
6. After lubricating pivot shaft threads with chassis lubricant, start bushing on pivot shaft and into arm at same time. Tighten until bushing flange is firmly seated against metal of control arm.
7. Center pivot shaft in control arm and install other bushing being sure threads index so there is no bind. Tighten until bushing flange is firmly seated against metal of control arm.
8. Check to see that distance between inner faces of shaft ends of control arm are 11½ in. (plus or minus $\frac{1}{32}$ in.). Also check to see that distances from center of pivot shaft bolt holes to inside faces of arm are equal at each end. Turn pivot shaft in arm to centralize if distance is not equal.
9. Fasten pivot shaft to frame cross member and tighten nuts to 50-55 lbs. ft. torque.
10. Complete installation by following procedure for installing spring.
11. Lower car, lubricate control arm shaft and lower pivot pin and check wheel alignment.

Upper Control Arm & Shaft, Replace, 1949-52—

1. Place jack under lower control arm, raise wheel off floor and remove wheel.
2. Remove shock absorber and upper bracket.
3. Remove upper pivot pin.
4. Unfasten and remove upper control arm shaft from frame. Note position of notch in shaft with respect to frame bolts so shaft can be installed in same position on frame. Normal position of shaft is with notch toward center of car. Turning shaft over will result in changing centerline of shaft ⅛ in. with resultant change in camber of approximately ⅔ degree.
5. Remove shaft from control arm by removing front and rear threaded bushings.
6. Install the pivot shaft in the new arm, following the procedure outlined for the lower control arm shaft. A suitable spreader should be used between the legs of the arm to keep them spread 7½ in. After installing the bushings so they are tight against the metal surface of the arms, check to see that the distance remains at 7½ in. (plus or minus $\frac{1}{16}$ in.). Also check to see that the pivot shaft is equalized in the arm. If not, turn the shaft in the arm to centralize if distance from each bolt hole to arm are not equal.
7. After completing the installation, lower car, lubricate control arm shaft and upper pivot pin, and check wheel alignment.

Kingpins & Bushings, Replace—

1. Jack up wheel under lower control arm and remove wheel and brake drum assembly.
2. Remove brake backing plate without disconnecting brake hose. Place backing plate out of way to avoid any strain on brake hose.
3. Remove kingpin lock pin, Figs. 54 and 55.
4. Remove lower welch plug under kingpin by driving a punch through upper welch plug. If necessary, the kingpin can then be driven up to remove upper welch plug.
5. Drive out kingpin.
6. On 1937-39 models, press out bushings. On 1940-52 models, bushings are the floating type and may be lifted out.
7. Use a suitable reamer to clean up recesses for welch plugs in knuckle.
8. On 1937-39 models, use a suitable tool to press in the new bushings. After bushings are in place as shown in Fig. 56, they should be burnished in place and then reamed to size so kingpin will operate freely without binding.
9. On 1940-52 models, install new bushings as shown in Fig. 57. No reaming or burnishing is required.
10. On all models, position the steering knuckle on the knuckle support and install new kingpin. Make sure thrust bearing is correctly installed below knuckle support, Figs. 54 and 55. Check to see that knuckle is not binding.
11. Drive in kingpin lock pin.
12. Install welch plugs in both ends of knuckle, staking them securely in place.
13. Complete the installation and lubricate kingpin.

STEERING GEAR

STEERING GEAR REMOVAL

1935-36 — Remove the floor and toe boards. Remove the steering wheel and disconnect the steering column instrument board bracket. Disconnect the steering pitman arm. (Note the position of the arm on the shaft.) Disconnect the horn wire at bottom of the steering gear and remove the bolts holding the steering gear to the frame bracket. Remove the steering gear by pulling it forward.

Replace the steering gear and start the bolts in the instrument board bracket to hold the assembly in position. Install the bolts fastening the steering gear to the frame bracket. Do not tighten securely. Tighten the instrument board bracket bolts, then tighten the steering gear to the frame bracket bolts. Reversal of this method may cause a bind. Connect the horn wire. Connect the steering pitman arm and pitman arm shaft, aligning the marks

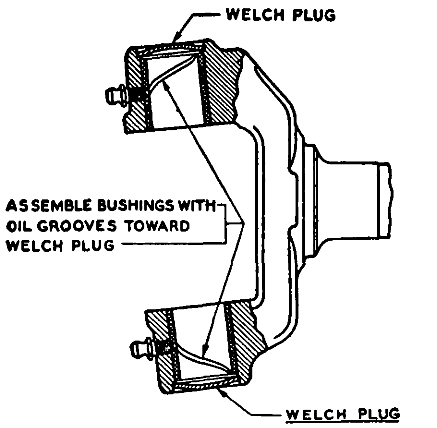


Fig. 57 Correct assembly of bushings in knuckle. 1940-52

on the end of the shaft and on the pitman arm. Replace the steering wheel with the upper spoke not more than 5° either way from the straight-up position (1936) when the front wheels are straight ahead. On 1935 cars the spoke goes below the column. Replace the floor and toe boards.

1937—Remove the front floor mat and the floor plate around the steering gear. Disconnect the horn wire at the terminal on the steering column. Press down on the outer edge of the button and grasp the opposite edge and pull the entire assembly from the retainer cup.

With a suitable puller, remove the steering wheel, being careful not to damage the horn wire. Disconnect the steering column instrument board bracket. Note the position of the pitman arm on the shaft, and remove the arm. Disconnect the horn wire on the outside of the column, and remove the steering gear bolts attached to the frame, and remove the gear by pulling it forward.

To replace, start the bolts in the instrument board bracket to hold the assembly in position. Install the frame attaching bolts, but do not tighten. Now, tighten the instrument board bolts and then the frame bolts. This will eliminate the possibility of the steering gear binding in the worm shaft and mast jacket. Connect the horn wire.

When replacing the pitman arm, align the marks on the end of the shaft with the arm. Replace the steering wheel, with the lower spoke not more than 5 degrees either way from the straight-up position, when the front wheels are in a straight-ahead position. Replace the floor plate and mat.

1938-39—For 1938 cars not equipped with steering column shift, omit the safety-shift operations.

Remove left hood side panel and the battery. Disconnect the horn wire. Disconnect the control rod at the upper end on 1938 cars. Remove the front floor mat, floor plate, toe plates and felts, and the center floor panel.

Disconnect the horn wire at the terminal. Press down on the outer edge of the horn button and grasp the opposite edge, and pull the entire horn button assembly from the retainer cup. Remove the steering wheel with a suitable puller.

Disconnect the selector cable at the bottom of the shift shaft. Remove the levers from the shaft on 1939 cars. Loosen the instrument panel bracket. Remove the pitman arm, using a suitable puller, and remove the steering gear to frame attaching bolts. Slide the steering column bracket to the upper support on the steering column and pull the gear out through the hole in the left fender skirt.

To replace, start the bolts in the instrument board bracket to hold the assembly in position. Install the frame attaching bolts, but do not tighten. Now, tighten the bracket bolts and then the frame bolts. This will eliminate the possibility of the gear binding in the worm shaft and mast jacket. Align the marks on the pitman arm and the shaft and install the arm.

Remove the selector rod on 1938 cars and apply Lubriplate on all bearing surfaces, but do not lubricate the rubber sleeve. Assemble the levers to the shift shaft (on 1939) and connect the selector cable. Replace the shift lever, being sure that the anti-rattle spring is properly placed at the ball end of the shift shaft.

Install the steering wheel with the lower spoke not more than 5 degrees either way from directly under the steering column with the front wheels in the straight-ahead position. Replace the horn button. Check the shift linkage adjustments and replace the floor plates, the horn button. Check the shift linkage wire and replace the battery and the hood side panel.

1940-48—The procedure is the same as described for 1939 cars except that it is necessary to remove the clutch and brake pedals on 1940 models.

To remove the shift linkage at the lower end of the steering column, remove the pin which holds the selector lever and idler lever to the lower support, allowing the selector lever to remain attached to the selector rod. Remove the screw at the lower end of the control shaft and slide off the sleeve control shaft lever and idler lever leaving the control shaft lever attached to the shifter rod.

1949-52 Cars With Standard Transmission.—1 Remove steering wheel and horn button.

2 If direction signal is installed, disconnect wiring harness at multiple connector plug under instrument panel, loosen direction signal housing clamp screw and lift off signal assembly.

3 Remove steering column lower plate.

4 Remove necessary plates and felts around column inside of car.

5 Remove horn wire.

6 Remove selector lever pivot pin. This will allow selector control lever and selector control idler lever to be removed from lower support together while remaining attached to transmission selector rod (in this way adjustment is not disturbed).

7 Remove control shaft return spring.

8 Remove bolt holding collar to control shaft and remove collar and shaft return spring clip. It is now possible to remove the control shaft lever and control shaft idler lever together while remaining attached to the transmission control rod.

9 Remove two gearshift control upper support screws and remove control shaft, gearshift lever and upper support by pulling up into car.

10 Remove nuts from U-bolt holding control shaft lower support to steering column and remove support.

11 Raise car on hoist if available, otherwise on high stands under *both lower control arms* to provide clearance for removing steering gear.

12 Remove left engine side pan.

13 Remove pitman arm with puller.

14 Loosen three blots holding steering gear to frame, then remove two bolts leaving the front upper bolt to support steering gear.

15 Remove bolts holding steering column lower bracket to upper bracket on instrument panel and also remove steering column rubber grommet.

16 Remove remaining steering gear housing to frame bolt.

17 Remove steering gear by bringing it down through floor board and over steering linkage toward right front wheel.

18 If car is equipped with a Hill Holder (NO-ROL) it will be necessary to remove steering gear by bringing it up through floor board, moving upper end toward left front door and passing pitman shaft through between pedals. In this case Step 15 above should be performed after removing the three steering gear housing to frame bolts.

19 Be sure to save shims found between steering gear housing and frame so they can be reinstalled.

1949-52 Cars With Hydra-Matic.—1 Follow steps 1 through 5 under procedure for cars with synchromesh transmission.

2 Disconnect wires from neutralizer switch.

3 Disconnect trunnion from gearshift control lower lever by removing trunnion cotter pin.

4 Remove nuts from U-bolt holding gearshift control shaft lower bracket to steering column.

5 Raise car so that sufficient space is provided to remove steering gear from below.

6 Remove left engine side pan.

7 Remove pitman arm with puller.

8 Loosen three bolts but remove two steering gear to frame bolts, leaving one bolt supporting gear.

9 Loosen gearshift control indicator assembly clamp screw.

10 Detach steering column upper bracket from lower bracket. This will allow steering gear to pivot on the one remaining housing to frame bolt and allow gearshift control shaft and indicator assembly together with steering column rubber grommet to be slipped off steering column.

11 Remove remaining housing to frame bolt and remove steering gear by bringing it down through toe board and over steering linkage toward right front wheel.

STUDEBAKER

INDEX OF SERVICE OPERATIONS

Year	Model Designation		Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Standard Dictator 6	1A	114	In Block	$3\frac{1}{4}$ x $4\frac{1}{8}$	205.3	6.30	88 @ 3600		40 @ 50
	De Luxe Dictator 6	2A	114	In Block	$3\frac{1}{4}$ x $4\frac{1}{8}$	205.3	6.30	88 @ 3600		40 @ 50
	Commander 8	1B	119	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.00	107 @ 3800		40 @ 50
	President 8	1C	123	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.50	110 @ 3600		40 @ 50
1936	Standard Dictator 6	3A	116	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.30	90 @ 3400		40 @ 50
	De Luxe Dictator 6	4A	116	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.30	90 @ 3400		40 @ 50
	President 8	2C	125	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.50	115 @ 3600		40 @ 50
1937	Standard Dictator 6	5A	116	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.00	90 @ 3400		40 @ 50
	De Luxe Dictator 6	6A	116	In Block	$3\frac{1}{4}$ x $4\frac{3}{8}$	217.8	6.00	90 @ 3400		40 @ 50
	President 8	3C	125	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.50	115 @ 3600		40 @ 50
1938	Commander 6	7A	$116\frac{1}{2}$	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.00	90 @ 3400	174 @ 1200	40 @ 30
	State Commander 6	8A	$116\frac{1}{2}$	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.00	90 @ 3400	174 @ 1200	40 @ 30
	President 8	4C	122	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.00	110 @ 3600	195 @ 2000	40 @ 25
1939	Champion 6	G	110	In Block	3 x $3\frac{7}{8}$	164.3	6.50	78 @ 4000	128 @ 1600	40 @ 25
	Commander 6	9A	$116\frac{1}{2}$	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.00	90 @ 3400	174 @ 1200	40 @ 25
	President 8	5C	122	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.00	110 @ 3600	195 @ 2000	40 @ 25
1940	Champion 6	2G	110	In Block	3 x $3\frac{7}{8}$	164.3	6.50	78 @ 4000	128 @ 1600	40 @ 25
	Commander 6	10A	$116\frac{1}{2}$	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.00	90 @ 3400	174 @ 1200	40 @ 25
	President 8	6C	122	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.00	110 @ 3600	195 @ 2000	40 @ 25
1941	Champion 6	.3G	110	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
	Commander 6	11A	119	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.50	94 @ 3600	176 @ 1600	40 @ 25
	President 8	7C	125	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.50	117 @ 4000	200 @ 2400	40 @ 25
1942	Champion 6	4G	110	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
	Commander 6	12A	119	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.50	94 @ 3600	176 @ 1600	40 @ 25
	President 8	8C	124	In Block	$3\frac{1}{16}$ x $4\frac{1}{4}$	250.4	6.50	117 @ 4000	200 @ 2400	40 @ 25
1946	Skyway Champion 6	5G	110	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
1947	Champion 6	6G	112	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
	Commander 6	14A	119(A)	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.50	94 @ 3600	176 @ 1600	40 @ 25
1948	Champion 6	7G	112	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
	Commander 6	15A	119(A)	In Block	$3\frac{5}{16}$ x $4\frac{3}{8}$	226.2	6.50	94 @ 3600	176 @ 1600	40 @ 25
1949	Champion 6	8G	112	In Block	3 x 4	169.6	6.50	80 @ 4000	134 @ 2000	40 @ 25
	Commander 6	16A	119(A)	In Block	$3\frac{5}{16}$ x $4\frac{3}{4}$	245.6	6.50	100 @ 3400	200 @ 1600	40 @ 25
1950	Champion 6	9G	113	In Block	3 x 4	169.6	7.00	80 @ 4000	138 @ 2400	40 @ 25
	Commander 6	17A	120(A)	In Block	$3\frac{5}{16}$ x $4\frac{3}{4}$	245.6	7.00	102 @ 3200	205 @ 1200	40 @ 25
1951	Champion 6	10G	115	In Block	3 x 4	169.6	7.00	85 @ 4000	138 @ 2400	40 @ 25
	Commander V8	H	115(A)	In Head	$3\frac{3}{8}$ x $3\frac{1}{4}$	232.6	7 00	120 @ 4000	190 @ 2000	40 @ 25
1952	Champion 6	12G	115	In Block	3 x 4	169.6	7.00	85 @ 4000	138 @ 2400	40 @ 25
	Commander V8	3H	115(A)	In Head	$3\frac{3}{8}$ x $3\frac{1}{4}$	232.6	7.00	120 @ 4000	190 @ 2000	40 @ 25

A—Land Cruiser Models, 123″ on 1947-49, 124″ on 1950 and 119″ on 1951–52.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1935	Six	.004H	.006H	.010	45	15	5	59@$2\frac{3}{32}$	.001 –.003	.001 –.003	.3437	.3437
	Eight	.004H	.006H	.010	45	15	10	59@$2\frac{3}{32}$	.001 –.003	.001 –.003	.3437	.3437
1936–38	Six	.016C	.016C	.020	45	15	10	57@$2\frac{3}{32}$	.001 –.003	.001 –.003	.3437	.3437
	Eight	.016C	.016C	.020	45	15	10	57@$2\frac{3}{32}$	.001 –.003	.001 –.003	.3437	.3437
1939–42	Champion	.016C	.016C	.020	45	15	10	52@$1\frac{21}{32}$	.001 –.0035	.0015–.0035	.3125	.3125
	Commander	.016C	.016C	.020	45	15	10	54@$2\frac{3}{32}$	.0015–.0035	.0015–.0035	.3437	.3437
	President	.016C	.016C	.020	45	15	10	54@$2\frac{3}{32}$	.001 –.003	.001 –.003	.3437	.3437

 Continued from page 740

Year	Model	Operating Clearance H-Hot C-Cold: Intake	Operating Clearance H-Hot C-Cold: Exhaust	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A): Intake Opens Degrees BTDC	Valve Timing (Note A): Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance: Intake	Valve Stem Clearance: Exhaust	Valve Stem Diameter: Intake	Valve Stem Diameter: Exhaust
1946–50	Champion	.016C	.016C	.020	45	15	10	52@$1\frac{21}{32}$	.001 –.0035	.0015–.0035	.3125	.3125
	Commander	.016C	.016C	.020	45	15	10	54@$2\frac{3}{32}$	.0015–.0035	.0015–.0035	.3437	.3437
1951–52	Champion	.016C	.016C	.020	45	15	10	52@$1\frac{21}{32}$	.0015–.0035	.0015–.0035	.3125	.3125
	Commander	.015H	.015H	.020	45	11	14	130@$1\frac{3}{4}$	.0015–.0035	.0015–.0035	.3437	.3437

A—BTDC means before top dead center; ATDC means after top dead center.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note A	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935	1A, 2A	.004–.008	B	2.06175–2.06275	.0005–.002	.005–.009	50–55	2.2495–2.2500	.0005–.0025	.003–.006	90–95
	1B, 1C	.004–.008	B	1.87425–1.87525	.00075–.00275	.005–.009	50–55	2.3435–2.3440	.001–.003	.003–.006	90–95
1936-37	Dictator	.004–.008	C	2.18675–2.18775	.0005–.002	.005–.009	50–55	2.4995–2.5000	.0005–.0025	.003–.006	90–95
	President	.004–.008	B	1.87425–1.87525	.00075–.00275	.005–.009	50–55	2.3435–2.3440	.001–.003	.003–.006	90–95
1938	7A, 8A	.004–.008	C	2.18675–2.18775	.0005–.002	.005–.009	50–55	2.4995–2.5000	.0005–.0025	.003–.006	90–95
	4C	.004–.008	B	1.87425–1.87525	.00075–.00275	.005–.009	50–55	2.3435–2.3440	.001–.003	.003–.006	90–95
1939-41	Champion	.004–.008	C	1.81175–1.81275	.0005–.002	.005–.009	25–27	2.4370–2.4375	.0005–.0025	.003–.006	90–95
	Commander	.004–.008	C	2.18675–2.18775	.0005–.002	.005–.009	50–55	2.4995–2.5000	.0005–.0025	.003–.006	90–95
	President	.004–.008	B	1.87425–1.87525	.00075–.00275	.005–.009	50–55	2.3435–2.3440	.001–.003	.003–.006	90–95
1942	4G	.004–.008	C	1.81175–1.81275	.0005–.002	.005–.009	25–27	2.4370–2.4375	.0005–.0025	.003–.006	90–95
	12A	.004–.008	C	2.18825–2.18875	.0005–.002	.005–.009	50–55	2.4995–2.5000	.0005–.0025	.003–.006	90–95
	8C	.004–.008	B	1.87425–1.87525	.00075–.00275	.005–.009	50–55	2.3435–2.3440	.001–.003	.003–.006	90–95
1946	5G	.004–.008	C	1.81175–1.81275	.0005–.002	.005–.009	25–27	2.4370–2.4375	.0005–.0025	.003–.006	90–95
1947-48	Champion	.004–.008	C	1.81175–1.81275	.0005–.002	.005–.009	25–27	2.4370–2.4375	.0005–.0025	.003–.006	90–95
	Commander	.004–.008	C	2.18675–2.18775	.0005–.002	.005–.009	50–55	2.4995–2.5000	.0005–.0025	.003–.006	90–95
1949-50	Champion	.004–.008	C	1.81175–1.81275	.0005–.002	.005–.009	25–27	2.4370–2.4375	.0005–.0025	.003–.006	90–95
	Commander	.004–.008	C	2.18675–2.18775	.0005–.002	.005–.009	50–55	2.8745–2.8750	.0006–.0027	.003–.006	90–95
1951-52	Champion	.004–.008	D	1.81175–1.81275	.0005–.00215	.005–.009	28–32	2.4370–2.4375	.0005–.0025	.003–.006	88–93
	Commander	.005–.007	C	1.99925–2.00025	.0005–.00215	.007–.012	52–54	2.4995–2.5000	.0006–.0027	.003–.006	88–93

A—Thrust taken by front bearing.
B—Clearance for front bearing .00075 to .00225; all others .002 to .00375″.
C—Clearance for front bearing .00075 to .00225; all others .001 to .00275″.
D—Clearance for front bearing .0007–.0022; all others, .001–.0027″.

Year	Model	Spark Plugs Type	Spark Plugs Gap, Inch	Breaker Gap, Inch Note A	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M. Synchro-mesh Trans-mission	Engine Idle Speed, R. P. M. Auto-matic Trans-mission	Cylinder Head Torque, Lbs. Ft.
1935	Six	CH-7	.025	.020	35–38	153624	B	Positive	500		83
	Eight	CH-7	.025	.022	31–37	16258374	B	Positive	500		83
1936–37	Six	CH-7	.025	.020	35–38	153624	C	Positive	500		83
	Eight	CH-7	.025	.022	31–37	16258374	B	Positive	500		83
1938	Six	CH-7	.025	.020	35–38	153624	C	Positive	500		83
	Eight	CH-7	.025	.022	31–37	16258374	D	Positive	500		83
1939–40	Champ.	CH-8	.025	.020	35–38	153624	E	Positive	500		52
	Comm.	CH-8	.025	.020	35–38	153624	C	Positive	500		83
	Pres.	CH-8	.025	.022	31–37	16258374	D	Positive	500		83
1941–42	Champ.	CH-J9	.025	.020	35–38	153624	E	Positive	500		52
	Comm.	CH-J9	.025	.020	35–38	153624	C	Positive	500		83
	Pres.	CH-J9	.025	.017	21–30	16258374	D	Positive	500		83
1946	Champ.	CH-J9	.025	.020	35–38	153624	C	Positive	500		52
1947	Champ.	CH-J9	.025	.020	35–38	153624	C	Positive	500		52
	Comm.	CH-J9	.025	.020	35–38	153624	C	Positive	500		83
1948–49	Champ.	CH-J7	.025	.020	35–38	153624	C	Positive	500		52
	Comm.	CH-J7	.025	.020	35–38	153624	C	Positive	500		83
1950	Champ.	CH-J7	.025	.020	35–38	153624	C	Positive	500	500	52
	Comm.	CH-J7	.025	.022	31–37	153624	C	Positive	500	500	83
1951–52	Champ.	CH-J7	.025	.020	35–38	153624	C	Positive	500	500	48
	Comm.	CH-H8	.035	.016	21–30	18436572(F)	C	Positive	500	500	48

A—Plus or minus .002″.
B—TDC mark on flywheel.
C—IGN mark on vibration damper.
D—TDC mark on vibration damper.
E—IGN mark on flywheel.
F—Odd numbers left bank, even numbers right bank as viewed from rear of engine.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Fitting Pistons With Scale: Shim Thickness To Use	Fitting Pistons With Scale: Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A) Compression	Rings: Ring Gap, Minimum (Note A) Oil	Rings: Clearance in Groove Compression	Rings: Clearance in Groove Oil	Pins: Type	Pins: Fit
1935–38	Six	Above	.002(B)	7 to 15	.013	.013	.0015–.002	.001–.0015	C	D
	Eight	Above	.003(B)	7 to 15	.013	.013	.0015–.002	.001–.0015	C	D
1939–40	Champion	Above	.002(B)	16 to 22	.007	.007	.0015–.002	.001–.0015	C	D
	Commander	Above	.002(B)	7 to 15	.013	.013	.0015–.002	.001–.0015	C	D
	President	Above	.003(B)	7 to 15	.013	.013	.0015–.002	.001–.0015	C	D
1941	Champion	Above	.002(B)	11 to 16	.007	.007	.0015–.002	.001–.0015	C	D
	Commander	Above	.002(B)	10 to 15	.009	.009	.0015–.002	.001–.0015	C	D
	President	Above	.002(B)	7 to 12	.013	.013	.0015–.002	.001–.0015	C	D
1942	Champion	Above	.002(B)	15 to 20	.007	.007	.002–.0025	.0015–.002	C	D
	Commander	Above	.002(B)	15 to 20	.009	.009	.002–.0025	.0015–.002	C	D
	President	Above	.002(B)	10 to 15	.013	.013	.002–.0025	.0015–.002	C	D
1946–50	Champion	Above	.002(B)	15 to 20	.007	.007	.002–.0025	.0015–.002	C	D
	Commander	Above	.002(B)	15 to 20	.009	.009	.002–.0025	.0015–.002	C	D
1951–52	Champion	Above	.002(B)	11 to 16	.007	.007	.002–.0025	.0015–.002	C	D
	Commander	Above	.002(B)	11 to 16	.008	.008	.002–.0025	.0015–.002	C	D

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Feeler gauge should be one inch wide.
C—Locked in rod.
D—Thumb push fit with parts at 70° (normal room temperature).

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE: Crankcase Refill Capacity, Quarts	ENGINE: Grade of Oil: Above +32°F.	ENGINE: Grade of Oil: Above +10°F.	ENGINE: Grade of Oil: Above −10°F.	TRANSMISSION: Capacity, Pounds or Pints	TRANSMISSION: Grade of Oil: Summer	TRANSMISSION: Grade of Oil: Winter	DIFFERENTIAL: Capacity, Pounds or Pints	DIFFERENTIAL: Grade of Oil: Summer	DIFFERENTIAL: Grade of Oil: Winter
1935	1A, 2A	16	14	5	30	20	10	2½	90	90	2½	90	90
	1B	21	17	8	30	20	10	3½	90	90	5	90	90
	1C	21	17	8	30	20	10	3 (D)	90	90	5	90	90
1936	3A, 4A	14	18	6	30	20	10	2½ (E)	90	90	2½	90	90
	2C	17	18	8	30	20	10	3 (F)	90	90	4	90	90
1937	5A, 6A	13	18	5½	30	20	10	2½ (E)	90	90	3	90H	90H
	3C	16	18	8	30	20	10	3 (G)	90	90	3½	90H	90H
1938	7A, 8A	14	18	5½	30	20	10	2½ (J)	90	90	3	90H	90H
	4C	17	18	8	30	20	10	2½ (J)	90	90	3	90H	90H
1939-40	G, 2G	10½	15	5	30	20	10	1 (K)	90	90	2½	90H	90H
	9A, 10A	14½	18	6	30	20	10	2½ (J)	90	90	3	90H	90H
	5C, 6C	17	18	8	30	20	10	2½ (J)	90	90	3	90H	90H
1941	3G	10	15	5	30	20	10	1 (A)	90	90	2½	90H	90H
	11A	13	18	6	30	20	10	2½ (J)	90	90	3	90H	90H
	7C	15	18	8	30	20	10	2½ (J)	90	90	3	90H	90H
1942	4G	10½	15	5	30	20	10	1 (A)	90	90	2½	90H	90H
	12A	13	18	6	30	20	10	2½ (J)	90	90	3	90H	90H
	8C	15	18	8	30	20	10	2½ (J)	90	90	3	90H	90H
1946	5G	10½	15	5	30	20	10	1 (A)	90	90	2½	90H	90H
1947-48	6G, 7G	10	17	5	30	20	10	1½ (B)	90	90	2½	90H	90H
	14A, 15A	13	17	6	30	20	10	2¼ (C)	90	90	3	90H	90H
1949	8G	11	18	5	30	20	10	1½ (B)	90	90	2½	90H	90H
	16A	13	18	6	30	20	10	2¼ (C)	90	90	3	90H	90H
1950	9G	10	18	5	30	20	10	1½ (L)	90 (L)	90 (L)	2½	90H	90H
	17A	13½	18	6	30	20	10	2¼ (L)	90 (L)	90 (L)	3	90H	90H
1951-52	Champion	10½	18	5	30	20	10W	1½ (L)	90 (L)	90 (L)	2½	90H	90H
	Commander	17¼	18	6	30	20	10W	2¼ (L)	90 (L)	90 (L)	3	90H	90H

A—With overdrive, 3¼ pints.
B—With overdrive, 2½ pints.
C—With overdrive, 3 pints.
D—With overdrive, 5½ pints.
E—With overdrive, 6 pints.
F—With overdrive, 7 pints.
G—With overdrive, 4½ pints.
H—Hypoid gear lubricant.
J—With overdrive, 4½ pints on 1941 and 4 pints on 1942.
K—With overdrive, 2½ pints.
L—With overdrive, 2½ pints on Champion; 3 pints on Commander. Cars with automatic transmission use Automatic Transmission Fluid, Type A. 11½ qts. on 1950 and 9½ qts. on 1951-52.

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935	1A, 2A	.002-.004	Shims	Shims	.003-.008
	1B, 1C	.004-.006	Nut	Nut	.001-.005
1936	All	.002-.004	Shims	Shims	.003-.008
1937-48	All	.005-.007	Shims	Shims	.003-.008
1949-52	All	.003-.005	Shims	Shims	.003-.008

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	1A	+1¼	+1¼	3/32	9½
	Others	+ ¼	+1¼	3/32	9½
1936	3A	+1	+1¼	3/32	9½
	4A, 2C	+ ¼	+1½	3/16	9½
1937	5A	+1¼	+1¼	3/32	9½
	6A, 3C	+ ¼	+1¼	3/16	A
1938	All	+ ¼	+ ½	3/32	5½
1939	G	+6	+ ½	3/32	5½
	9A, 5C	+ ¼	+ ½	3/32	5½
1940-46	Champion	+1½	+ ½	3/32	5½
1940-42	Commander	+ ¼	+ ½	3/32	5½
	President	+ ¼	+ ½	3/32	5½
1947-48	All	+ ½	+ ½	3/32	5½
1949	Champion	+1	+ ½	3/32	5½
	Commander	−2½	+ ½	3/32	5½
1950	Champion	−1½	+ ½	3/32	5¼
	Commander	−2	+ ½	3/32	5¼
1951	All	−1¾	+ ½	3/32	5¼
1952	All	−1¾	+ ½	3/32	6

A—Early models 9½; late models 5½.

FIRST SERIAL NUMBER

LOCATION—1935-39 except 1A On left side of frame under front fender. 1935, 1A On right side of frame under front fender 1940 On left side of frame under front fender or left front door hinge pillar 1941-46 On left front door hinge pillar 1947-51 On plate on the left front door lock pillar post

Year	Model	
1935	1A	5500001
	2A	5212001
	1B	8103000
	1C	7101001
1936	3A	5512001, South Bend, Ind
		5850001, Los Angeles, Cal
	4A	5235001, South Bend, Ind
		5800001, Los Angeles, Cal
	2C	7104001, South Bend, Ind
		7800001, Los Angeles, Cal
1937	5A	5536001, South Bend, Ind
		5852801, Los Angeles, Cal
	6A	5255001, South Bend, Ind
		5802501, Los Angeles, Cal
	3C	7111001, South Bend, Ind
		7800801, Los Angeles, Cal
1938	7A	5582001, South Bend, Ind
		5857501, Los Angeles, Cal
	8A	4090001, South Bend, Ind
		4800001, Los Angeles, Cal
	4C	7120101, South Bend, Ind
		7801801, Los Angeles, Cal
1939	G	G-1001, South Bend Ind
		G-800001, Los Angeles Cal
	9A	4110001, South Bend, Ind
		4802301, Los Angeles, Cal
	5C	7125501, South Bend Ind
		7802501, Los Angeles, Cal
1940	2G	G-30501, South Bend, Ind
		G-803701, Los Angeles, Cal
1940	10A	4148501 South Bend Ind
		4807601, Los Angeles Cal
	6C	7133101, South Bend, Ind
		7803301, Los Angeles, Cal
1941	3G	G-90101, South Bend Ind
		G-811201, Los Angeles Cal
1941	11A	4178801, South Bend, Ind
		4811901, Los Angeles, Cal
	7C	7139101, South Bend, Ind
		7803901, Los Angeles, Cal
1942	4G	G-165501, South Bend, Ind
		G-821001, Los Angeles, Cal
	12A	4216501, South Bend, Ind
		4816601, Los Angeles, Cal
	8C	7145501, South Bend, Ind
		7804601, Los Angeles, Cal
1946	5G	G-193001
1947	6G	G-212501, South Bend, Ind
		G-824001, Los Angeles, Cal
	14A	4232501, South Bend, Ind
		4818501, Los Angeles, Cal
1948	7G	G-314501, South Bend, Ind
		G-827501, Los Angeles, Cal
	15A	4287001, South Bend, Ind
		4820501, Los Angeles, Cal
1949	8G	G-400501, South Bend Ind
		G-839701, Los Angeles, Cal
	16A	4361001, South Bend Ind
		4832701, Los Angeles, Cal
1950	9G	G-468101, South Bend, Ind
		G-851801, Los Angeles, Cal
	17A	4398601, South Bend, Ind
		4839001, Los Angeles, Cal
1951	10G	G-1000001, South Bend Ind
		G-889101, Los Angeles, Cal
	H	8110001, South Bend Ind
		8800001, Los Angeles Cal

FIRST ENGINE NUMBER

LOCATION: 1935-50 all and 1951 Six—on upper left side of cylinder block, 1951 Eight, on cylinder block to right of distributor mounting pad

Year	Model	
1935	1A	D-27501
	2A	D-27501
	1B	C-30501
	1C	B-5501
1936	3A	D-63001
	4A	D-63001
	2C	B-7901
1937	5A	D-112601
	6A	D-112601
	3C	B-15501
1938	7A	H-101
	8A	H-101
	4C	B-24601
1939	G	101
	9A	H-42501
	5C	B-30201
1940	2G	34101
	10A	H-87601
	6C	B-38501
1941	3G	101201
	11A	H-122201
	7C	B-45001
1942	4G	186301
	12A	H-164301
	8C	B-52101
1946	5G	216501
1947	6G	236001
	14A	H-182001
1948	7G	342001
	15A	H-239001
1949	8G	441001
	16A	H-326001
1950	9G	521001
	17A	H-370001
1951	10G	778001
	H	V-101

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches: Length	Width	Thickness	Brake Pedal Free Play, Inches
1935	Dictator	Molded	23	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
	Commander	Molded	25	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
	President	Molded	$27\frac{1}{2}$	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
1936	Dictator	Woven	23	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
	President	Woven	25	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
1937	Dictator	A	$19\frac{11}{16}$	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	President	A	$21\frac{1}{2}$	$1\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{8}$
1938	All	A	$19\frac{11}{16}$	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1939-40	Champion	A	18	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	Others	A	$19\frac{11}{16}$	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1941-42	Champion	Molded	18	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
	Others	Molded	$19\frac{11}{16}$	$2\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1946	Champion	Molded	18	$1\frac{3}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
1947-50	Champion	Molded	$18\frac{1}{2}$	2	$\frac{3}{16}$	$\frac{3}{8}$
	Commander	Molded	$22\frac{1}{4}$	2	$\frac{3}{16}$	$\frac{3}{8}$
1951-52	Champion	Molded	$18\frac{1}{2}$	2	$\frac{3}{16}$	$\frac{3}{8}$
	Commander	Molded	B	2	$\frac{3}{16}$	$\frac{3}{8}$

A—Primary shoe, molded. Secondary, woven.
B—Front, $22\frac{1}{4}$; rear $18\frac{1}{2}$.

ENGINE

ENGINE REMOVAL

1935-52—On all models except Champions, the engine may be lifted out after the transmission and radiator have been removed Before lifting it out however, make a careful inspection to see that all wires, pipes, sheet metal and accessories that would hamper the removal of the engine, are disconnected and removed

On 1947-52 Champion models, it is not necessary to remove the transmission The engine and clutch may be lifted out after removing the radiator and disconnecting clutch housing from engine

CYLINDER HEAD

1951-52 V8 Engines—

1 If the right bank head is to be removed, remove generator and oil level gauge Disconnect oil pressure gauge line Remove Climatizer blower nuts and swing blower out of the way

2 If left bank head is to be removed, remove water temperature indicator and place it back out of the way Disconnect oil filter inlet pipe and the fuel pump oil line from the head Remove the battery

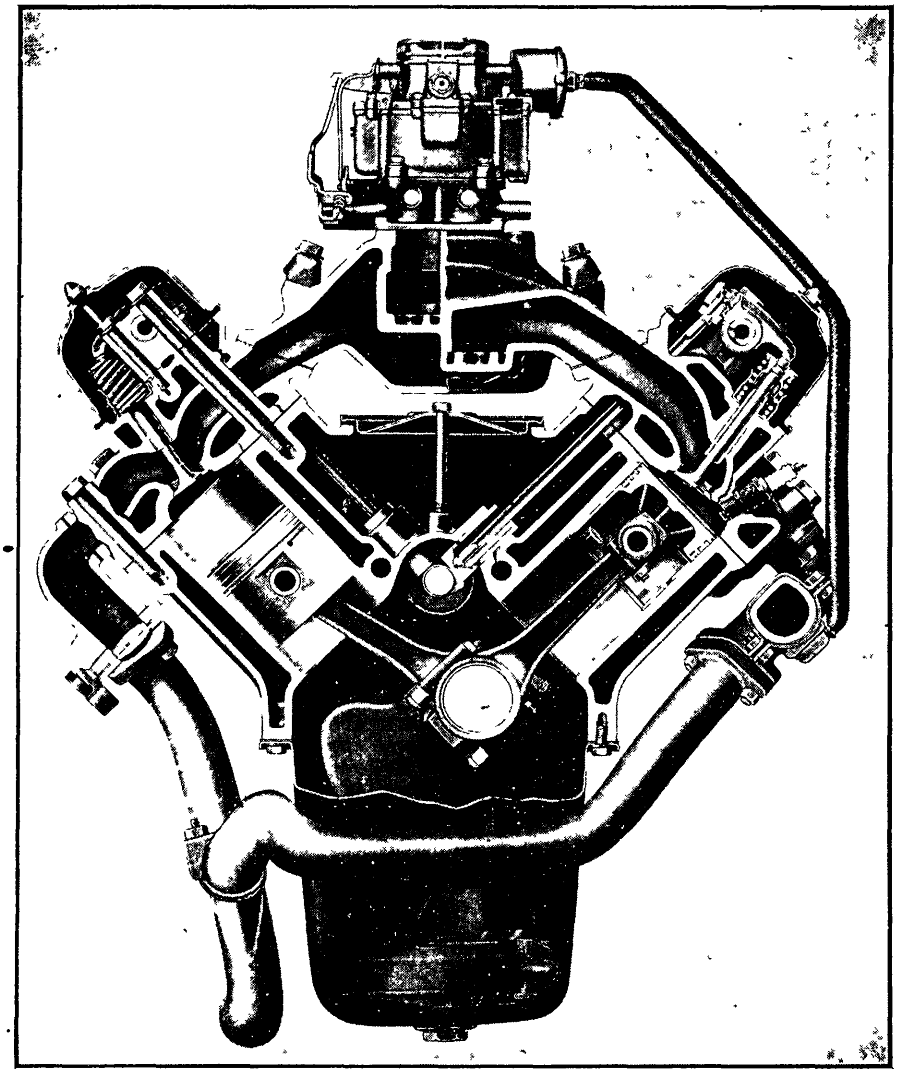


Fig. A 1951-52 V8 overhead valve engine

3. Remove carburetor air cleaner.
4. Disconnect throttle control lever-to-cross shaft rod.
5. Disconnect fuel pump-to-carburetor fuel line at fuel pump.
6. Disconnect vacuum line at distributor.
7. Disconnect automatic choke tube at carburetor.
8. If left bank head is to be removed, remove choke tube.
9. Unfasten intake manifold and lift it off with carburetor.
10. Remove rocker arm assembly as outlined further on.
11. Loosen the U-clamp at the joint between the cross-over pipe and exhaust connection, and the U-clamp at the clutch housing. Remove studs from both manifold flanges, which allows the cross-over pipe and exhaust connection to drop off the manifold studs.
12. Remove two screws at water pump flange at front of head.
13. Loosen water pump screws.
14. Lift out push rods.
15. Remove cylinder head screws and lift the head with its exhaust manifold off the hollow dowels. Be sure manifold heater valve is not damaged when removing right bank head.

Installation Notes—Since the right and left bank cylinder heads are identical, water pump ports are provided at the front and rear of all heads. It is necessary to block off the rear port, the one not in use, with a dummy plate and gasket. When installing a new head, check the capscrews holding the plate to the head to be sure they are tight. The heat indicator cylinder head unit is mounted in the left head dummy plate.

Clean the face of the cylinder block and head. File or hone all high spots. If the cylinder head is warped, etched or brinnelled in excess of .015 in., it should be replaced. If warpage or brinnelling is less than .015 in, it is permissible to plane it off up to .015 in. to correct the condition.

Make sure the cylinder head oil return passage through the hollow dowel is clear. The dowels are also used to align the head and gasket during installation.

Apply gasket seal to the head gasket and install the gasket. Be sure the main oil gallery-to-rocker arm oil passage at the rear of the right bank or front of the left bank is clear and not blocked by the gasket.

To avoid losing torque to overcome friction between threads, dip capscrews in engine oil before starting them in the cylinder block threads.

Install nine short screws in the two outer rows of holes in the head and the five medium length screws in the center row and tighten them finger tight. Install the rocker arm assembly with the long screws and tighten them finger tight. Insert and tighten the rocker arm studs, tightening them alternately so that the assembly is pulled down evenly. Then tighten the cylinder head capscrews in the order shown in Fig. 1, and to the torque shown in the *Tune Up Chart*.

After completing the balance of the installation, recheck the torque of the cylinder head or heads.

If a new rocker arm or rocker arm adjusting screw has been installed, make sure the adjusting screw is in far enough not to hold the valve open when normally it should be closed.

Start the engine and warm it up to approximately 160 degrees and retorque the head in proper sequence to assure a tight and even seal of the gasket to the head and block.

Check the valve clearance and adjust if necessary. Adjust the throttle stop screw for proper idling.

1935-52 L-Head Engines — The general procedure for removing the cylinder head is as follows:

1. Drain radiator.
2. Remove fuel line from carburetor to fuel pump.
3. Remove carburetor air cleaner.
4. Detach accelerator and choke controls at carburetor.
5. Remove carburetor.
6. If valve work is to be done, disconnect exhaust pipe from manifold and remove manifolds from engine.
7. Remove upper radiator hose, spark plugs, temperature gauge engine unit and cylinder head capscrews.
8. Lift cylinder head from block, using lifting hooks in two of the spark plug holes. Do not use a screwdriver, chisel or other sharp instrument to drive between the head and block to loosen the head as damage may result.

Installation Notes — Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block. File or hone all high spots.

If the cylinder head is warped, etched or brinnelled in excess of .015 in., it should be replaced. If warpage or brinnelling is less than .015 in., it is permissible to plane it off up to .015 in. to correct the condition.

Use a torque wrench when tightening cylinder head capscrews. Uneven or excessive tightening of nuts may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder head in the order shown in Figs. 2, 3 and 4, tightening them a little at a time in the proper sequence a couple of times around before final tightening to the torque values given in the *Tune Up Chart*. After the engine has warmed up to approximately

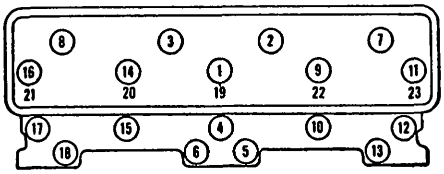


Fig. 1 1951-52 V8 cylinder head tightening sequence

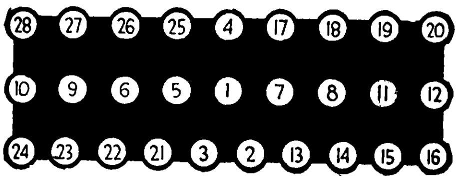


Fig. 2 Head tightening, 1935-42 President

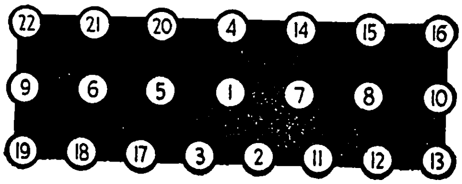


Fig. 3 Head tightening sequence, 1939-52 Champion

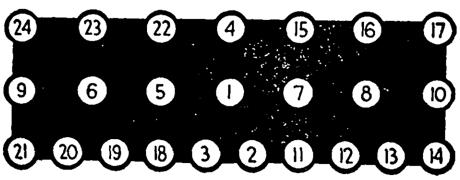


Fig. 4 H ad tightening sequence, 1938-50 Commander

160 degrees, recheck the torque and tighten as required.

ROCKER ARMS

1951-52 V8 Engines—To remove the rocker arm assembly, proceed as follows:

1. Remove carburetor air cleaner.
2. Disconnect wires from spark plugs.
3. Drain cooling system.
4. Remove crown nuts from rocker arm cover and swing spark plug wires back out of the way.
5. Lift off rocker arm cover.
6. Remove four rocker arm bracket screws.
7. Unscrew four cylinder head capscrews that hold rocker arm assembly to head.
8. Lift off rocker arm assembly with cylinder head capscrews remaining in rocker arm shaft brackets.

Disassembly—Before disassembly, mark rocker arms, brackets and shaft so that they can be reassembled in their original positions, Fig. 5.

1. Push outer flat washer at one end of assembly so that the spring washer is compressed and remove cotter pin from shaft.
2. Remove washers and slip the end rocker arm off the shaft.
3. Holding the next rocker arm so that the spacer spring is compressed, remove cylinder head capscrew from end rocker arm shaft bracket. Still holding the spacer spring compressed, slide the bracket off the shaft.
4. Gradually release compression off the spring and remove the next rocker arm and spacer spring.
5. Proceed in the same manner to remove the remaining rocker arms, capscrews, brackets and springs.
6. Take the cotter pin out of the other end of the rocker arm shaft and remove the remaining washers.

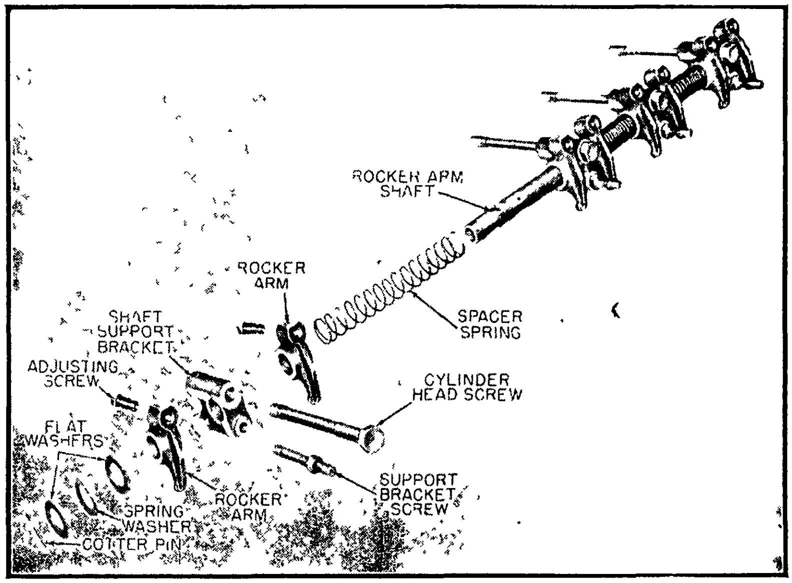


Fig. 5 Rocker arm assembly. 1951-52 V8 engine

Reassembly—Reverse the order of the above procedure to reassemble but before doing so check the following:

Under test the rocker arm spacer springs should require from 9½ to 10½ lbs to compress each spring 2¦ in. A spring that does not test within these limits should be replaced.

Make certain that the oil holes and grooves in the rocker arm shaft are clean.

Clearance between shaft and rocker arms should be 0005 to .0025 in. Lubricate all parts with engine oil during assembly

It is essential that the bottom of the rocker arm be on the oil groove side of the shaft and that the adjusting screw end of the rocker arm be on the same side as the cylinder head capscrew groove in the shaft, otherwise proper lubrication will not be achieved.

If correctly assembled, when installed on the engine, the flat on the end of the rocker arm shaft will be at the rear on the right bank and at the front on the left bank.

Installation—Place the rocker arm assembly on the head with the four cylinder head capscrews inserted through the head. Screw the capscrews down finger tight. Install the four rocker arm bracket screws and lockwashers Tighten these screws alternately to avoid distortion of the assembly.

Make sure the push rods remain seated in the heads of the rocker arm adjusting screws and in the lifters.

Tighten the two inner cylinder head capscrews to 46-50 lbs. ft. torque and then the two outer capscrews to the same torque.

Before installing the rocker arm cover check the valve clearances and, if necessary, adjust as outlined further on

Apply gasket seal to the flange of the rocker arm cover and place a new gasket on the flange. Install the rocker arm cover and complete the installation.

PUSH RODS

1951-52 V8 Engines—The bottom end of the push rod rides in a cup in the valve lifter The push rods are made of seamless tubing with rounded steel ends welded in place. Exhaust and intake push rods are identical but, of course, should be put back in their original position when reassembling.

VALVES, ADJUST

1951-52 V8 Engines—The drilled and grooved adjusting screw is self-locking. A torque of at least 30 lbs. in. should be required to turn the screw when the threads are engaged on both sides of the groove. If the torque is below the limit, valve clearance will not be maintained and the parts should be replaced.

The clearance for both intake and exhaust valves should be set to .014-.016 in. If the cylinder head capscrews are to be tightened, always complete the tightening process before adjusting valve clearances.

To set the clearance the engine should be running at idle speed and the engine temperature should be stabilized at normal operating temperature.

After the choke tube and rocker arm covers have been removed, place the spark plug wire retaining brackets on the rocker arm assembly screws and secure them with the crown nuts. Then, with the engine idling, adjust the valve clearance by turning the adjusting screw as required to obtain the proper clearance as measured with a feeler gauge, Fig. 6.

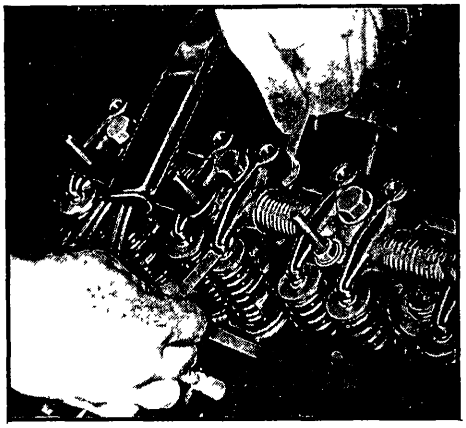


Fig. 6 Adjusting valves on 1951-52 V8

1935-52 L-Head Engines—Valves in these engines should be adjusted while the engine is at normal room temperature. The procedure is as follows:

Crank the engine over until the valve to be adjusted is fully closed. Hold the tappet body with a tappet wrench to prevent it from turning. Then turn the adjusting screw until the proper clearance is obtained (see *Valve Data* chart). Adjust remaining tappets in same manner.

On Champion engines the tappet adjusting screw, Fig. 7, is self-locking. When one of these screws is replaced the torque required to turn the screw should be measured with a spring scale as shown in Fig. 8, and should register at least 25 lbs. in. If it doesn't, replace the screw.

VALVES, REMOVE

1951-52 V8 Engines—After the cylinder head has been removed as outlined previously, remove the spark plugs to avoid damage to them. It is not necessary to remove the exhaust manifold.

Place a suitable holding strap over the valve heads to hold the valves in place while compressing the springs. Cylinder Head Holder Tool No. J-4674, Fig. 9, is available for valve work on these engines.

In using the tool as shown, do not compress the valve springs any more than is required to remove the locks and seals, Fig. 10. If they are compressed until the coils bottom, the springs will lose as much as 10 to 15 pounds tension.

After removing all locks, seals, springs and dampers, invert the head, remove the valve holding strap and lift out the valves. Place the valve in a board with numbered holes so that they can be identified as to the valve port from which they were removed.

Installation Notes—The spring dampers should be inspected to be sure that the fingers are not bent out. The fingers must contact the sides of the springs. Install the dampers so they are on the closed coil end of the springs.

Install the valve spring retainers on the springs, making sure the retainers with the skirts are on the intake valves, Fig 10. Compress the spring until the retainer is past the inner groove of the valve stem far enough to permit installing the rubber seal.

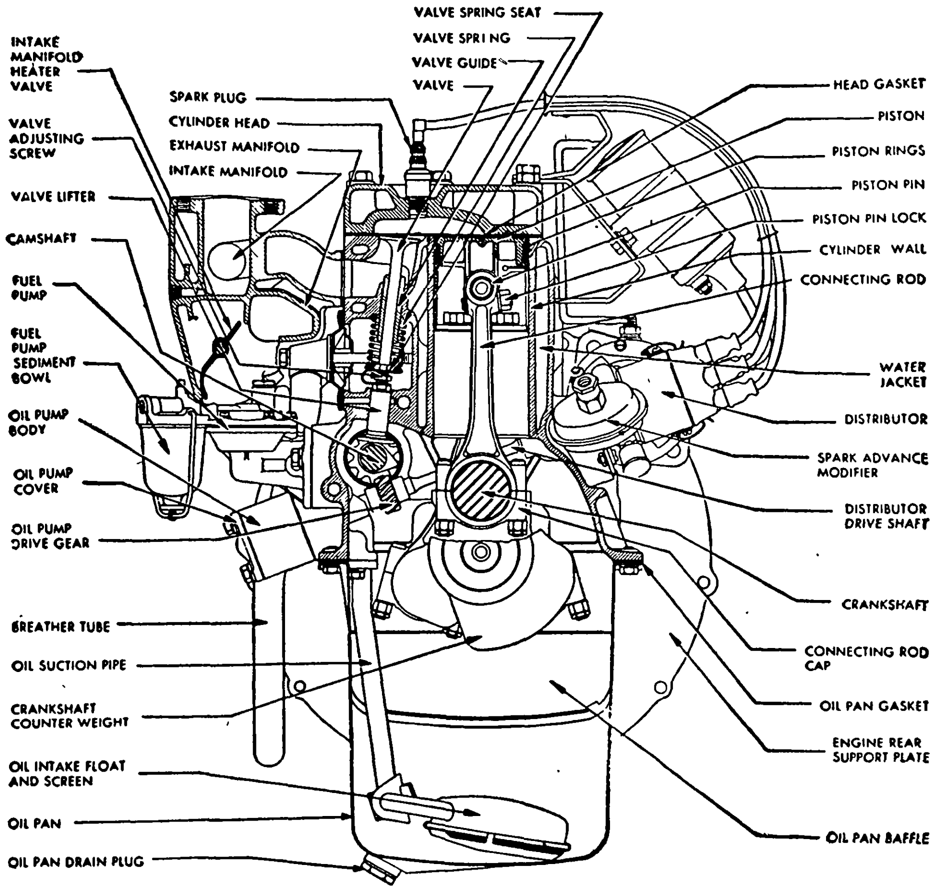


Fig. B End view of 1947-52 Champion engine

The seal must not be installed before the retainer is installed because pressing the retainer over the seal would damage the seal. Always install new rubber seals.

1935-52 L-Head Engines — To remove valves from these engines, take off the cylinder head and valve covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so they can be identified as to the valve port from which they were removed.

VALVE SPRINGS

1935-52 All Models—Wash the springs with gasoline or other suitable solvent. Then examine them for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check the valve spring pressure on a spring testing fixture, if one is available, Fig. 11. If a fixture is not available, at least check the free length of each spring by standing it alongside a new one. Any spring that does not conform to the specifications in the *Valve Data* chart

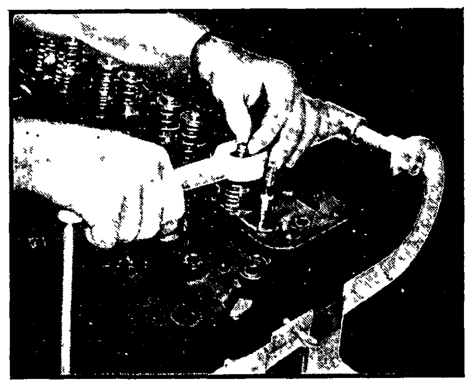


Fig. 9 Removing valve ke pers with th aid of special cylinder head h lding to l. 1951-52 V8 ngine

within 10 per cent. should be replaced. Likewise, any spring that stands shorter than the new spring used for comparison should be discarded.

VALVE GUIDES

1951-52 V8—Clean the valve guides with a wire guide brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the valve stem-to-guide clearance with a dial indicator if one is available. Mount the indicator on the valve guide so that the button contacts the

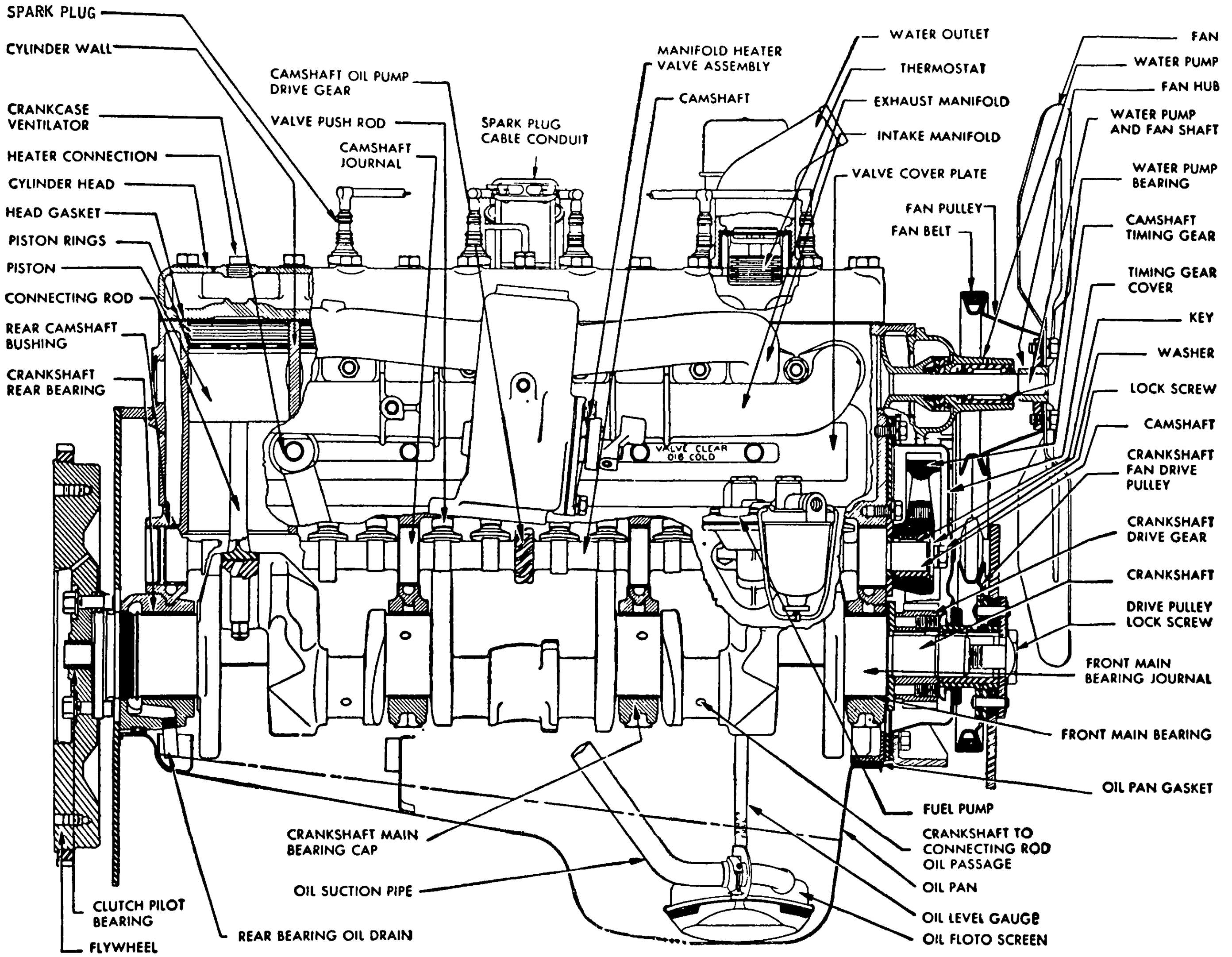


Fig. C Side view of 1947-52 Champion engine

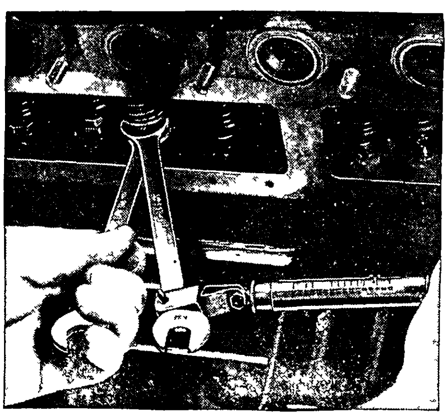


Fig. 8 Using spring scale to check tensi n n self-l cking tapp t adjusting screw, 1939-52 Champi n

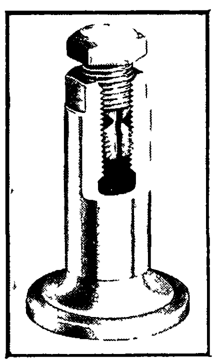


Fig. 7 Self-locking tappet adjusting scr w, 1939-52 Champi n

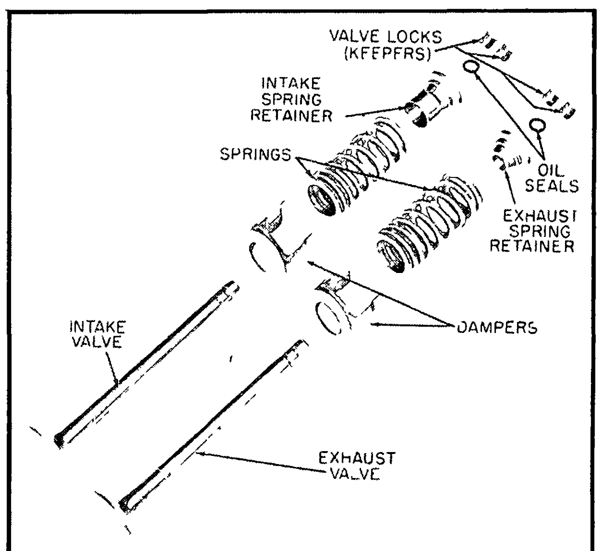


Fig. 10 Lay ut f valves and relat d parts. 1951-52 V8 engin

valve stem squarely and as near the end of the guide as possible. Then move the valve stem away from the indicator. Note the total clearance reading. If the guides are worn so that the reading exceeds .0035 in., new guides should be installed.

The special Valve Guide Tool shown in Fig 12 should be used to remove and install guides in these engines. When removing a valve guide, use the driver to drive the guide out of the cylinder

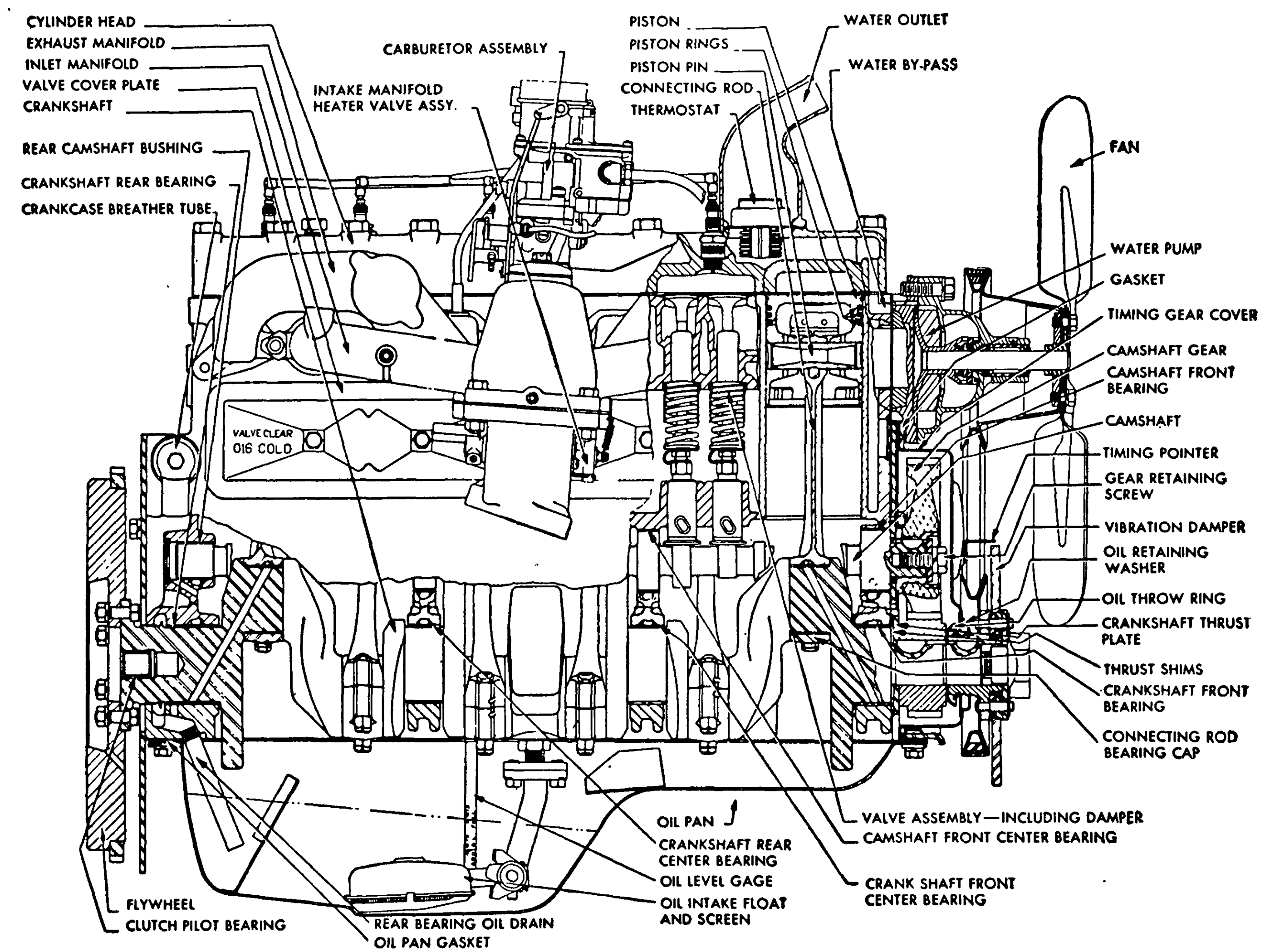


Fig. D Side view of 1947-50 Commander engine

head from the combustion chamber side.

When installing a guide, first coat the outside of the guide lightly with white lead. Then start the chamfered end of the guide into the head from the combustion chamber side. Place the installing plate on the face of the head as shown in Fig. 12 and drive in the guide until the shoulder of the driver contacts the bottom of the counterbore in the plate. The plate is marked "Intake" on one side and "Exhaust" on the other. Be sure the exposed mark of the plate corresponds to the valve guide being installed.

If the special tool is not available, carefully measure the position of the guides before removing them and drive the new ones in accordingly.

1935-52 L-Head Engines—To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance (over .0035 in.) it will be necessary to replace the guide. If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed.

If it is necessary to replace valve guides, the old guides can be driven down and out of the valve chamber. A special driver is available for this work. However, in lieu of the driver, the guides can be pulled out of the block by using a suitable piece of pipe together with a long bolt and suitable washer.

Be sure the new guides are driven to the correct position in the block. This can be determined by measuring the position of the old guides before they are removed.

VALVES, REFACE

1935-52 All Models—In refacing valves, take off only the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

Inspect the valve seats for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats reardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

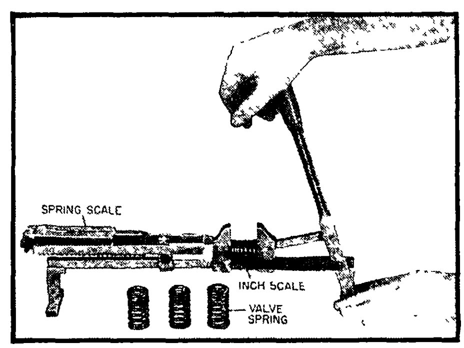


Fig. 11 Checking valve spring tension, 1935-52

The valve seat width after refacing should measure not more than 1/16 in. The width may be checked by placing a scale across the face of the seat.

VALVE LIFTERS

1951-52 V8—A straight barrel type lifter is used. To remove the lifters, take off the cylinder heads and push rods as outlined previously. Then remove the three capscrews that retain the valve lifter chamber cover and breather pipe and lift off the cover and pipe.

Take out the valve lifters, keeping them in order so they can be replaced

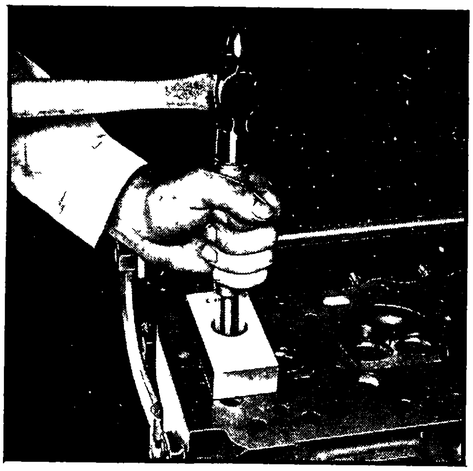


Fig. 12 Sh wing special tool used to contr l positi n f valve guides when driven in plac . 1951-52 V8 engine

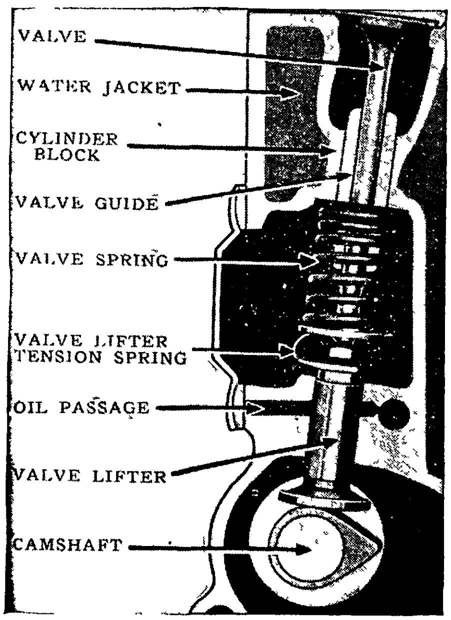


Fig. 13 Valve mechanism, 1939-52 Champion

in the same bore from which they were removed.

Wash the lifters with clean gasoline or other solvent. Remove the carbon and sludge deposits from the oil holes. Inspect all lifters for excessive wear and replace where necessary.

1935-52 L-Head Engines—Mushroom type lifters are used on all Champion and 1947-50 Commander engines which means that the oil pan and camshaft must be removed and the lifters taken out from below when lifters require replacement, Fig. 13.

On Dictator engines and Commanders prior to 1947, barrel type lifters are employed. Removal of lifters of this type is a matter of taking out the valves and springs and removing the lifters through the valve chamber as shown in Fig. 14.

On President engines the lifters operate in detachable guide brackets. Removal of this type is accomplished by unfastening the bracket from the block. It is not necessary to remove the cylinder head and valves.

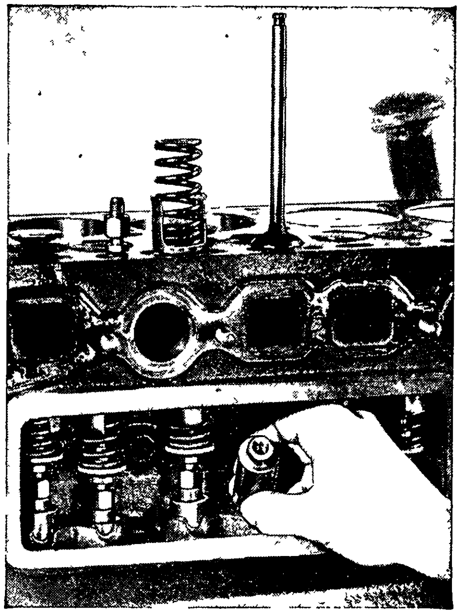


Fig. 14 Removing valve lifters on Commander and Dictator engines prior to 1947

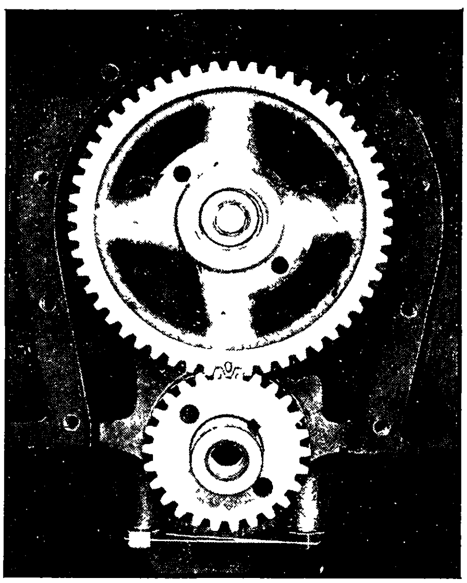


Fig. 15 For correct valve timing, gears must be installed so the timing marks mesh as shown. 1951-52 V8 engine

TIMING GEARS

1935-52 All Models—For correct valve timing, timing gears should be assembled as shown in Figs. 15 and 16. Always use suitable puller and pusher equipment, Figs. 17 and 18, when servicing gears. This is particularly important in the case of the camshaft gear as there is danger of loosening the welch plug in back of the camshaft if the gear is driven on with hammer blows.

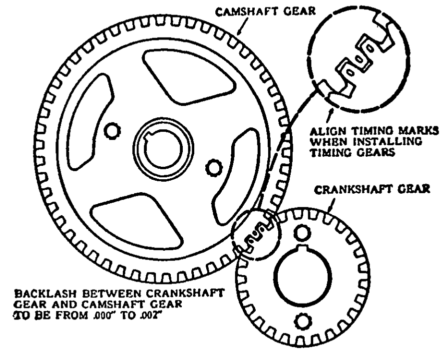


Fig. 16 Timing gear installati n, 1935-50 all models and 1951-52 Champi n

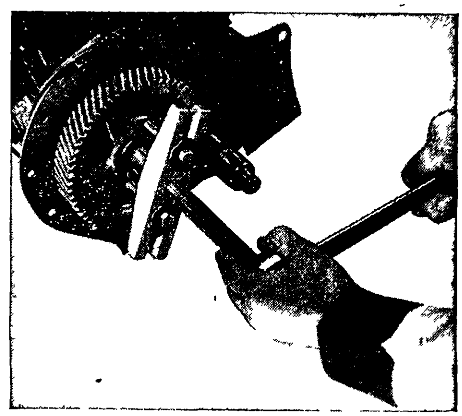


Fig. 17 Using puller t r m ve camshaft gear, 1935-52

Camshaft gears are available in two sizes and are marked "S" for standard and "H" for high limit. The crankshaft gear is furnished in the standard size only. Whenever new gears are installed they should be selected to give 001 to .003 in. backlash.

CAMSHAFT REMOVAL

1951-52 V8—To remove the camshaft from these engines, proceed as follows:

1. Turn the crankshaft until the timing marks show the "IGN" mark directly under the pointer on the timing gear cover and the distributor rotor is in position to fire No. 6 cylinder. In this position the timing mark on the camshaft gear is properly aligned between the marks on the crankshaft gear, Fig. 15.
2. Remove rocker arm assembly, push rods and valve lifters.
3. Remove distributor drive shaft assembly.
4. If the oil pump is not to be removed, the relationship between the positions of the crankshaft and the oil pump shaft must be maintained after the removal of the distributor drive shaft. Therefore, to avoid difficulty in meshing the tongue of the distributor drive shaft with the groove of the oil pump shaft do not turn the crankshaft after it is once positioned with the timing mark under the pointer.
5. Remove water pump, vibration damper, pulley and hub, and take off the timing gear cover.
6. Remove the two screws which fasten the camshaft thrust plate to the

cylinder block and withdraw the camshaft and gear as a unit, being careful not to damage the camshaft bearings.

1935-52 L-Head Engines—To remove the camshaft, take off the radiator and all necessary sheet metal. Remove vibration damper and pulley. Remove the timing gear cover and screws which fasten the camshaft thrust plate to the cylinder block, Fig. 19. Take off the manifolds, cylinder head, fuel pump, oil pump and valve covers.

If removal of the valves is not intended, raise the lifters and keep them up with spring-type clothespins or metal supports, Fig. 20, so they won't interfere with the camshaft as it is being withdrawn. (On President engines, remove the lifters and guide brackets.)

CAMSHAFT END PLAY

1935-52 All Models—Camshaft end play is controlled by a thrust plate, Fig. 21, located between the front camshaft bearing and camshaft gear.

On L-head engines, end play of .004 to .008 in. is permissible and is regulated by the amount by which the thickness of the thrust spacer exceeds that of the thrust plate. However, if a new thrust plate and spacer are installed, the end play should be held to .004 to .006 in. Use a micrometer to measure both parts.

On 1951-52 V8 engines, end play should be from .005 to .007 in. and is regulated in the same manner as for the L-head engines.

PISTONS & RODS, REMOVE

1935-52 All Models—After removing the cylinder heads and oil pan, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove the connecting rod caps and push the pistons and rods out through the top of the cylinders, using care to prevent the big end of the rods from damaging the crankshaft or cylinders.

Make sure the rods and pistons are properly numbered so they can be reinstalled in the original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1951-52 V8—Pistons should be assembled to the connecting rods so that the oil squirt holes are on the same side as the unslotted side of pistons, Fig. 22. And when installed in the cylinders the T-slot side of all pistons should be toward the left side of the engine. In other words, the T-slot side of left bank pistons should face away from the camshaft whereas the T-slot side of right bank pistons should face the camshaft.

1935-52 L-Head Engines—When correctly assembled the oil squirt hole in the connecting rod will be on the camshaft side of the engine with the T-slot side of the piston facing away from the camshaft.

PISTONS

1935-52 All Models—Standard size service pistons are high limit or maximum diameter; therefore, they can usually be

Fig. 18 Using pusher to install camshaft gear, 1935-52

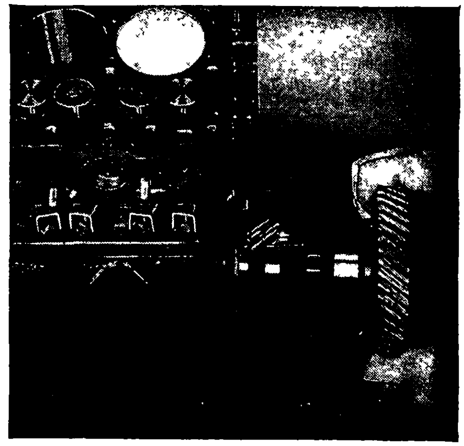


Fig. 20 Using metal jacks t h ld up valve lifters when rem ving camshaft, 1935-52 Six-cyl.

Fig. 19 Removing camshaft thrust plate screws, 1935-52

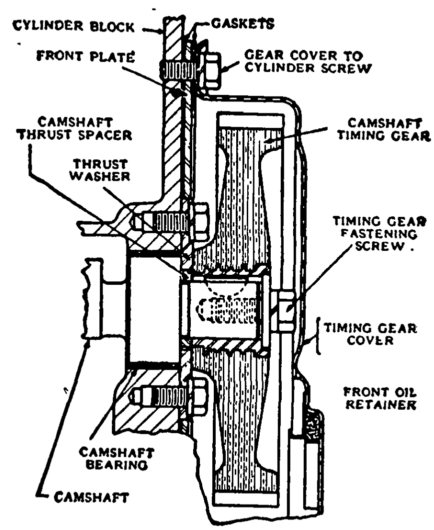


Fig. 21 Camshaft end thrust control, 1935-52

used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages. Service pistons are also furnished in .005, .010, .015, .020 and .030 in. oversizes.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin. Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is very important that refinished cylinder bores are trued up to have not more than .0005 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fibre brush.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore. Therefore, the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees between the temperature of parts is sufficient to produce a variation of .0005 in.

PISTON RINGS

1935-52 All Models — When new piston rings are to be installed without reboring cylinders, the glazed cylinder walls should be slightly dulled but without increasing the bore's diameter. This is done with a "Glazebuster" or with a hone equipped with the finest grade of stones.

New rings must be checked for clearance in piston grooves and for gap in cylinder bores. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and

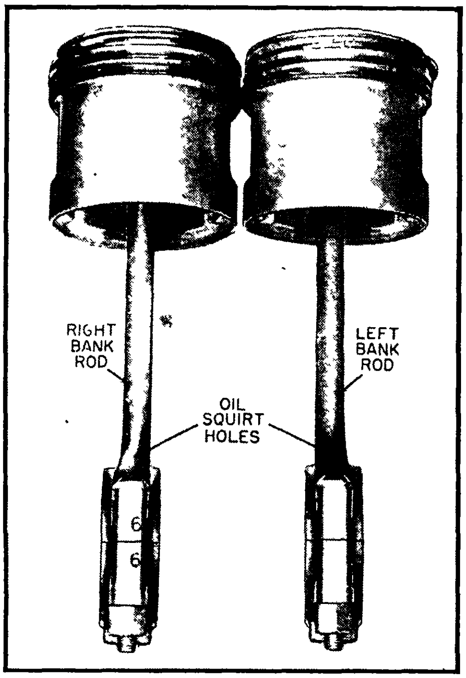


Fig. 22 Pist ns and rods. 1951-52 V8

Fig. 23 Fitting pistons with spring scale and feeler gauge, 1935-52

then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

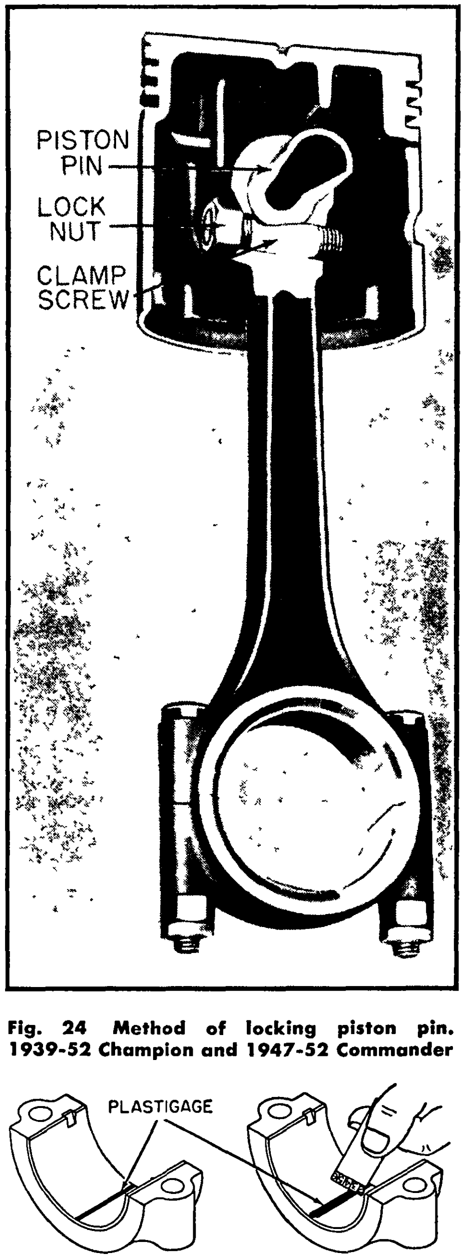


Fig. 24 Method of locking piston pin. 1939-52 Champion and 1947-52 Commander

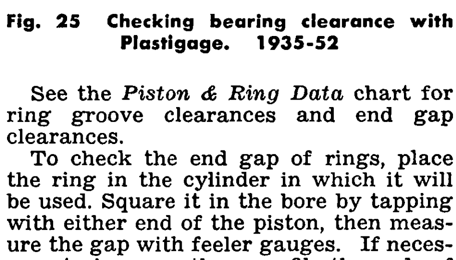


Fig. 25 Checking bearing clearance with Plastigage. 1935-52

See the *Piston & Ring Data* chart for ring groove clearances and end gap clearances.

To check the end gap of rings, place the ring in the cylinder in which it will be used. Square it in the bore by tapping with either end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends of rings carefully with a smooth file.

PISTON PINS

1935-52 All Models—Service piston pins are available in standard and .0025 and .005 in. oversizes. When fitted correctly in the piston, pins should require a light finger push with parts at room temperature of approximately 70 degrees.

1951-52 V8—To remove the piston pin, remove the lock nut and star washer from the clamp screw, Fig. 24. Install and tighten the lock nut on the other end of the clamp screw, which will loosen the clamp screw in the rod. Remove the screw from the rod and slide the piston and rod off the pin.

To install the pin, slide the piston and rod into position. But before inserting the clamp screw, be sure the solid side of the piston is to the squirt hole side of the rod.

If the connecting rod is a new one and hasn't been marked, it should be checked to determine whether it is a left or right bank rod. The rods are offset at the crankpin end and can be identified as shown in Fig. 22.

Install the piston pin clamp screw so that the nut will be installed on the T-slot side of all pistons. Be sure the flat surface of the clamp screw mates with the flat surface of the piston pin, otherwise the pin will work loose in service.

1939-52 Champion & 1947-50 Commander—On these engines the piston pin is locked in the rod in the same manner as for V8 engines, Fig. 24. However, on connecting rods 1, 3 and 5, the clamp screw nut is installed on the T-slot side of the piston. On Nos. 2, 4 and 6, the nut is installed on the solid side of the piston.

When installing the clamp screw regardless of the rod number, hold the rod with its offset to the left and insert the screw from the front. This will locate the lock nut on the correct side with relation to the piston.

CONNECTING ROD BEARINGS

1947-52 Champion & Commander; 1935-42 President—Connecting rod bearings in these models consist of two half shells, the upper shell having an oil hole which communicates with an oil hole in the rod.

When the shells are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the shells must never be filed flush with the parting surface of the rod and cap.*

If this type bearing becomes noisy or is worn so that the clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the rod or cap be filed to adjust bearing clearance.

Service bearings are furnished in standard size and several undersizes, including undersizes for reground crankshafts.

The clearance for connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber and full instructions for its use are furnished with the envelope in which it is contained, Fig. 25.

Lacking Plastigage, however, clearance may be checked with a .002 in. test shim, ¾ in. square. Place the shim between the bearing and shaft journal. Install the bearing cap and tighten the nuts to the recommended torque. A locked

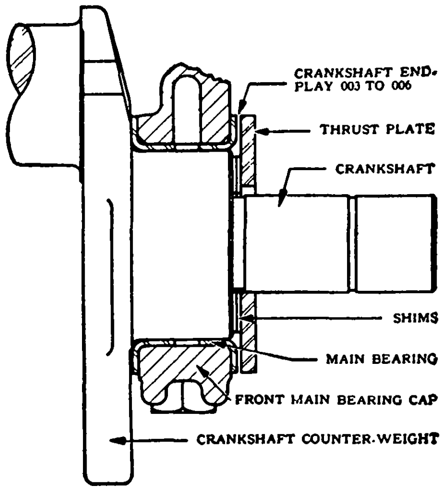


Fig. 26 Crankshaft end play c ntrol, 1935-52

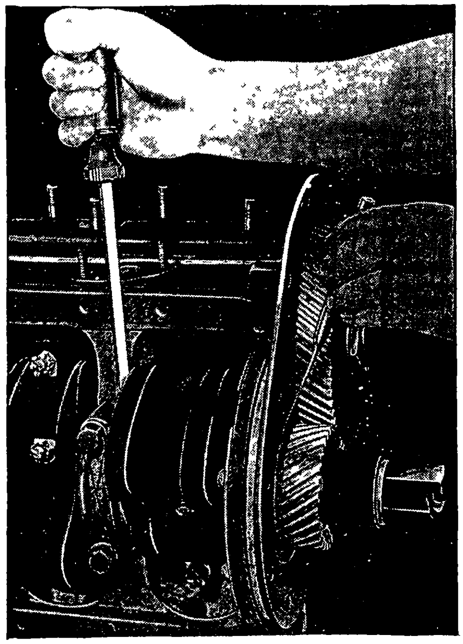


Fig. 27 Checking crankshaft end play, 1935-52

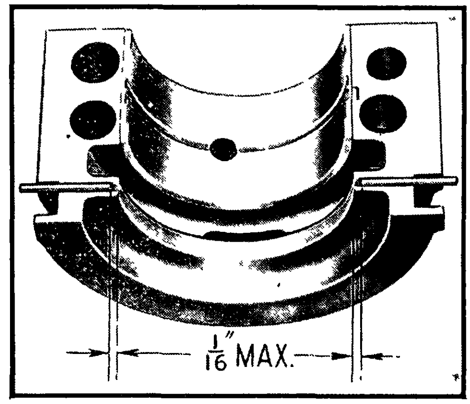


Fig. 28 Installing neopren s als in b aring cap groove. 1949-52

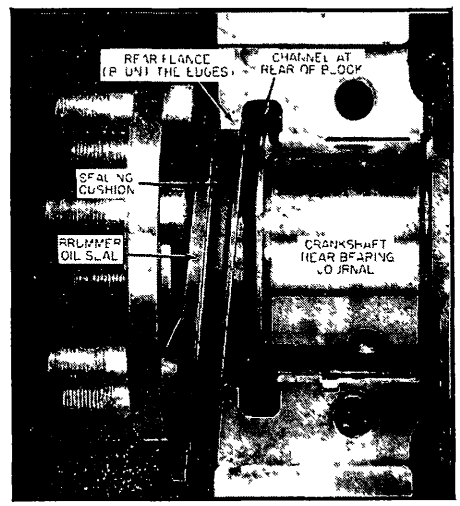


Fig. 29 Installing crankshaft rear oil s al. 1949-52

bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed. Do not overlook removing the test shim.

Connecting rod nuts are locked with stamped nuts which should not be reused when once removed. Install these nuts with the flat face toward the connecting rod nut. Turn the locking nut finger tight and then tighten it an additional one-third turn with a wrench.

NOTE—All engines not included in the above have direct-babbitted connecting rod bearings. No adjustment is provided and when clearance becomes excessive, new or rebuilt connecting rods must be installed.

CRANKSHAFT & MAIN BEARINGS

1935-52 All Models — Main bearings are the shell type and can be removed and replaced without removing the crankshaft. The bearings are made to size and do not require line reaming or adjustment.

When it is necessary to install new bearing shells, it is advisable to measure the shaft journals with a micrometer for being out-ofround. If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or connecting rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft.

Use a rifle brush to clean the oil passages in both the shaft and crankcase. If possible, blow out the oil holes with compressed air. Be sure the journals are not nicked or scored and that all parts are thoroughly clean.

After installing the bearings, check the running clearance to be sure it is standard (see *Engine Bearing Data* chart). Use Plastigage or a .002 in. test shim about one inch square. Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque. The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct. Do not overlook removing the test shim.

CRANKSHAFT END PLAY

1935-52 All Models—Crankshaft end play is controlled by shims located between the vertical surface of the front main bearing journal and the crankshaft thrust washer, Fig. 26.

Whenever new bearings are fitted the clearance should be carefully checked and shims should be added or removed as required to bring the end play within the limits given in the *Engine Bearing Data* chart.

End play can be measured by forcing the crankshaft forward and inserting feeler gauges between the crankshaft gear and thrust washer, Fig. 27.

CRANKSHAFT REAR OIL SEAL

1949-52 All Models—Oil sealing at the rear main bearing is controlled by a Brummer oil seal installed around the crankshaft journal, wood filler blocks between the sides of the main bearing cap and block, and Neoprene seals between the bearing cap face and block.

On 1949 engines it will be necessary to remove the clutch, flywheel, engine rear plate and oil pan when the Brummer oil seal requires replacement. In order to remove the engine rear plate, it is necessary to rmove the engine from the chassis.

On 1950-52 models, it is not necessary to remove the engine from the chassis to replace the Brummer oil seal.

On all models, after removing the parts mentioned above, proceed as follows:

1. Remove crankshaft rear bearing cap and all the old oil seals.
2. Wash bearing, blow dry and wipe clean.
3. Loosen the intermediate bearing caps approximately two turns to give additional clearance between the rear journal and block.
4. Insert the Neoprene seals in the cross grooves of the rear bearing cap so that the inner end of each seal is inset $\frac{1}{16}$ in., Fig. 28.
5. Press the seals uniformly and firmly into the grooves.
6. Place the cap with the seals downward on a flat surface and, while pressing on the cap, use a sharp knife or razor blade to cut the protruding ends of the seals flush with the side of the cap.
7. If the engine was not originally equipped with this type seal, use the flat side of a screwdriver to blunt the sharp edge of the flange, Fig. 29, on which the seal is to be mounted. It is not necessary to remove any material from this edge but only to blunt it so that it does not scuff the soft center sealing cushion at the bottom of the groove since this cushion is as important a part of the seal as the compression flange which wipes the crankshaft.
8. Before installing the Brummer oil seal, clean the channel just forward of the crankcase rear flange by pulling a swab saturated with alcohol or a similar solvent through the channel several times. Then dry the channel thoroughly.
9. Dip the ends of the seal in liquid soap and spread the soap throughout the inside of the outer groove.

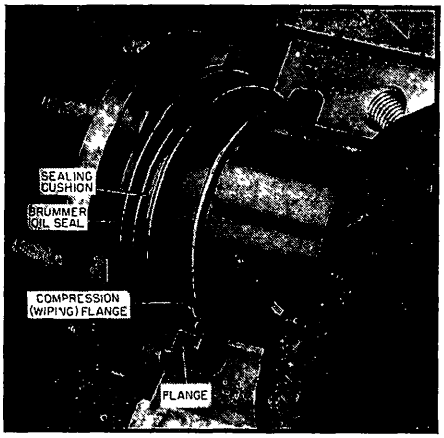


Fig. 30 Installing crankshaft rear oil seal. 1949-52

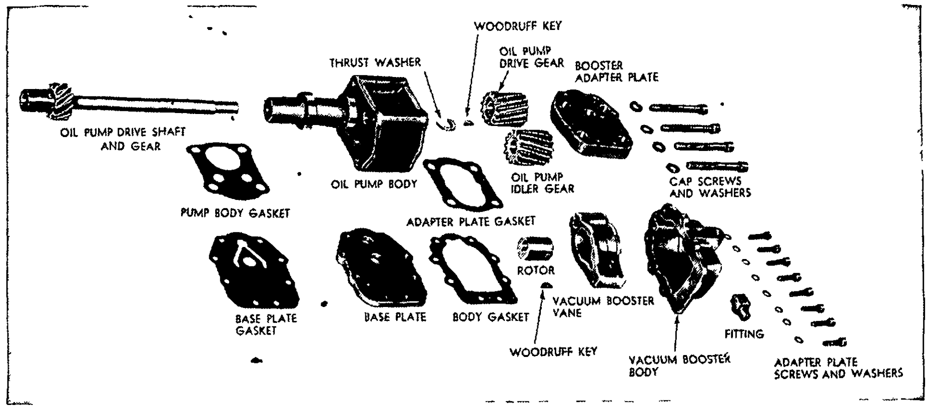


Fig. 33 Layout of oil pump and vacuum booster parts on 1947 C mmander. The booster is used for windshield wiper operation

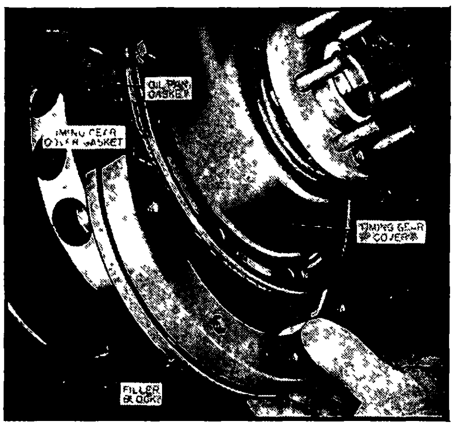


Fig. 31 R m ving filler block, 1951-52 V8

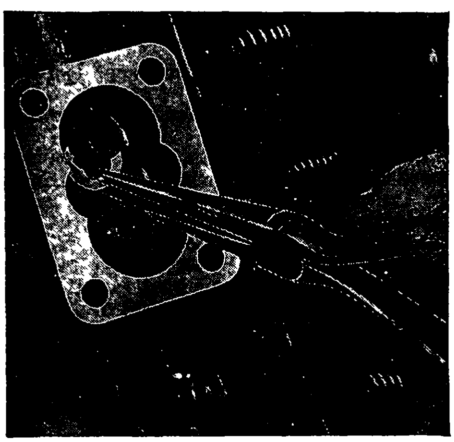


Fig. 32 Rem ving C washer to disassemble Champi n il pump, 1939-52

10. Spread the seal just enough to permit aligning one end of it with the crankcase rear flange and insert the seal as shown in Fig. 29.
11. Carefully work the seal around the crankshaft until the end emerges on the opposite side, Fig. 30.
12. Now align the seal, reverse the direction of rotation and insert the other end of the seal.
13. Continue to turn the seal until the joint is approximately 45 degrees from the lower surface of the block.
14. Apply oil between the compression flange of the seal and the crankshaft journal.
15. Install the bearing cap and the two Neoprene seals.
16. Install bearing cap screws and tighten to specified torque. Tighten intermediate bearings caps.
17. Install the two wood filler blocks, being sure the blocks are not damaged or split during the installation.
18. Complete the job and run the engine for 45 minutes and check for oil leaks.

ENGINE OILING

OIL PAN REMOVAL

1935-46 — The oil pan on these models may be removed in the conventional manner. To facilitate the job, however, turn the engine over so that No. 1 and 2 pistons are as near to the center of their cylinders as possible so that the crankshaft throws will not interfere with the pan's removal.

1947-49—Due to the construction of the front suspension and its position with relation to the engine, the latter will have to be removed from the chassis in order to take off the oil pan. On 1947-49 Champion, the engine and clutch may be removed as a unit, leaving the clutch housing and transmission in the chassis. On 1947-49 Commander, it is necessary to remove the transmission and clutch housing before the engine can be lifted out.

1950 Champion—To remove oil pan:

1. Raise car and support on jacks.
2. Drain oil and remove level gauge.
3. Disconnect center tie rod from auxiliary steering arm, turn left wheel to right and swing center tie rod to rear.
4. Remove lower right clutch housing bolt.
5. Remove front splash pans to gain access to front oil pan screws.
6. Remove screws and drop oil pan.

NOTE — For proper installation of oil pan side gaskets the filler block must be removed. To do this remove the front support-to-cross member bracket bolts. Place a hydraulic jack under the center of the vibration damper and raise the engine about one inch to provide clearance between support and bracket. Then remove the four screws which hold the front support and filler block to the engine plate and remove engine support and filler block. To install proceed as follows:

1. Apply gasket seal and place side gaskets in position.
2. Position filler block and support on engine plate and install a screw in one of the upper holes but do not tighten.
3. Using a hardwood stick pry upward against filler block and install a screw in the opposite upper holes.
4. Install two remaining screws until lock washers are just engaged.
5. With all gaskets in place install oil pan.
6. After oil pan screws are tightened tighten four support-to-filler block screws.
7. Complete job in reverse order of removal.

1950 Commander—To remove pan:

1. Raise car and support on jacks.
2. Drain oil and remove level gauge.
3. Remove front stabilizer shaft.
4. Turn front wheels to right moving end of bellcrank to left from underneath oil pan.
5. Remove engine front support-to-cross member bracket bolts.
6. Place small hydraulic jack at oil pan mounting flange as far forward as possible.
7. Raise engine so front engine support is 1½" from top of cross member bracket and insert a block of wood to maintain this position.
8. Remove jack and oil pan screws.
9. Turn crankshaft so that No. 1 piston is midway of its travel in the bore and slide the pan down and out.

NOTE—Reverse the above procedure to install the pan. After the oil pan screws are installed raise the engine enough to remove the wooden block. Then lower

the engine, align the holes of the support and cross member bracket and install the support bolts.

1951-52 Champion—To remove pan:

1. Raise car and support it with stationary jacks.
2. Drain oil and remove oil level gauge.
3. Disconnect tie rods from steering bellcrank.
4. Remove steering bellcrank pin bolt.
5. Remove bellcrank shaft grease fitting and remove shaft bracket retaining bolt nuts.
6. Remove shaft and bracket from bellcrank.
7. Swing bellcrank as far as possible to left.
8. Remove front splash pans to gain access to front oil pan screws.
9. Remove pan attaching screws and pan.

NOTE—For proper installation of the oil pan side gaskets the filler block must be removed. To do this remove the four screws which hold the filler block to the engine plate and remove the filler block. If the filler block adheres to the front plate gasket, use a thin putty knife and carefully separate the gasket and filler block. If the gasket is damaged, cut away the exposed portion of the gasket and cut from a new front plate gasket the amount required to fit the new gasket to the plate. Then proceed with the installation according to the instructions for 1950 Champion items 1 through 7.

1951-52 V8 Engines—To remove pan:

1. Raise car and support it on stationary jacks.
2. Drain oil and remove oil level gauge.
3. Disconnect one battery cable.
4. Remove starter motor.
5. Disconnect one end of right tie rod.
6. Disconnect reach rod from steering bellcrank.
7. Remove steering bellcrank shaft and bracket.
8. Swing bellcrank out of way to left side of car.
9. Remove exhaust cross-over pipe.
10. Remove attaching screws and oil pan.

NOTE—For proper installations of the oil pan side gaskets the filler block must be removed, Fig. 31. To do this remove the four screws which hold the filler block to the timing gear cover and, using a thin putty knife carefully separate the filler block from the timing gear cover gasket. If this gasket is damaged, cut away the exposed portion of the gasket. Then cut from a new timing gear gasket the required amount and fit it to the timing gear cover, using gasket seal to secure it in place. Then proceed with the installation as follows:

1. Apply gasket seal and place oil pan side gaskets on pan flanges.
2. Position filler block against timing gear cover and install a screw in one of the upper holes.
3. Using a hardwood stick, pry upward against the filler block and install a screw in the opposite upper hole.
4. Install the two remaining screws and tighten all four screws until the heads of the screws just engage the lockwashers.
5. With all gaskets in position, install oil pan and tighten screws evenly. Then tighten the four filler block screws.

OIL PUMP

IMPORTANT—On all L-head engines, before removing the oil pump, crank the engine to bring No. 1 piston to its firing position, which is when the ignition mark on the vibration damper or flywheel is in line with the pointer. If possible, leave the engine in this position while the pump is off in order to obtain correct ignition timing. However, if the engine is disturbed while the pump is off, return it to the No. 1 firing position before attempting to install the pump.

1935-42 Dictator & Commander—To remove the pump, unfasten it from the crankcase and lift it out. To disassemble drive out the pin and slide the upper drive gear from the shaft. Remove the cover and take out the lower gears and shaft. After the installation of new parts prime the pump with engine oil before replacing the cover so the pump will operate immediately when the engine is started.

1935-42 President—The oil pump used in these engines is similar to the above except that it is located inside the crankcase, which necessitates the removal of the oil pan.

1939-52 Champion—Removal of the oil pump in these engines is a piece-by-piece operation. Take off the bottom cover and pick out the "C" washer, Fig. 32, from the pump shaft. Remove the body and pull out the shaft and gears.

Reverse the operations to assemble, being sure the engine is in the position to fire No. 1 cylinder. (If the pump is equipped with a vacuum booster for windshield wiper operation, see instructions given for the 1947 Commander below.)

1947 Commander—Fig. 24 is a layout of the oil pump and vacuum booster parts used in these engines. The pump proper is of the conventional gear type. The vacuum booster is used to improve the operation of the windshield wipers.

To remove the pump and booster, it is necessary to unfasten the engine from its mountings and hoist it on an angle to gain access to the mounting screws.

When hoisting the engine, screw an engine lifting eyebolt in the center cylinder head bolt position and arrange the hoist so its chain slants upward about 15 degrees to the left. Raise the engine slowly until the mounting screws are accessible and block it in this position.

Unfasten the booster from the pump and, after disconnecting the pump mounting screws, work it out of the engine by twisting it from side to side. When the drive gear has almost cleared the cylinder block opening, swing the bottom of the pump to the right (or forward) and continue the downward travel. When the pump clears the opening, the end of the booster shaft will pass between the steering knuckle upper control arm bolts.

1950 Commander—To remove pump:

1. Set engine so No. 1 piston is at upper dead center and "UDC-1-6" mark on vibration damper is directly under pointer.
2. Disconnect oil pressure pipe at pump.
3. Remove pump cover screws.
4. Using a hardwood stick about 3 feet long, inserted between exhaust manifold and engine block, tilt engine down to right and at the same time, guide the pump out of the block and remove from below the lower flange of the frame side rail.

To install the pump, tilt engine as during pump removal and guide pump into block. Before pump drive gear and camshaft have meshed, turn pump drive shaft with keyway facing rear of car. Then engage gears. When full engagement has been obtained, keyway will point almost straight downward. This procedure is necessary to obtain correct ignition timing.

1951-52 V8 Engines — Removing the pump from these engines does not effect the ignition timing. After removing the oil pan as previously outlined, remove the two pump retaining nuts and slip the pump from the mounting studs.

OIL PRESSURE REGULATOR

1935-40 Dictator & Commander; 1941-42 President — The oil pressure relief valve is located at the right front side of the engine. Pressure is regulated by turning the adjusting screw to the right to increase it, and to the left to reduce the pressure.

1935-40 President — The regulator is located at the right front side of the engine and is regulated by adding or removing shims between the spring and screw. Adding shims increases pressure, and vice versa.

1939-52 Champion; 1949-52 Commander —The oil pressure relief valve is located at the lower right-hand front corner of the engine. If necessary, an adjustment can be made by inserting shims between the outer end of the spring and the screw plug. Inserting shims increases pressure.

COOLING SYSTEM

RADIATOR CORE REMOVAL

1935—Remove hood and radiator brace rods. Disconnect headlamp wires and separate the horn wire connections. Unfasten hose connections. Disconnect radiator core and shell where necessary and lift off.

1936 — Remove hood, radiator brace rods and fan blades. Unfasten hose connections, disconnect headlamp wire clips and move out of the way. Unfasten core from shell and support and lift out.

1937—Procedure is similar to above but on cars with solid axle, raise front of car and take core out from below. On knee action models, take the core out through the top of the shell.

1938-50 — On models with battery under hood, disconnect battery. Unfasten

headlamp loom from radiator fastenings. Take off fan blades and/or water pump as required, disconnect core from its mounting and lift out.

1951-52 Models — Drain cooling system and disconnect upper and lower hoses. Remove fan blades and the capscrews holding the radiator to its support. Then lift the radiator off the support and out of the chassis.

WATER PUMP, OVERHAUL

1935-37 President—To disassemble, pull coupling flange from shaft. Remove cover. Loosen packing nut and pull shaft out through rear of pump. Press the bushing out rearward.

If bushing is replaced, see that there is from .001 to .003 inch clearance between bushing and shaft. Pump shaft end play should be from .003 to .005 inch and may be obtained by facing the flanged inner end of the bushing.

When assembling the pump, be sure to install the thrust washers on each side of the impeller. Fill the grease cups before operating the pump.

1935-42 Dictator & Commander; 1938-40 President—To disassemble, drive out the pin and press the shaft out of the hub. Remove the back plate and pull out the shaft and impeller. Remove the packing and nut and press the rear bushing out rearward and the front bushing forward.

Clearance between shaft and bushings should be from .001 to .003 inch. Shaft end play should be from .003 to .005 inch. Bushings require no reaming. Lubricate pump before putting it in operation.

1939-52 Champion; 1941-42 President; 1947-50 Commander—These Models use the seal type, ball bearing pump, two designs being shown in Figs. 34 and 35.

To disassemble, remove the bearing lock ring and press the shaft and bearing out through the front of the housing. Pick out the seal parts, being careful to note their arrangement so that upon reassembly, leakage will be avoided.

Inspect the parts for damage or wear. If the thrust seal surface is rough, it should be refaced with a suitable facing tool. Always use a new impeller and seal assembly. And to insure a tight fit, use a new fan hub.

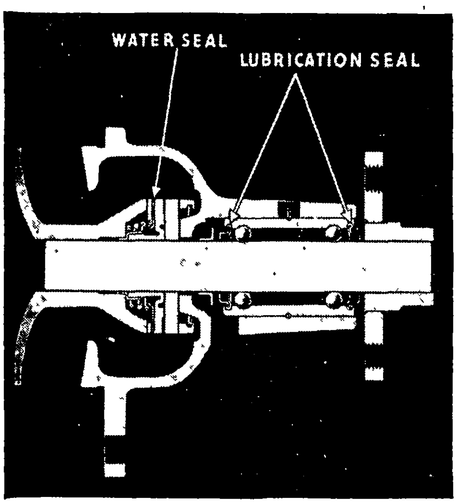


Fig. 34 Water pump. Typical f all 1941-51 Champi n and Pr sident and 1947-50 C mmander

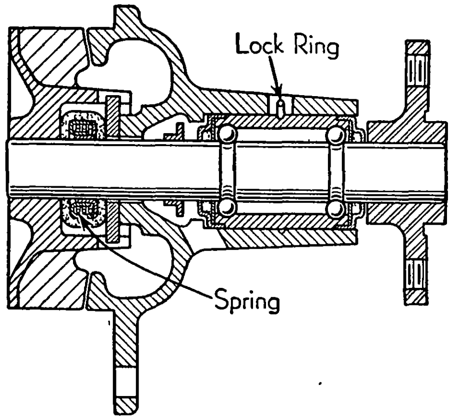


Fig. 35 Water pump, 1939-40 Champion

When assembling, press the fan hub on the shaft so that it is flush with the end of the shaft. Install the shaft and bearing and insert the bearing lock ring. Slip the seal parts into the impeller and press the impeller on the shaft, allowing $\frac{1}{32}$ inch clearance between the impeller and housing.

1951-52 Commander — To remove the water pump, drain the cooling system and remove the fan belt, fan and pulley. Disconnect all water hose. Remove the generator adjusting arm from the top stud. Then remove the seven capscrews holding the pump housing to the engine. Lift off the water pump and four gaskets.

To disassemble the pump, remove the cover and impeller from the pump housing. Pull out the bearing lock ring. Place the assembly in an arbor press and press the hub, shaft and bearing assembly out of the impeller and cover. Then press the shaft and bearing out of the hub.

Inspect the parts for wear or damage. If the thrust seal surface in the housing has become rough, it should be refaced with a suitable facing cutter.

In assembling the pump, a new fan hub should be used to insure a tight fit on the shaft. Press the fan hub on the shaft so it is flush with the end of the shaft. The impeller should be pressed on the shaft so it too is flush with the end of the shaft.

ELECTRIC SYSTEM

IGNITION TIMING

1936-52 — On 1935-40 Presidents, two sets of points are used and both should be adjusted accurately to the dimension given in the *Tune Up* chart. In addition, the points must be synchronized so that the adjustable points open exactly 45 degrees (distributor shaft) after the stationary points have opened. To obtain best results, both operations should be performed on a distributor testing fixture.

To set the basic ignition timing on all models, set the breaker gap to the clearance given in the *Tune Up* chart and crank the engine to bring No. 1 piston up on its compression stroke and stop when the "IGN" mark on the vibration damper (flywheel on some models) is in line with the pointer. In this position, the breaker points should have just started to break. If they haven't, loosen the distributor clamp and rotate the distributor until the points start to break.

For best results, use a timing light connected in series with the No. 1 spark plug. With the engine idling, the light should show the ignition mark aligned with the pointer every time No. 1 spark plug fires. Advance or retard the octane selector to compensate for the grade of fuel being used.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-37—Loosen the lock nut and turn the clutch release adjustment lever set screw to the right to decrease pedal travel and to the left to increase the travel. A minimum of 1 inch free pedal travel should be maintained.

1938-46—Clutch pedal free travel should be maintained at a minimum of 1 inch. Turn the lever sleeve on the link rod as required, Fig. 36.

1947-52 Champion & Commander — Clutch pedal free travel should be maintained at from ¾ to 1 inch (Champion before serial number G-217064, ½ to ¾ inch). To adjust, Fig. 37, unhook the pullback spring, loosen the lock nut and turn clutch adjustment clevis as required.

CLUTCH REMOVAL

1935-40 (Except Champion) — To remove the clutch, disconnect one battery terminal. Remove floor boards and raise car as required. On solid floor models, remove rear engine support. Remove transmission, clutch housing and clutch.

Before assembling, clean flywheel, clutch housing, and lubricate pilot bear-

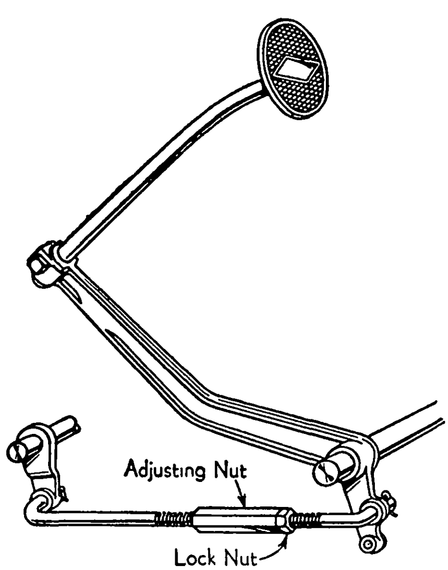


Fig. 36 Clutch pedal linkage, 1938-46

ing. After assembling, adjust clutch pedal free movement and, if equipped, the Hill Holder rod.

1939-40 Champion (Conventional Transmission)—To remove the clutch, proceed as follows:

1. Jack up rear of car to provide working space and place an adjustable jack under the rear of the engine, protecting the oil pan with a board.
2. Disconnect the starter cable at the battery.
3. Remove floor plates over transmission and clutch housing.
4. Remove two upper transmission mounting screws.
5. Disconnect speedometer cable at transmission, remove speedometer pinion and plug the speedometer hole to prevent oil leakage.
6. Remove propeller shaft and joints.
7. Remove transmission support cross member.
8. Disengage shifting rods from transmission levers.
9. Remove exhaust pipe bracket from clutch housing.
10. Lower rear of engine, remove two lower transmission case bolts and remove transmission.
11. Remove clutch shaft sleeve pins and push sleeve away from transmission toward frame side member.
12. Unhook pullback spring from brake pedal and from clutch housing clip.
13. Remove clutch housing.
14. Insert wooden wedges between clutch release levers and clutch cover to prevent distorting the cover. Then unfasten the clutch from the flywheel.

Before replacing, clean flywheel, clutch housing, and lubricate pilot bearing. After assembling, adjust clutch pedal free movement and test operation of clutch.

1939-40 Champion (Overdrive Transmission)—Follow steps 1 through 13 given above for conventional transmission and continue as follows:

1. Drain cooling system.
2. Loosen hose clamps, unfasten exhaust manifold from the exhaust pipe, and remove oil pressure pipe from behind engine block.
3. Remove transmission rear flange and pack opening around shaft with rags to prevent grease leakage.
4. Lower engine until center of mainshaft is about two inches below the under surface of the frame X member.
5. Remove two lower transmission screws and take out transmission and clutch.

1941-46—To remove the clutch:

1. Disconnect battery, fold front floor carpet back and remove floor plates over transmission and clutch housing.
2. Unfasten the starter and arrange it so it will not fall.
3. Raise rear axle 2½ feet and rest car on stationary jacks.
4. Remove propeller shaft and joints.
5. Remove speedometer cable and pinion; block speedometer hole to prevent grease leakage.
6. Disconnect overdrive control cable (if equipped).
7. Disconnect gearshift rods from transmission levers.
8. Plug the transmission rear opening with rags to prevent grease leakage.
9. Disconnect exhaust pipe from clutch housing.
10. Disconnect clutch operating shaft by removing sleeve pins and sliding sleeve outward off clutch release shaft.
11. On President, remove overdrive transmission support.
12. With roller jack, and oil pan protected, support engine and remove rear cross member to frame bolts.
13. On Commander and Champion, unfasten engine rear cross member and, leaving it connected to parking brake cable, swing the cross member to one side.
14. On President, unfasten cross member from clutch housing.
15. Lower engine ½ inch.
16. Unfasten transmission from clutch housing and remove transmission.
17. Remove clutch and brake pedal pullback springs, and disconnect solenoid wires.
18. On Commander and President, drive ring dowels in clutch housing forward.
19. Unfasten clutch housing from engine.
20. On Champion, drive dowel bolts forward.
21. On Commander and President, break clutch housing loose from upper center dowel pin.
22. Remove clutch housing, release bearing and related parts, and clutch.

Before assembling, clean flywheel, clutch housing, and grease pilot bearing. After assembling, adjust clutch pedal free movement and test operation of clutch.

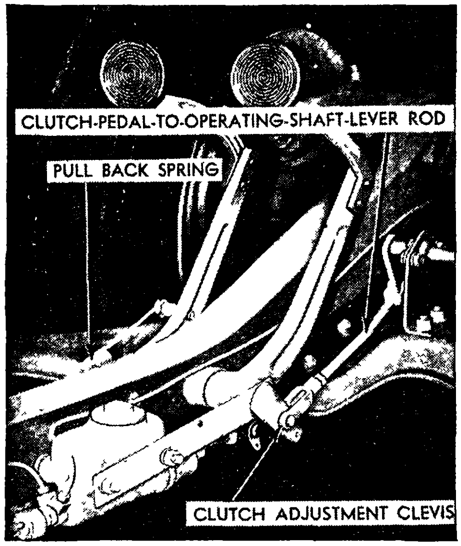


Fig. 37 Clutch pedal linkage. Typical of all 1947-52

1947-50—To remove the clutch:

1. Raise the rear of the car and rest it on stationary jacks placed under the rear axle housing, and remove the transmission.
2. Disconnect one battery cable, unfasten the starter and suspend it clear of the flywheel housing.
3. After removing the floor plates, remove the clutch housing mounting cap screws which are accessible through the inspection hole.
4. Unfasten the speedometer cable retainer from the cross member and move the cable out of the way.
5. With an adjustable jack and block of wood, raise the rear of the engine and unfasten the rear engine mounting.
6. Disconnect the parking brake cable from the lever, the clutch operating shaft from the release shaft, and the brake pedal return spring from the frame cross member.
7. Loosen the exhaust pipe flange at the manifold, remove the exhaust pipe support bracket, loosen the clamp, and rotate the bracket out of the way.
8. Remove the engine rear support cross member. Then remove the remaining clutch housing mounting screws and take off the clutch housing.
9. Insert wedges between the release levers and the clutch cover to prevent cover distortion and remove the clutch from the flywheel.

Reverse the operations to install the clutch, being sure the clutch housing and flywheel are clean, and that the pilot bearing is in good condition and lubricated. When assembled, adjust the clutch pedal free travel and test the clutch operation.

1951-52—To remove clutch:

1. Disconnect battery and remove distributor.
2. On Champion, remove oil level gauge and adapter. Take off starter without disconnecting wires and tie it out of the way.
3. On Commander, disconnect cable from starter and remove starter.
4. On all models, remove floor plate and top clutch housing capscrew.
5. Remove transmission as outlined under *Transmission*.
6. Remove clutch release shaft-to-sleeve pin, shift the operating shaft away from the clutch housing and slip the sleeve off the end of the release shaft.
7. Place a small hydraulic jack under the rear of the oil pan. Insert a block of wood between the jack pad and oil pan to prevent damaging the pan.
8. Raise the engine just enough to take the engine weight off the rear support.
9. Remove engine rear support bolts.
10. Remove operating shaft support bracket mounting bolts.
11. Remove support crossmember-to-frame bolts and take out the crossmember.
12. Remove exhaust pipe support bracket-to-clutch bolts.
13. Loosen clamp and swing support bracket out of way.

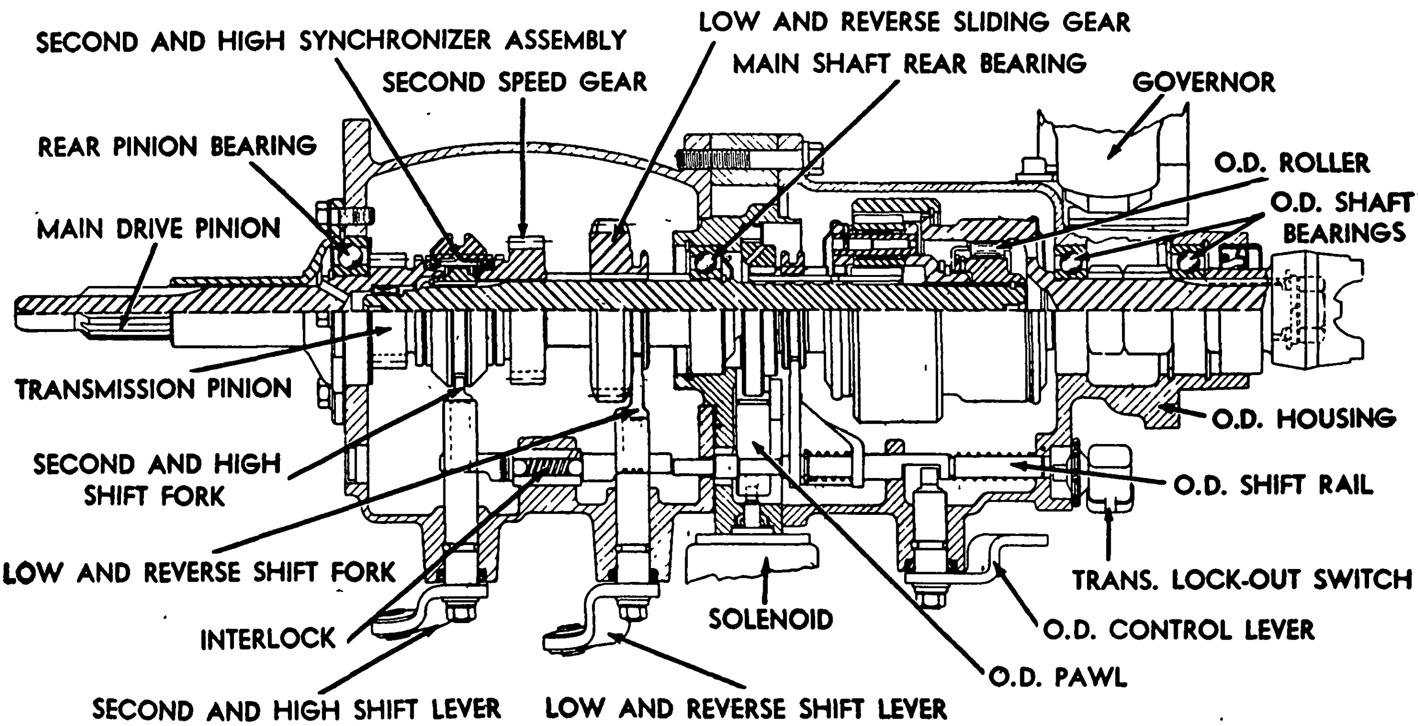


Fig. 39 OVERDRIVE TRANSMISSION, 1947-52. See Overdrive chapter for service data

14. On Commander, remove clutch housing plate.
15. Unscrew remaining bolts and take out clutch housing. On Champion, remove dowel bolts first.
16. Remove screws holding clutch to flywheel, alternately backing off the screws until the spring pressure is released and remove the clutch pressure plate and driven plate.
17. Reverse the operations to install the clutch, being sure the clutch housing and flywheel are clean, and that the pilot bearing is in good condition and lubricated. When assembled, adjust the clutch pedal free travel and test clutch operation.

SYNCHROMESH TRANSMISSION

TRANSMISSION REMOVAL

1935-40 (Except Champion)—

1. Remove floor boards or floor plates.
2. Remove clutch and brake pedal arms where necessary.
3. Disconnect front of propeller shaft or remove as required.
4. Disconnect parking brake, where necessary, speedometer cable and overdrive control, etc.
5. Support rear of engine where necessary.

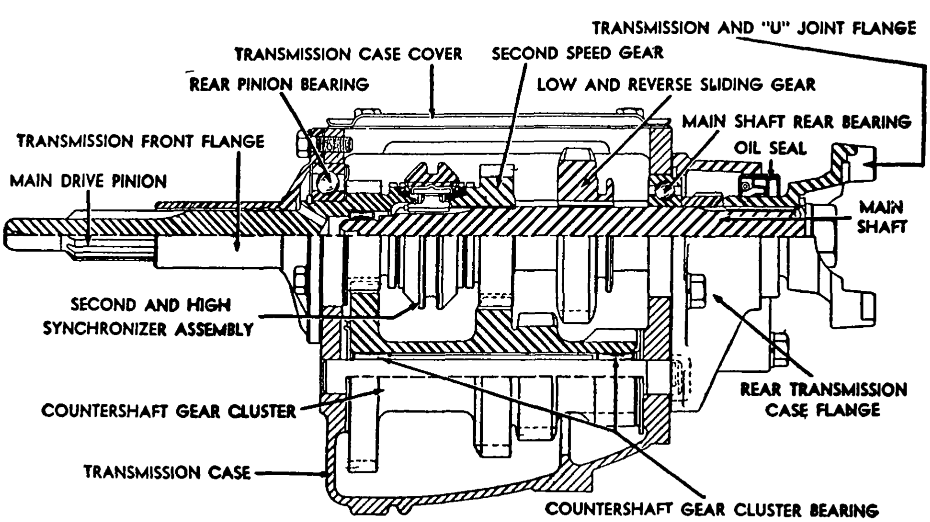


Fig. 38 TRANSMISSION, 1947-52. Typical of 1939 Champion and all 1940-46

6. Unfasten transmission from clutch housing and slide transmission back and out.

1939-40 Champion (Conventional Transmission)—

1. Disconnect starter cable at battery
2. Raise rear of car and place stationary jacks under rear axle housing.
3. Place an adjustable jack under rear of engine, protecting oil pan with a board.
4. Remove two top transmission mounting screws, disconnect speedometer cable and remove speedometer pinion. Plug speedometer hole with rags to prevent oil leakage.
5. Remove propeller shaft and joints.
6. Remove transmission support.
7. Remove transmission control rod pins and exhaust pipe bracket from clutch housing.
8. Lower rear of engine, remove lower transmission mounting screws and slide transmission back and out.

1939-40 Champion (Overdrive Transmission)—

1. Follow steps 1 through 6 for the conventional transmission, then proceed as follows:
2. Drain cooling system, loosen hose clamps, disconnect exhaust manifold from exhaust pipe flange, and move the oil pressure line out from behind the engine.
3. Remove clutch control shaft sleeve pins and disengage sleeve from release shaft.
4. Disconnect solenoid wires and overdrive control.

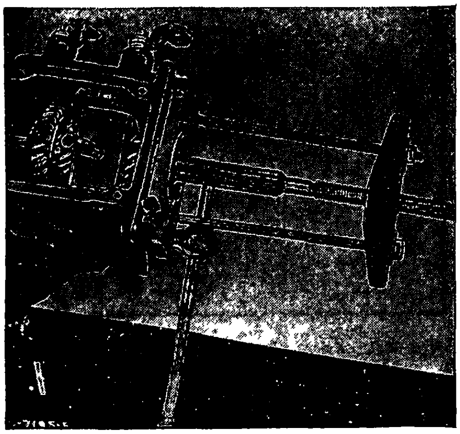


Fig. 40 Rem ving drive pinion bearing. 1939 Champion and all 1940-52

5. Remove transmission rear flange and pack rear opening with rags to prevent grease leakage.

6. Lower engine until center line of mainshaft is about 2 inches below the surface of the frame X member.

7. Unhook brake pedal spring.

8. Remove two lower transmission mounting screws and slide the transmission back and out.

1941-46 Conventional Transmission—

1. Disconnect battery, remove transmission floor plate and unscrew upper transmission mounting bolts.

2. Raise rear of car sufficient to permit working in a sitting position.

3. Place adjustable roller jack under rear of engine.

4. Remove propeller shaft.

5. Remove speedometer cable and pinion and plug opening with rags to prevent grease leakage.

6. Disconnect gearshift levers at transmission.

7. On Commander and Champion, remove rear engine support, clutch operating shaft sleeve pins, clutch housing to exhaust pipe bracket, and lower engine.

8. Remove lower transmission mounting bolts and slide transmission back and out.

1941-46 Overdrive Transmission—After performing steps 1 through 4 given under conventional transmission, proceed as follows:

1. On President, remove support under overdrive housing.

2. On all, disconnect solenoid wires and overdrive control wire.

3. Remove speedometer cable and pinion.

4. Disconnect gearshift levers at transmission.

5. On Commander and Champion, remove rear engine support, clutch operating shaft sleeve pins, exhaust pipe bracket from clutch housing, and lower engine.

6. Remove lower transmission mounting bolts and slide transmission back and out.

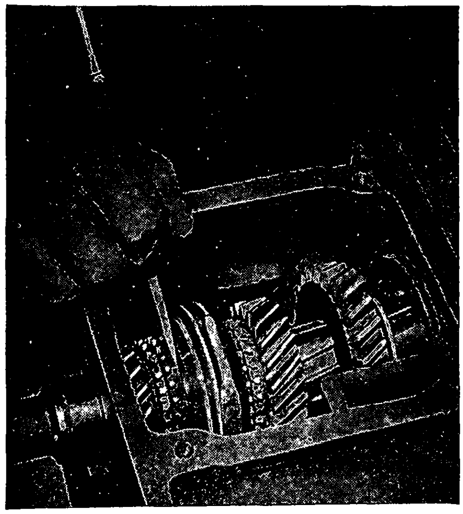


Fig. 41 Marking relationship of synchronizer parts to assure correct assembly. 1939 Champion and all 1940-52

Fig. 42 Removing synchronizer snap ring. 1939 Champion and all 1940-52

1947-52 Conventional & Overdrive Transmissions—

1. Unfasten parking brake cable and place it out of the way.

2. Unfasten front universal from transmission and propeller shaft support from center frame cross member. Move propeller shaft and support rearward.

3. Disconnect gearshift rods from transmission levers and remove speedometer cable from transmission.

4. From overdrive transmissions, disconnect solenoid wires, lockout switch wire and overdrive control wire.

5. Unfasten transmission mounting screws and slide transmission back and out.

TRANSMISSION, OVERHAUL

1935-39 (Except Champion)—For service on overdrive see the *Overdrive* chapter. For conventional transmissions, proceed as follows:

1. Remove shift rails and forks.

2. Pull off companion flange and remove mainshaft through rear.

3. Drive countershaft out, allowing cluster gear to lie in case.

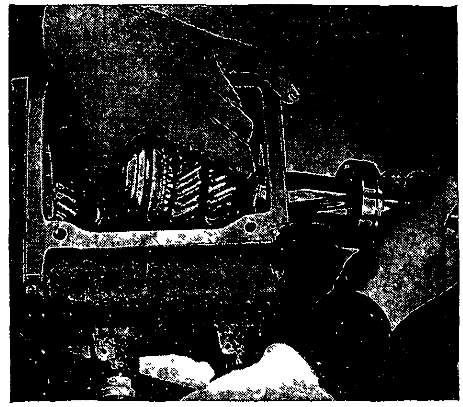


Fig. 43 Removing mainshaft and gears. 1939 Champion and all 1940-52

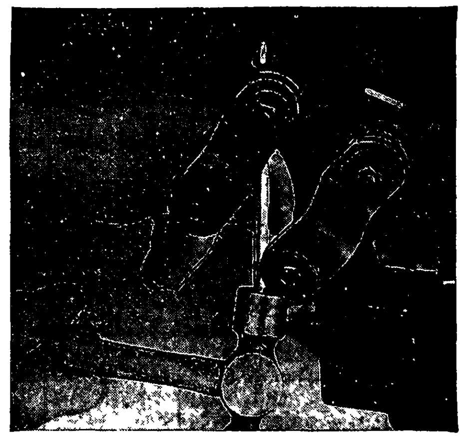


Fig. 44 Removing shift shaft l cking pins. 1939 Champion and all 1940-52

4. Remove main drive gear from inside case.

5. Lift out cluster gear and related parts.

6. Drive out shaft and lift out reverse idler gear.

7. To disassemble mainshaft, slip off synchronizer. Then, with a pointed tool, depress the second speed gear plunger and turn the thrust washer and slide it and the gear off the shaft.

Assemble the transmission in the reverse order, being sure to install the main drive gear before driving in the countershaft.

TRANSMISSION, OVERHAUL

1939 Champion & All 1940-52 (Conventional Transmission)—To disassemble:

1. Remove cover, front flange and snap rings from pinion bearing.

2. Use puller to remove pinion bearing, Fig. 40, using the proper synchronizer ring protector as shown to take up the thrust and prevent possible damage to the synchronizer.

3. Pull off the companion flange, remove the rear bearing retainer and oil seal, and slide the speedometer drive gear off the shaft.

4. Mark the synchronizer blocker rings, gear and sleeve, Fig. 41, so that

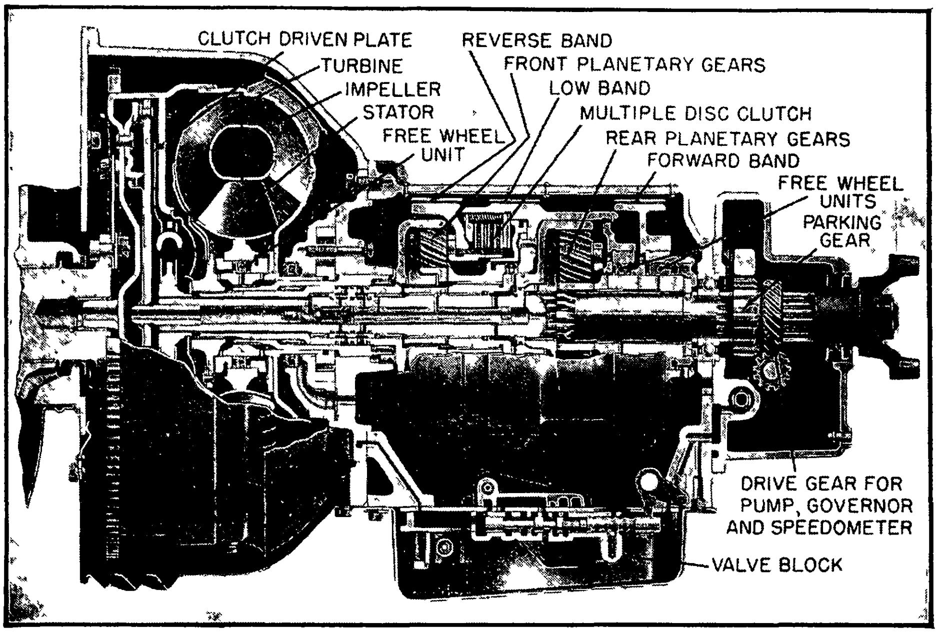


Fig. 45 Sectional view of Automatic Transmission. 1950-52

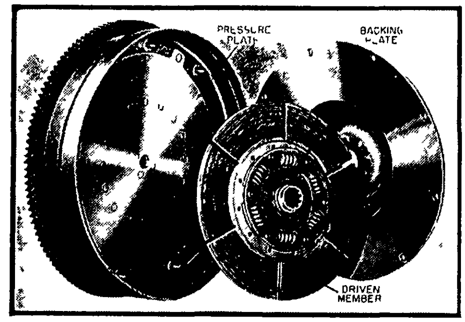


Fig. 48 Component parts of direct driv clutch. 1950-52

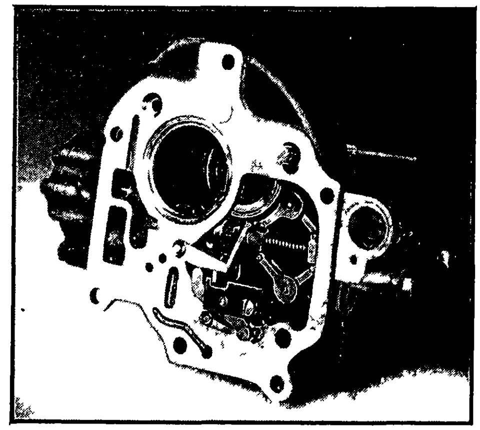


Fig. 49 Governor assembly. 1950-52

these parts may be reassembled in their original position.

5. Raise the drive pinion over the countershaft gear, pull the mainshaft and bearing rearward and remove the pinion from the case.
6. Cock the mainshaft to the side as far as possible, disengage and remove the shift forks.
7. Release the snap ring, Fig. 42, grasp the mainshaft parts and slide the shaft through these parts and out through the rear, Fig. 43.
8. Remove the lock plate and drive the countershaft out rearward.
9. Lift out the cluster gear and washers, noting the position of these parts.
10. Drive out the shaft and lift out the reverse idler gear.
11. Remove the shift shaft locating pins, Fig. 44, and take out the shift levers and shafts and oil seals.

Assembly may be made in the reverse order, being sure to use new gaskets and oil seals.

AUTOMATIC TRANSMISSION

1950-52—The Studebaker Automatic Transmission, Fig. 45, consists of two major assemblies: (1) A torque converter which provides a smooth transfer of power through use of fluid; supplies a range of torque multiplication, and in combination with the transmission permits the elimination of the clutch pedal.

(2) A hydraulic controlled transmission which provides three forward ratios and a reverse ratio. One of these forward ratios is a direct drive ratio which is obtained automatically through the use of a direct drive clutch enclosed in the torque converter.

An electrically operated anti-creep system is employed in conjunction with the automatic transmission to eliminate creeping.

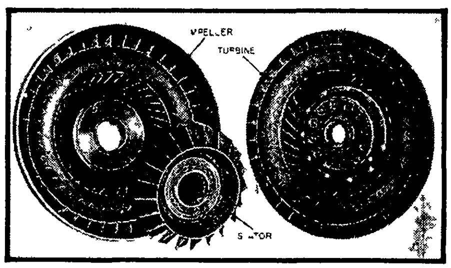


Fig. 46 Component parts of torque converter. 1950-52

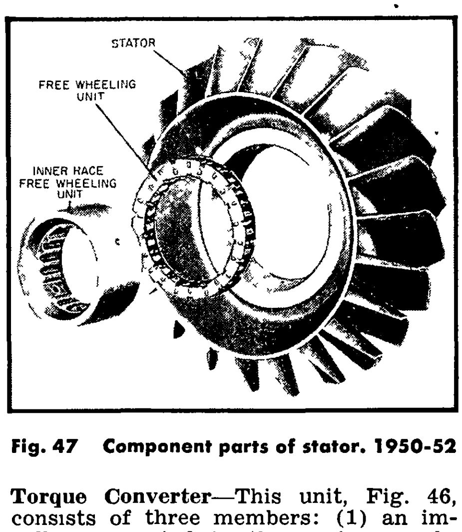


Fig. 47 Component parts of stator. 1950-52

Torque Converter—This unit, Fig. 46, consists of three members: (1) an impeller connected to the engine crankshaft; (2) a turbine splined to the converter output shaft, and (3) a stator connected to the transmission case in one direction of rotation through a free wheeling unit, Fig. 47. These members are enclosed in a housing filled with oil.

The impeller receives power from the engine, transmitting this power by means of the oil in the unit to the turbine, which in turn, transmits the power to the transmission.

The stator redirects the flow of oil as it leaves the turbine so that it enters the impeller at the most efficient angle. This action of the stator gives a "supercharging" effect which provides for torque multiplication.

The maximum torque multiplication through the torque converter is approximately 2 to 1 and occurs when the turbine is stationary and the impeller is turning at approximately 1450 rpm (normal stall speed). As the speed of the impeller and turbine become substantially equal, the torque multiplication ceases and the unit acts only to transmit engine torque at 1 to 1 ratio.

When torque multiplication ceases the stator is no longer needed to redirect oil flow and the free wheeling unit which fastens it to the transmission case permits it to rotate in the same direction as the impeller and turbine, the entire unit becoming in effect a fluid coupling.

The torque converter and transmission employ a cooling system which is entirely independent of the engine cooling system. Outside air enters a duct located near the left wheel housing and passes into the side of the converter housing. A blower on the torque converter spreads the air over the entire surface of the converter. It is then expelled through the louvres in the converter housing cover plate.

The direct drive clutch, Fig. 48, is enclosed within the torque converter. It

consists of three units: (1) a hydraulically operated pressure plate, (2) a backing plate and (3) a driven member. Oil pressure to the pressure plate locks these three units together, allowing engine torque to be transmitted to the rear axle at a 1 to 1 ratio in direct drive.

Transmission Unit—The hydraulically controlled transmission consists of:

(1) Two planetary gear sets which receive torque from the converter and multiply, or reverse and multiply, this torque before transmitting it to the rear axle.

2. A multiple disc clutch which locks the members of the front planetary gear set into a single unit when a straight drive through this unit is desired.

3. Three bands and their servo mechanisms which control the operation of the planetary gear sets.

4. Two free wheeling units which simplify the valving required to accomplish smooth shifts from intermediate (second gear) to direct drive.

5. A governor, Fig. 49, which actuates a governor valve to control the operation of the direct drive clutch.

6. A front pump, Fig. 50, which is of the external-internal gear type and is driven by the engine. Its function is to supply the necessary oil pressure to the torque converter, hydraulic control system, and for lubrication during idling, low speed, and reverse operation.

7. A rear pump which is of the external gear type and is driven by the propeller shaft. Its function is to supply the necessary oil pressure to operate the transmission when pushing the car to start the engine. In addition, it supplies necessary oil pressure to the torque converter, hydraulic control system and for lubrication at higher car speeds.

8. A valve block which controls oil flow in the hydraulic system, Fig. 51. The valves included in the valve block are: (a) A front pump relief valve which regulates front pump pressure at 80 lbs. for operation in the P, N. D and L ranges. This valve also acts to regulate front pump pressure at 200 lbs. for reverse operation. The increased pressure in reverse is necessary to absorb the high torque in this range. (b) A rear pump relief valve which regulates rear pump pressure at 80 lbs. and which acts to return the front pump output to the oil pan when rear pump output is adequate for the needs of the transmission. (c) A converter valve which acts to supply oil to the converter at 27 lbs. pressure. (d) A selector valve which controls the flow of oil pressure from the oil pumps to the servo mechanisms and, through the governor valve to the multiple disc clutch and direct drive clutch. (e) A reverse interlock valve which prevents application of the reverse band when the car is moving forward.

9. A governor valve which is located in the governor housing and controls the operation of the direct drive clutch. This valve has two positions, second and direct, and incorporates a hydraulic detent to eliminate "hunting" between these positions.

10. A parking interlock piston which prevents engagement of the parking pawl when the car is moving forward.

11, A reverse shuttle valve which provides for smooth engagement of the reverse band.

Anti-Creep System—This system consists of: (1) A solenoid valve which holds brake pressure on the rear wheel brakes whenever the anti-creep circuit is closed.

2. A pressure control switch which is operated by rear pump pressure to open the anti-creep circuit when the car is moving forward and to close the circuit when the car is stationary or moving in reverse.

3. An idle adjusting screw switch which opens and closes the anti-creep circuit as the accelerator is depressed or released.

These units are connected as shown in Fig. 52, With the ignition switch on, accelerator released (idle adjusting screw switch closed) and car stationary (pressure control switch closed) the anti-creep circuit is completed and the solenoid valve is energized. When the brakes are applied under these conditions, the anti-creep solenoid valve will retain approximately 200 lbs. pressure at the rear wheel brakes to prevent creeping.

When the accelerator is depressed, the circuit is opened at the idle adjusting screw switch, allowing the solenoid to de-energize, thereby releasing the brakes instantly. When the car is moving forward, normal brake operation is not affected since the rear pump pressure holds open the anti-creep pressure control switch, thus preventing the solenoid from energizing.

MAINTENANCE REQUIREMENTS

Oil Requirements — The transmission uses SAE 10 or 10W premium type engine oil for all year, all climate service. The total oil capacity of the transmission is approximately 11½ quarts (9½ on Champion). However, when draining the transmission a small amount of oil will remain in the unit and the amount required to refill it will be that needed to bring the oil level to the "Full" mark on the gauge as described below.

Do not use any type of sealing compound when installing pipe plugs, drain plugs or gaskets in the automatic transmission.

Check transmission oil level every 1,000 miles as follows:

1. With car on level floor and parking brake set firmly, set selector lever at L, and raise transmission oil temperature by idling the engine to normal engine operating temperature.

2. Remove inspection hole cover located on top of the floor carpet to expose the oil level gauge.

3. Clean area around the inspection hole. Remove oil level gauge, wipe dry and check oil level. The space between the "Full" and "Low" marks on the gauge represent one pint.

4. With the engine still idling, and selector still at L, add good quality SAE 10 or 10W premium type engine oil as required to bring the level to the "Full" mark on the gauge. Do not overfill.

Draining & Refilling—Drain and refill the transmission every 15,000 miles or once a year as follows:

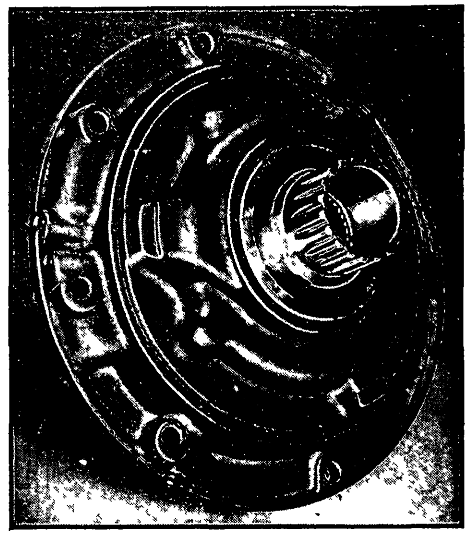


Fig. 50 Front oil pump. 1950-52

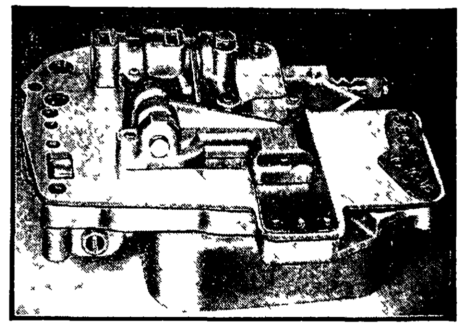


Fig. 51 Valve block assembly. 1950-52

1. Set selector lever at L and raise transmission oil temperature by idling engine to normal operating temperature.

2. Stop engine and remove inspection hole cover located on top of floor carpet to expose oil level gauge. Clean the area around the inspection hole and remove the gauge.

3. Remove the drain plug from the left side of the transission oil pan near the front.

4. Remove the converter housing cover plate and rotate the converter until drain plug is in position for draining. Remove converter drain plug.

5. Remove converter pressure take-off plug from the left side of the transmission to facilitate draining.

6. After oil has drained, install and tighten drain plugs in the transmission oil pan and converter. Install converter housing cover plate. Install and tighten converter pressure take-off plug.

7. Pour six quarts of 10 or 10W premium type engine oil into the transmission oil filler tube.

8. Start engine and idle for approximately one minute with the selector lever set in the L position to transfer the oil to the converter from the transmission case.

9. With engine still idling and selector lever in L position, add three more quarts of oil and then add additional oil as required to bring the level to the "Full" mark on the oil level gauge. Do not overfill.

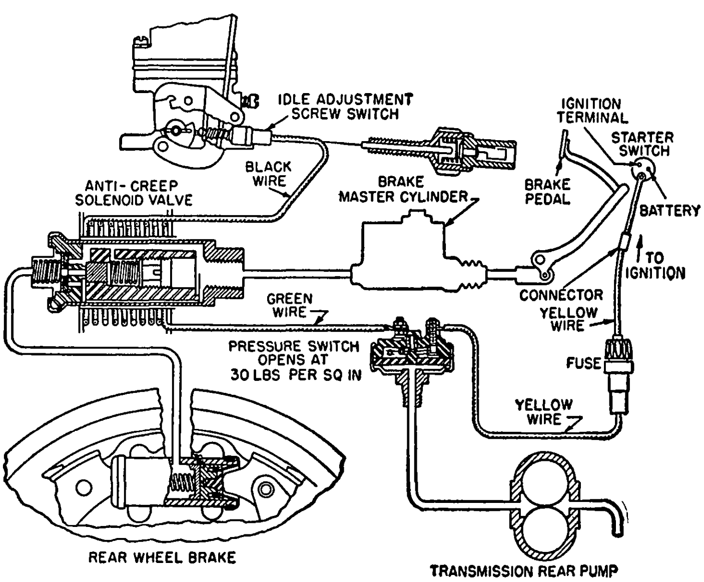


Fig. 52 Anti-creep system wiring diagram. 1950-52

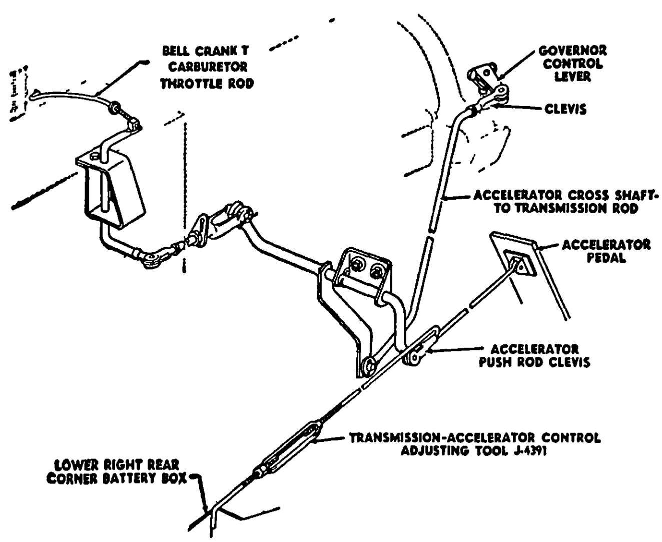


Fig. 54 Automatic transmission control linkage. 1950-52 Commander

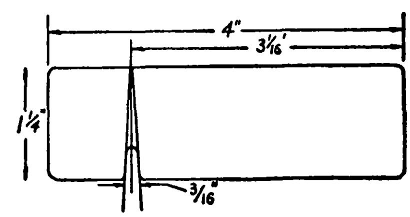


Fig. 53 Dimensi ns for making a gauge to measur clearance between firewall and cl vis pin at accelerator cross shaft when adjusting acc lerat r linkage on Commander. 1950-52

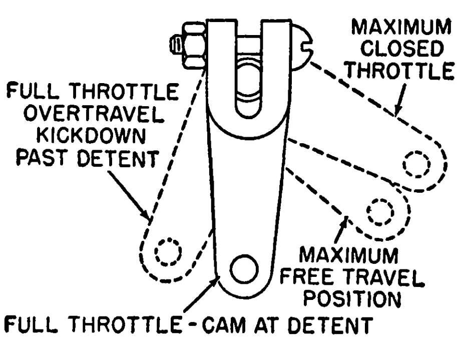


Fig. 55 Gov rn r control lever. 1950-52

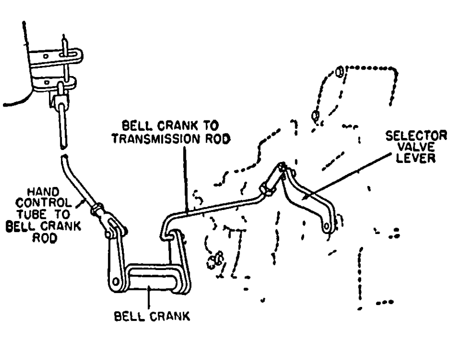


Fig 56 Hand c ntr l linkage. 1950-52

SERVICE ADJUSTMENTS COMMANDER, 1950-52

Accelerator - To - Transmission Control Linkage—In making this adjustment it is necessary to make an exact measurement of 3 1/16 in between the firewall and the center of the clevis pin at the accelerator cross shaft when the accelerator is in the fully released position

To assure accuracy and also save time in making this adjustment, a gauge can be made in the shop which will eliminate the need of reading the small graduations on a steel scale Fig 53 shows the dimensions for making the gauge out of a piece of 1/8 in steel stock

1 With the accelerator fully released, measure the distance between the center of the clevis pin at the accelerator cross shaft and the flat portion of the firewall (not at the rib) This distance should be 3 1/16 in as measured with a steel scale or the gauge shown in Fig 53 If it is not 3 1/16 in, adjust the clevis as required to obtain this dimension

2 With the Transmission-Accelerator Control Adjusting Tool J4391, Fig 54, at its maximum length, install the tool between the lower end of the accelerator push rod just above the fixed clevis and the lower right rear corner of the battery box In doing so the accelerator push rod will be pulled forward, causing the bell crank-to-carburetor throttle rod to partially open the carburetor throttle

3 Adjust the length of the tool by turning the turnbuckle, Fig 54, until the accelerator push rod is brought forward far enough just to put the carburetor throttle valve in its wide open position The accelerator linkage must be held at exactly this position to allow a correct setting of the transmission governor-to-accelerator control rod

4 Remove the clevis pin holding the clevis to the governor control lever

5 Turn the governor control lever forward (clockwise) until the resistance of the detent is felt, Fig 55

6 Adjust the length of the rod by turning the clevis until the clevis pin can be slipped easily into the clevis and governor control lever when they are assembled Do not insert the cotter pin

7 Remove the Transmission-Accelerator Control Adjusting Tool

8 Check the linkage operation as follows

9 With the floor mat properly in place and the accelerator fully depressed, remove the clevis pin and check to make sure the governor control lever on the transmission is at the end of its forward travel

10. With accelerator fully released, check to make sure there is at least 1/4 in of free travel of the governor control lever before spring pressure is felt as it is turned forward If adjustment is correct, install clevis pin and cotter pin

11 If full forward travel or the proper amount of free travel of the governor control lever are not obtained, recheck the linkage adjustment If proper travel is still not obtained, check for and eliminate any bind, distortion or interference in the linkage which would affect proper adjustment

Hand Control Linkage Adjustment—

1 Place selector lever in R position

2 Remove the clevis pin holding the control tube-to-bellcrank rod clevis to the hand control bellcrank, Fig 56

3 Check the length of the hand control bellcrank-to-transmission rod This length must be 7 5/16 in from the center of the fixed end of the bellcrank to the center of the adjustable joint at the selector valve lever and, once set, is not to be changed in making further adjustments

4 Set the selector valve lever on the transmission in the full rearward (reverse) position, Fig 57.

5 Adjust the length of the hand control linkage by turning the clevis on the hand control tube-to-bellcrank rod until the clevis pin slips easily into the clevis and bellcrank Remove the clevis pin Do not change the length of the hand control bellcrank-to-transmission rod

6 Set the selector lever on the steering column in the P position and set the

selector valve lever in the full forward (Park) position, Fig. 57. In this position it should be impossible to rotate the propeller shaft.

7. Check the hand control linkage setting by again slipping the pin into the assembled clevis and bellcrank. The pin should slip in easily. If it does not, adjust the linkage to give the best possible compromise fit in both the P and R positions. A variation of no more than ½ turn of the clevis to secure adjustment in both the P and R positions is permissible. If greater variation is found, check the entire linkage for wear, looseness or distortion.

8. Connect the linkage and check transmission operation.

CHAMPION MODELS

Accelerator-To-Transmission Control Linkage—See Fig. 57A.

1. Adjust engine idle speed to 500-550 rpm by means of the idle adjustment screw at the carburetor throttle lever.

2. Remove the wire from the anti-creep switch and remove the switch.

3. Measure the distance between the accelerator cross shaft bracket and the contact plate. This measurement should be ¼″ with the accelerator fully released. If it is not, remove the clevis pin from the accelerator cross shaft-to-bell crank rod clevis, loosen the lock nut and adjust the clevis until the ¼″ measurement is obtained.

4. Then install the anti-creep switch until the plunger of the switch just contacts the contact plate.

5. Install the wire, turn on the ignition and adjust the release switch as required until an audible click is heard in the solenoid. Then tighten the lock nut.

6. Shift the selector lever to the Park position. With the Accelerator-to-Transmission Control Adjusting Tool, Fig. 57A, at its maximum length, hook one end of the tool in the notch of the accelerator cross shaft lever and the other end at the upper right rear corner of the battery box, as shown. In doing so, the accelerator push rod will be pulled forward, causing the bell crank-to-carburetor throttle rod to partially open the carburetor throttle. Adjust the length of the tool by turning the turnbuckle until the accelerator is brought forward far enough to put the throttle valve in its wide open position.

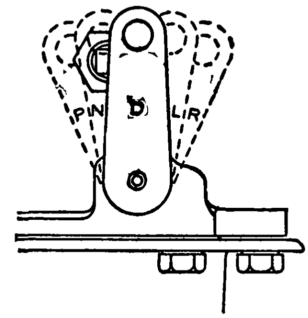


Fig. 57 Transmission select r valv l v r. 1950-52

7. Disconnect the accelerator cross shaft-to-transmission rod ball joint from the governor control lever.

8. Turn the governor control lever forward (clockwise) until the resistance of the detent is felt (see Fig. 55).

9. Adjust the length of the rod by turning the ball joint until it can be slipped easily into the governor control lever when the lever is at the point where the resistance of the detent is felt (full throttle position).

10. Remove the accelerator-to-transmission control adjusting tool.

11. Check the linkage operation as follows: (a) With floor mat properly in place and accelerator fully depressed, remove ball joint and check to make sure the governor control lever on the transmission is at the end of its forward travel. (b) With the accelerator fully released, check to make sure there is at least ¼″ of free travel of the governor control lever before spring pressure is felt as it is turned forward. If the adjustment is correct, connect the ball joint to the governor control lever. (c) If full forward travel or the proper amount of free travel of the governor control lever are not obtained, recheck the linkage adjustment. If proper travel is still not obtained, check for and eliminate any bind, distortion or interference in the linkage which would affect proper adjustment.

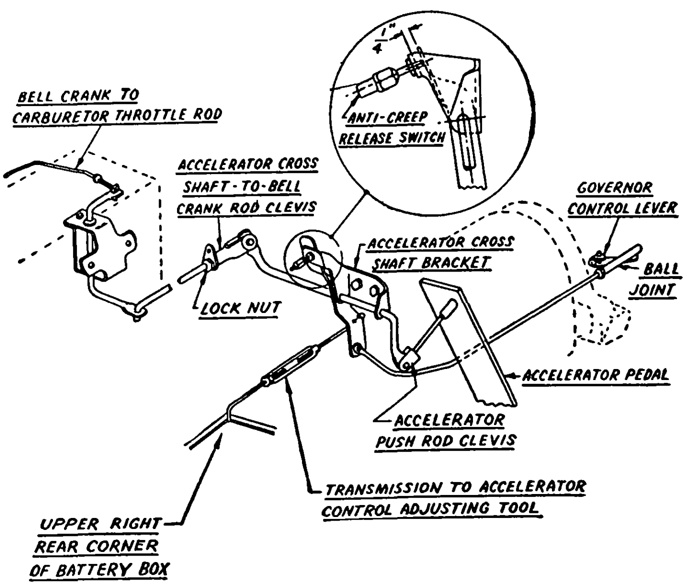


Fig. 57A Transmission control linkage. 1950-52 Champion

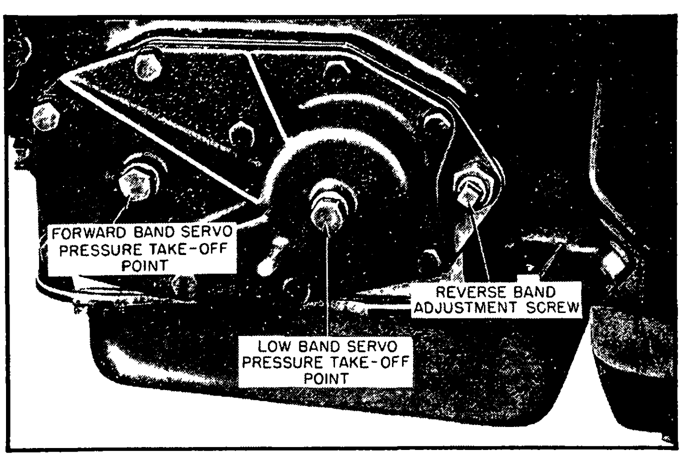


Fig. 59 Right side f transmissi n. 1950-52

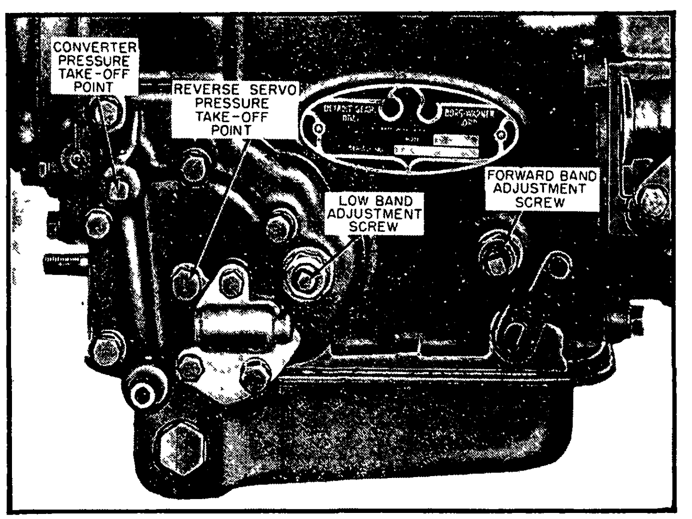


Fig. 60 L ft sid f transmissi n. 1950-52

Hand Control Linkage Adjustment—The adjustment procedure is the same as described for Commander models.

Band Adjustment—The adjustment procedure is the same as described for Commander models.

Band Adjustment — To check or adjust any of the three bands, proceed as follows:

1. Remove capscrew and copper gasket from pressure take-off hole in the servo mechanism opposite the adjustment screw of the band to be adjusted.
2. Carefully screw the Band Adjusting Tool J4285, Fig. 58, into the pressure take-off hole, noting that the indicator plug in the handle of the tool moves outward as the tool is screwed into the adjustment hole.
3. If the band is properly adjusted, the indicator plug will be flush with the end of the tool handle when the tool shoulder rests against the transmission case.
4. If, in screwing the tool in position, the indicator plug becomes flush with the end of the tool before the tool shoulder is against the transmission case, the band adjustment is too tight.
5. As soon as it becomes apparent that the band is too tight, loosen the lock nut on the opposite side of the transmission and back off the adjusting screw two full turns before the tool is screwed fully into position (see Figs. 59 and 60). This is a necessary precaution since, if the tool is screwed against a tight band to the extent that the indicator plug is forced beyond the end of the tool handle, the tool may be damaged.
6. If, with the band adjusting tool fully in place, the indicator plug is not flush with the end of the tool, band adjustment is required. To perform the adjustment, loosen the lock nut on the band adjusting screw and turn the screw in until the indicator plug in the tool handle is flush with the end of the handle.
7. Tighten the adjusting screw lock nut securely, making sure the adjusting screw does not turn while doing so.
8. Remove the tool and install the capscrew, using a new copper gasket. Do not use any type of sealing compound on this capscrew. Tighten to 28-33 lbs. ft. torque.

TRANSMISSION, REMOVE

1. Drain oil from transmission and torque converter.
2. Disconnect both universal joints and the propeller shaft support from the crossmember and slide the complete assembly rearward and fasten out of the way.
3. Disconnect parking brake cable from bellcrank.
4. Disconnect bellcrank bracket from crossmember and pull bellcrank and cable rearward and fasten out of the way.
5. Disconnect hand control bellcrank-to-transmission rod from selector valve lever.
6. Remove clevis pin holding accelerator cross shaft-to-transmission rod from governor control lever.
7. Remove speedometer cable and pinion.
8. Disconnect anti-creep cables from anti-creep solenoid switch and remove wiring harness from clip holding harness to transmission.

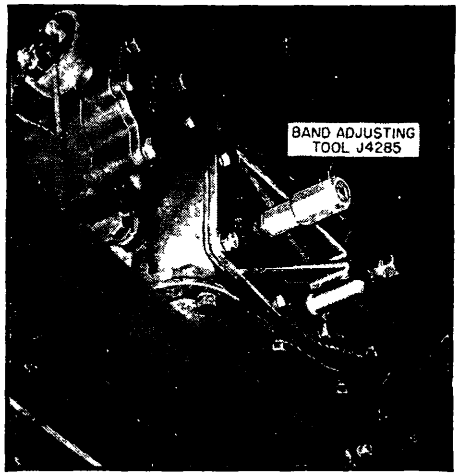


Fig. 58 Band adjusting tool. 1950-52

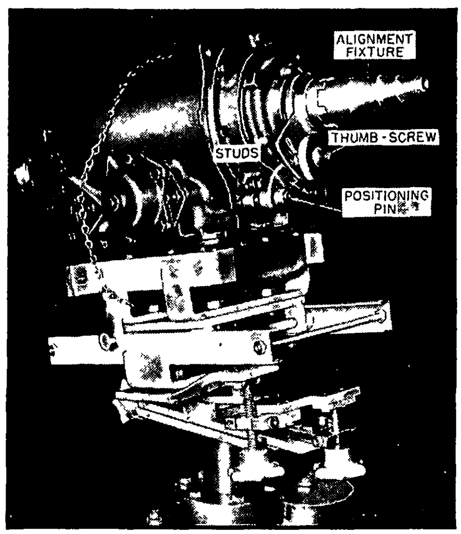


Fig. 61 Transmission mounted on special lift ready for installation. 1950-52

9. Remove two lower transmission case-to-converter housing stud nuts.
10. It is recommended that the special transmission lift designed for removing this transmission be used. With the lift supporting the transmission, remove the two upper transmission case-to-converter housing capscrews. Install transmission pilot studs into the capscrew holes.
11. Remove the transmission assembly by sliding it rearward out of the converter housing.
12. If the mainshaft oil deflector tube does not come out with the transmission, remove it from the torque converter with long-nose pliers or snap ring pliers.
13. If the converter is to be removed, remove the pilot studs from the converter housing.

TRANSMISSION, INSTALL

1. Using Spline Alignment Fixture J4283, Fig. 61, position splines on transmission shaft as follows: (a) Loosen fixture thumb screw and install fixture over splines, inserting it into transmission as far as it will go, being sure that positioning arm sector points toward one of the

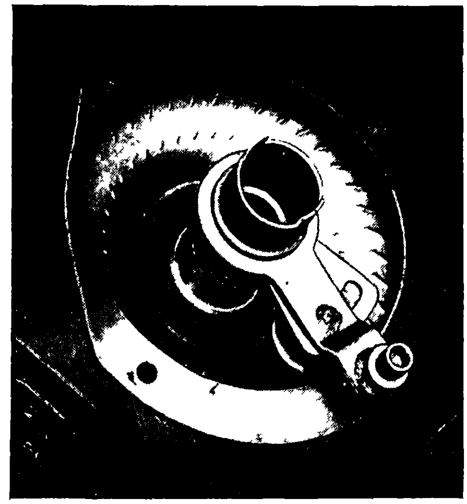


Fig. 62 Spline alignment fixture ins rted in torque converter. 1950-52

lower transmission case studs. (b) Move positioning arm and universal joint companion flange until the positioning pin slips easily over one of the lower transmission case studs. (c) Tighten the thumb screw to lock the positioning arm in place. (d) Carefully remove the fixture to prevent moving the splines out of alignment and install the mainshaft oil transfer tube.

2. Install the alignment fixture in the torque converter to position the internal splines as follows: (a) Work the alignment fixture into the torque converter until the splines are properly lined up on the fixture. (b) Rotate the torque converter and the spline alignment fixture until the positioning pin slips easily into the stud hole in the converter housing corresponding to the lower transmission case stud on which the alignment of the fixture was set, Fig. 62. (c) Remove the fixture carefully to prevent loss of alignment.
3. Install pilot studs into the upper transmission capscrew holes in the converter housing if they have been removed.
4. Raise the transmission to the proper height and angle and carefully slide it into the converter housing, using the pilot studs as a guide and making sure that the transmission universal joint companion flange is not disturbed.
5. Remove the pilot studs and install the capscrews, lockwashers and stud nuts which hold the transmission to the converter housing.
6. Complete the assembly in the reverse order of removal and adjust the control linkage as previously described.

TORQUE CONVERTER, REMOVE

1. With the car on the floor, disconnect the starter motor from the converter housing and pull the starter free of the engine rear plate.
2. Drain the radiator enough to permit disconnecting the upper hose.
3. Raise the car and remove the transmission as outlined previously.
4. Loosen the screws holding the converter housing air intake hose clamp to the frame side rail and pull the hose free of the clamp.
5. Disconnect the exhaust pipe from

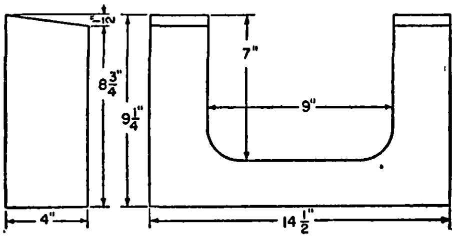


Fig. 64 Dimensi ns for making an engine supp rt saddle. 1950-52

the engine manifold and loosen the bolts and nuts from the clamp holding the exhaust pipe to the converter housing bracket.

6. Prior to the removal of the engine rear support crossmember, engine weight must be lifted up from the crossmember. Also, a means to lower the engine after the crossmember has been removed must be provided to permit removal of the converter housing. The engine support saddle can be readily constructed to the dimensions shown in Fig. 64 from wood or channel iron capable of supporting 600 lbs.

7. Place the engine support saddle forward of the engine rear plate and up against the crankcase oil pan flange. Install the hydraulic jack on the jack support and raise the engine.

8. Remove the clevis pin holding the hand control tube-to-bellcrank rod to the bellcrank and remove the two pullback springs.

9. Disconnect the parking brake conduit from the conduit hook.

10. Remove the engine rear support crossmember bolts and disconnect the fender-to-crossmember brace.

11. Remove the crossmember, leaving the engine mountings fastened to the converter housing.

12. Lower the rear of the engine approximately 3 inches to provide sufficient clearance for removal of the converter housing. The maximum amount the rear of the engine can be lowered depends upon the amount of clearance between the engine oil pan and the steering linkage. Excessive lowering of the engine will result in damage to the engine oil pan. In cases where additional clearance is required, loosening of the nuts holding the steering bellcrank to the engine front crossmember will allow the bellcrank to drop downward providing the additional clearance.

13. Remove the converter housing-to-engine rear plate capscrews and remove the small filler plate.

14. Remove the converter housing from the dowels, taking care not to damage or distort the converter housing dowels or converter blower.

15. Unfasten the converter from the engine drive plate and remove the converter.

TORQUE CONVERTER, INSTALL

1. One of the "O" aligning marks on the converter must be aligned with the "O" mark on the engine drive plate. Install the converter on the drive plate and loosely install the plain washers and nuts.

2. Clean the engine rear plate and the

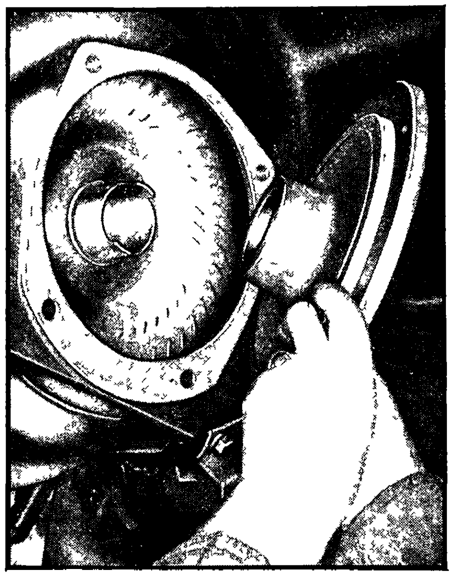


Fig. 65 Converter aligning flange tool being installed on converter. 1950-52

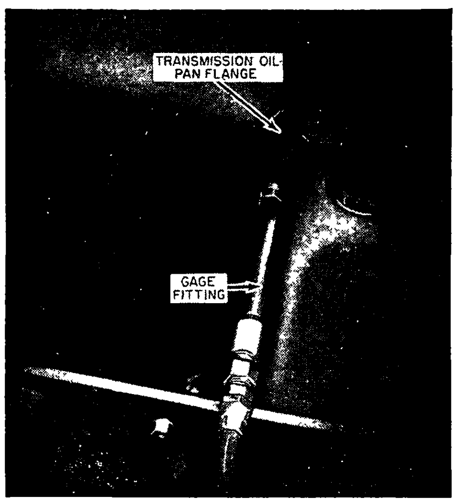


Fig. 66 Connection for front pump pressure test. 1950-52

mating face of the converter housing, taking care not to damage the dowels or the converter blower. Be sure the converter housing is installed on the dowels.

3. Install the three top housing-to-rear plate capscrews. Raise the engine and install the remaining converter housing capscrews.

4. Position Converter Aligning Flange Tool J4286 into the bore of the converter housing and over the pump drive fingers on the converter, Fig. 65.

5. Install the two top transmission capscrews to hold the aligning flange tool in position and rotate the torque converter through two complete revolutions to center the converter assembly.

6. Tighten the converter-to-drive plate nuts to 23-28 lbs. ft. torque and then install the converter filler plate.

7. Install the crossmember and connect the fender-to-crossmember braces. Install the parking brake conduit.

8. Connect the hand selector steering

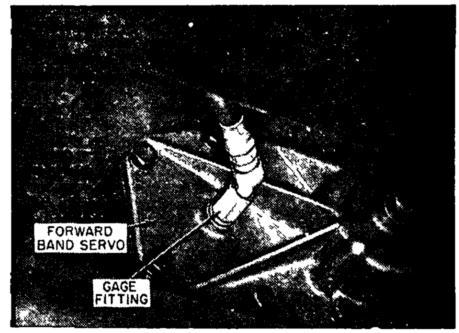


Fig. 67 Connection for f rward band serv pressure test. 1950-52

post-to-bellcrank rod and brake pullback springs.

9. Connect the exhaust pipe to the engine manifold and tighten the exhaust pipe bracket bolts and nuts to the converter housing.

10. Install the converter housing air intake hose in the clamp and frame side rail and tighten the clamp screws.

11. Install the transmission as outlined previously.

12. Lower the car. Connect the radiator hose and fill the radiator. Install the starter motor and test the operation of the transmission.

STARTER CUT-OUT SWITCH

The starter cut-out switch is located at the base of the steering post jacket and acts to break the starter solenoid circuit when the selector lever is in the D, L or R position and also to control the operation of the back-up light if so equipped.

Removal—Remove the two screws holding the switch to the steering post jacket. Lift out the switch and disconnect the hand control-to-switch rod. Disconnect the wiring cable from the switch.

Installation—Align the pin hole in the switch lever with the corresponding hole in the switch body. Install a pin through the holes that maintain alignment of the lever and body. Connect the wiring cable to the switch. Assemble the rod to the switch.

With the selector lever in N position, place the switch in position on the steering post jacket and install the screws. Remove the pin from the switch lever and body and test the operation of the switch.

IDLE ADJUSTING SCREW SWITCH

The idle adjusting screw switch is located on the carburetor throttle lever and acts to release the anti-creep system when the accelerator pedal is depressed to move the car. It replaces the usual idle adjusting screw and the position of the switch determines engine idling speed.

Removal—Disconnect the wire leading to the idle adjusting screw switch. Screw the switch out of the carburetor throttle lever.

Installation—With the lock spring in position on the switch, screw the switch into place in the carburetor throttle lever. Start the engine and,

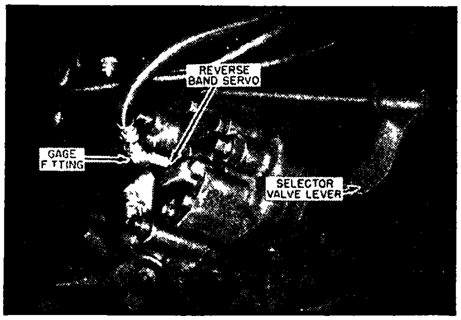


Fig. 68 C nnecti n for reverse band servo pr ssure test. 1950-52

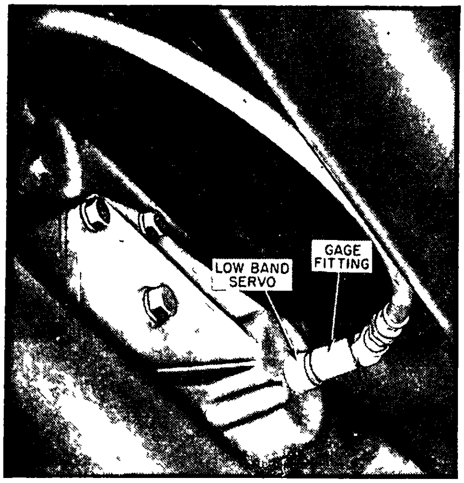


Fig. 69. C nnecti n for low band servo pressur test. 1950-52

with the selector lever in the N position, set the engine idle at 500-550 rpm by turning the switch in or out as required. Connect the lead-in wire to the switch, and check anti-creep operation.

ANTI-CREEP SOLENOID CONTROL SWITCH

This switch is located at the rear of the transmission case and acts to prevent operation of the anti-creep system while the car is moving forward.

Removal—Disconnect the two control cables from the switch. Unscrew the switch from the rear of the transmission case.

Installation—Screw the switch into the back of the transmission case. Connect the control cables to the switch and check its operation.

ANTI-CREEP SOLENOID VALVE

The anti-creep solenoid valve is fastened to the rear of the brake master cylinder and acts to hold pressure on the rear brakes after the brakes have been applied to stop the car with the accelerator fully released.

Removal—With the ignition off, disconnect the cables at the connectors. Disconnect the brake tube from the solenoid valve to the adapter and take off the valve.

Installation—Insert the solenoid valve

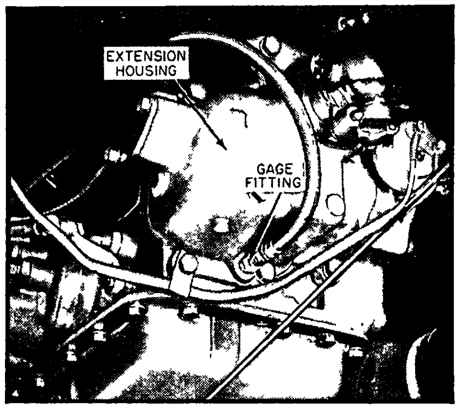


Fig. 70 Connection for multiple disc clutch pressure test. 1950-52

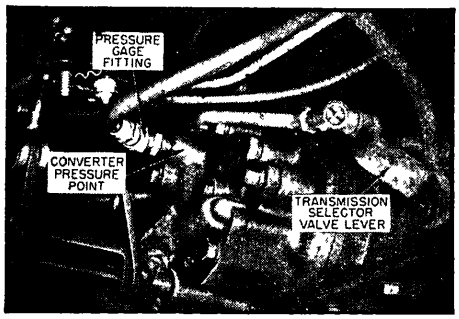


Fig. 71 Connection for torque converter pressure test. 1950-52

into the adapter and fasten the valve in place with the attaching screw. Connect the brake tube to the solenoid valve outlet. Bleed the brake system. Connect the control cables. Check operation of valve as follows:

With rear wheels stationary, ignition on and accelerator fully released, depress the brake pedal firmly and release. Rear wheel brakes should now be set, preventing the rear wheels from turning. The rear wheel brakes should release when the ignition is turned off or the accelerator is depressed.

OIL PRESSURE TESTS

Before making any pressure tests be sure that the oil is at the proper level and at normal operating temperature. During the tests, do not run the engine at speeds above idle for more than 30 seconds with the selector lever in the D, L or R positions with rear wheels stationary, otherwise the transmission will overheat.

The equipment needed to make the following tests include an oil pressure gauge with suitable line and fittings, and an electric tachometer connected to the engine ignition system.

For convenience, place the oil pressure gauge on the floor of the driver's compartment and allow the pressure gauge line to go through the oil level inspection opening to the transmission pressure take-off point.

Do not use any type of sealing compound when reinstalling plugs, capscrews or gaskets in the automatic transmission.

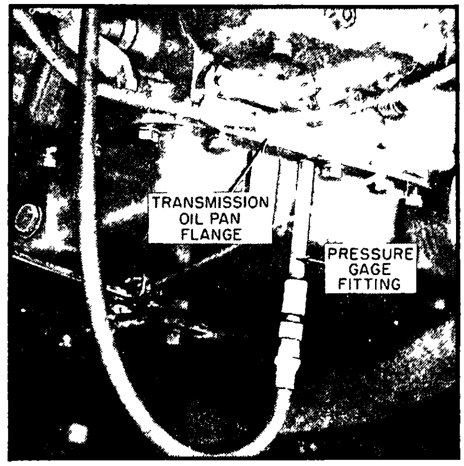


Fig. 72 Connection for direct drive clutch pressure test. 1950-52

Front Pump Pressure—Remove the Allen head pipe plug at the front transmission oil pan flange, Fig. 66, and connect the pressure fitting at this point.

With the selector lever in the P or N position, start the engine and bring its speed up to 1000 rpm, at which speed, the gauge should indicate a minimum of 60 pounds pressure.

Stop the engine, remove the gauge fitting and reinstall the pipe plug, tightening it to 15-18 lbs. ft. torque.

Forward Band Servo Pressure—Remove the capscrew from the forward hand servo mechanism cover plate and connect the gauge fitting at this point, Fig. 67. Apply the parking brake and foot brakes to prevent forward movement of the car.

Start the engine and move the selector lever to the D position. Gradually increase engine speed to 1000 rpm. At this speed the gauge should indicate a pressure of 60 pounds.

Stop the engine, remove the pressure fitting and reinstall the capscrew with a new copper washer and tighten it to 28-33 lbs. ft. torque.

Reverse Band Servo Pressure—Disconnect the hand control bellcrank-to-transmission selector valve lever rod at the bellcrank, Fig. 68. Move the selector valve lever to the R position (see Fig. 57). Remove the capscrew from the reverse band servo cover and install the pressure gauge fitting at this point.

Apply the parking and service brakes. Start the engine and increase its speed to 1000 rpm. At this speed the gauge should show a minimum of 160 pounds pressure.

Stop the engine, remove the fitting and reinstall the capscrew, using a new copper gasket. Tighten the capscrew to 28-33 lbs. ft. torque.

Low Band Servo Pressure—Remove the capscrew from the low band servo cover plate and install the pressure gauge fitting at this point, Fig. 69. Apply the parking and service brakes and start the engine. Move the selector lever to the L position and increase engine speed to 1000 rpm. At this speed the gauge

should indicate a minimum of 60 pounds pressure at the low band servo.

Stop the engine and remove the pressure fitting. Reinstall the capscrew with a new gasket and tighten it to 28-33 lbs. ft. torque.

Multiple Disc Clutch Pressure—Remove the pipe plug from the rear transmission extension housing, Fig. 70, and install the pressure gauge fitting at this point.

Apply the parking and service brakes and start the engine. Place the selector lever in the D position and increase engine speed to 1000 rpm. At this speed the gauge should show a minimum of 60 pounds pressure.

Stop the engine, remove the pressure fitting and reinstall the pipe plug, tightening it to 15-18 lbs. ft. torque.

Torque Converter Pressure—Remove the pipe plug from the torque converter pressure point, Fig. 71, and install the fitting. With the transmission selector valve lever in N (neutral) position, and engine running at approximately 1000 rpm, pressure reading should be 25-35 lbs.

With the rear wheels jacked up and free to rotate and selector lever in the D position and engine running at 1500 rpm, pressure should be 25-35 lbs.

Stop the engine, remove the pressure fitting and reinstall the pipe plug, tightening it to 6 or 7 lbs. ft. torque.

Direct Drive Clutch Pressure — Remove the Allen head pipe plug from the rear transmission oil pan flange, Fig. 72, and install the pressure gauge fitting at this point. With the rear wheels raised off the floor and free to rotate, and engine running at idle, place the selector lever in the D position. Pressure gauge should show zero pressure at the direct drive clutch.

Increase engine speed to 1500 rpm. At approximately 1200 rpm, the transmission should shift to direct drive which will be indicated by a rapid pressure rise in the direct drive clutch. While in direct drive, the pressure gauge should show a minimum of 60 pounds pressure.

Check the direct drive clutch pressure during deceleration. When the speedometer indicates approximately 10-12 mph, the pressure should drop to zero.

Remove the gauge fitting and replace the pipe plug and tighten it to 15-18 lbs. ft. torque.

Rear Pump Pressure—Remove the anti-creep wiring harness, Fig. 73, from the anti-creep switch and remove the switch from the transmission case. Install the pressure gauge fitting in the rear pump as shown.

With engine running and all brakes applied, the pressure gauge should indicate zero pressure.

With engine running at idle and rear wheels raised from the floor and free to rotate, place the selector lever in the D position. Rear pump pressure should build up as evidenced by a steady increase in pressure reading. At 20 mph on the speedometer, the rear pump pressure should be a minimum of 60 pounds.

Remove the test equipment and reinstall the anti-creep control switch and connect the wiring.

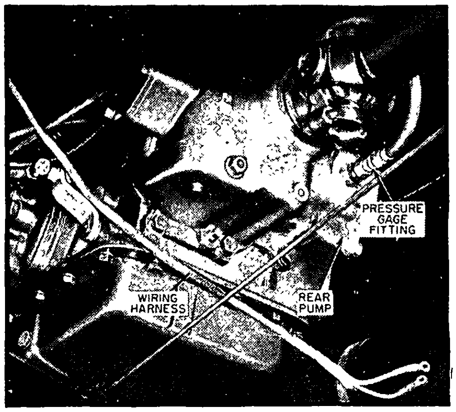


Fig. 73 Connection for rear pump pressure test. 1950-52

TROUBLE SHOOTING

Does Not Operate or Has Excessive Slippage and Engine Race In D, L and R Ranges—1. Low oil supply. 2. Hand control linkage disconnected or improperly adjusted. 3. Low front pump pressure.

Operates Normally In Reverse But Is Inoperative or Has Excessive Slippage and Engine Race In D and L Ranges—Forward band slipping.

Does Not Operate With Selector Lever In R Position But Operates Normally In D and L Position—Reverse band slipping.

Does Not Provide Effective Engine Braking With Selector Lever In L Position—Low band slipping.

Slips Excessively When Accelerating in Drive-Intermediate But Is Otherwise Normal—Multiple disc clutch slipping.

Does Operate In All Positions But Has Poor Performance In All Forward Ranges—Reverse band dragging.

Does Operate In All Positions But Has Poor Performance In All Ranges Except Direct Drive—Direct drive clutch dragging.

Operates Normally In Low But Has Poor Performance In D and R—Low band dragging.

Operates Normally In All Ranges But Has Poor Performance In Reverse—Forward band dragging.

Operates Normally In Drive Ranges But Has Poor Performance In Low and Reverse—Multiple disc clutch dragging.

Operates Normally In All Ranges But Has Low Top Speed In Direct Drive, and Excessive Overheating Is Present In Transmission — Torque converter not operating properly.

Slips Excessively After Shifting Into Direct Drive, But Is Normal In Drive-Intermediate, Low and Reverse—Improper adjustment of accelerator control linkage, or direct drive clutch not engaging properly.

Does Not Downshift From Direct Drive to Intermediate When Accelerator Is Depressed to Floorboard Between 18-50 MPH But Is Otherwise Normal—Transmission accelerator control linkage improperly adjusted.

Engine Labors or Stalls When Selector Lever Is Placed In D Position, But Operation Is Normal In L and R—1. Transmission accelerator control linkage improperly adjusted. 2. Direct drive clutch engaging as soon as selector lever is placed in D position.

Engine Shudders or Stalls When Coming to a Stop In D Range, But Operation is Normal In R and L Ranges and When Starting In D—Direct drive clutch not disengaging.

Engine Cannot Be Cranked By Pushing Car With Lever In D or L Position—Rear pump inoperative.

Transmission Excessively Noisy When Operated In Drive Ranges—Low oil supply or oil intake screen restricted.

Rear Wheel Brakes Drag After Application of Brakes with Car Moving Forward and Accelerator Released. Brakes Release When Accelerator is Depressed—Anti-creep circuit is not being broken at pressure control switch when car is moving forward.

Rear Wheel Brakes Drag At All Times (Usual Cause of Brakes Dragging Eliminated)—Anti-creep solenoid valve sticking.

Rear Wheel Brakes Drag When Starting From Standstill—A process of elimination is required to find the cause of this trouble. The procedure is as follows:

1. Remove fuse from anti-creep electrical system. Then check to see if rear wheels are free.
2. If rear wheels are not free, trouble is mechanical.
3. If rear wheels are free, replace fuse and apply brakes. Then disconnect the wire at the idle adjustment screw switch. If brakes release, install a new switch.
4. If brakes still don't release, disconnect idle adjustment screw switch-to-solenoid valve wire from the connector at the solenoid valve. If brakes release, this wire is grounded and it should be repaired or replaced.
5. If brakes still do not release the solenoid coil in the solenoid valve assembly is grounded. Replace the solenoid valve assembly.

Rear Wheel Brakes Drag When Starting from a Standstill—

1. Remove fuse from anti-creep electrical system, Fig. 74. Then check to see if rear wheels are free.

2. If rear wheels are not free with fuse removed, the difficulty is with the brake mechanism.

3. If rear wheels are free with fuse removed, replace the fuse and apply the brakes. Then disconnect the wire at the idle adjusting screw switch. If the brakes release, replace the switch.

4. If brakes still won't release, disconnect the idle adjusting screw switch-to-solenoid valve wire from the connector at the solenoid valve. If brakes release, this wire is grounded and it should be repaired or replaced.

5. If brakes still won't release, the solenoid coil in the solenoid valve is grounded. Replace solenoid valve assembly.

Starter Solenoid Will Not Operate With Selector Lever In Any Position—

1. Place selector lever in the P or N position.
2. Check for current at the "BAT" terminal on the side of the starter solenoid switch.
3. If no current is evident, check for dead battery. If battery is OK, check the battery-to-starter solenoid cable and battery-to-ground cable for bad connection or damaged cable.
4. If current is present as in Step 2, ground the small terminal on top of the solenoid switch to the solenoid case. Starter should operate.
5. If starter still does not operate with the terminal on top of the solenoid switch still grounded, check for current by grounding the "START" terminal at the back of the solenoid to the solenoid case.
6. If no current is evident as in Step 5, replace the starter solenoid switch.
7. If current is evident as in Step 5, the difficulty is in the starter motor and it should be repaired or replaced.
8. If starter operates as in Step 4, ground the starter solenoid-to-starter cut-out switch. Starter should operate.
9. If starter does not operate as in Step 8, replace the starter solenoid switch-to-starter cut-out switch cable.
10. If starter does operate as in Step 8, ground the starter cut-out switch-to-instrument panel starter switch cable at the cut-out switch. Starter should operate.
11. If starter still does not operate as in Step 10, replace the starter cut-out switch.
12. If starter operates as in Step 10, disconnect the starter cut-out switch-to-instrument panel switch cable at the instrument panel switch. Ground the cable coming from the starter cut-out switch. Starter should operate.
13. If starter still does not operate as in Step 12, replace the wire from the starter cut-out switch to the instrument panel starter switch.
14. If the starter operates as in Step 12, check instrument panel switch to instrument panel ground If OK, replace the instrument panel starter switch.

Anti-Creep System Does not Operate— First make sure the idle speed is adjusted to 500-550 rpm maximum and that the throttle spring returns the throttle to its stop. (See Fig. 52 for a diagram of this system.)

1. Remove the black wire from the idle adjusting screw switch. Turn on ignition. Then, using an ammeter, check the amperage draw from the black wire terminal to ground. Amperage draw should be between 1.2 and 2.2 amperes.
2. If amperage draw is between 1.2 and 2.2 and the car still creeps, replace the idle adjusting screw switch.
3. If no amperage draw, inspect the 14 ampere fuse in the yellow wire circuit leading from the ignition switch. Replace fuse if burned out.
4. If the fuse is good, check all the wires and connections leading to the ignition switch with a voltmeter. If no voltage is indicated or if the voltage drop is more than .2 of a volt from battery voltage at any connection, repair or replace as required.
5. If the amperage draw is in excess of 3 amperes as in Step 1, it indicates that there is a short in the solenoid coil. Replace the solenoid valve assembly.
6. If amperage draw is less than 1.2 amperes as in Step 1, it indicates a resistance to the flow of current in the circuit.
7. Remove the connector between the black wire from the idle adjusting screw switch and solenoid lead wire. Using an ammeter, check amperage flow from solenoid lead wire to ground.
8. If amperage is less than 1.2 as in Step 7, replace the solenoid valve.
9. If amperage draw is between 1.2 and 2.2, install the connector on the solenoid lead wire and check the amperage draw between end of connector and ground.
10. If amperage draw is less than 1.2 as in Step 9, replace the connector.
11. If amperage draw is between 1.2 and 2.2 as in Step 9, replace or repair the black wire from the connector to idle adjusting screw switch.

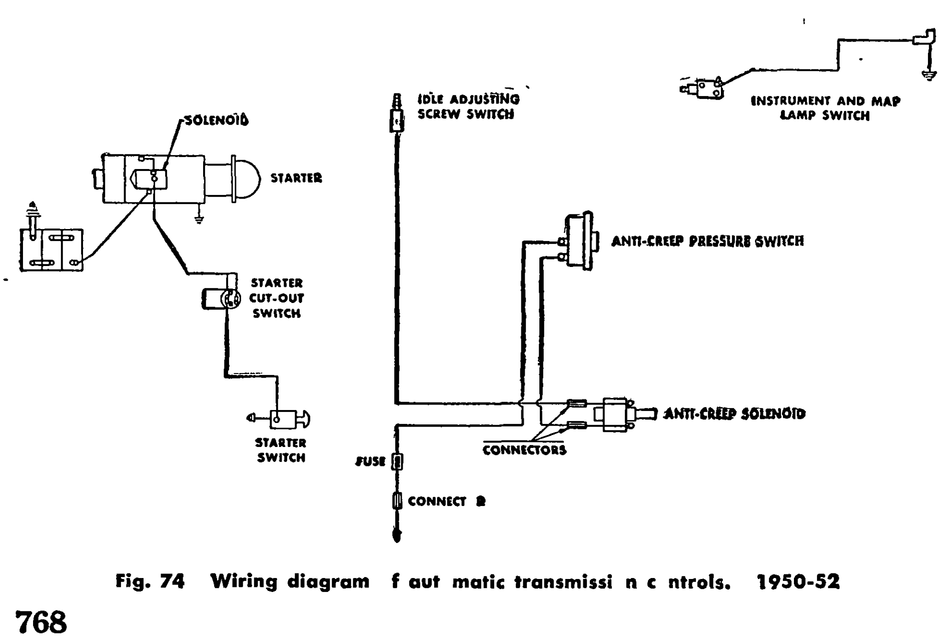


Fig. 74 Wiring diagram f aut matic transmissi n c ntrols. 1950-52

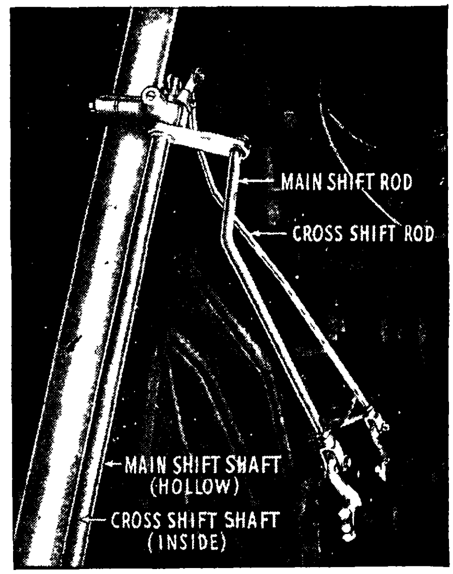


Fig. 75 Gearshift c ntr ls, 1939 Commander and Presid nt

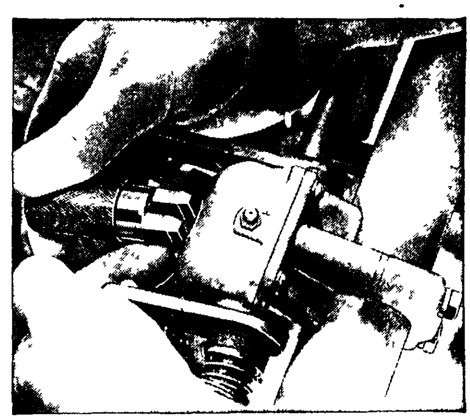


Fig. 76 Gearshift adjusting gauge, 1939 Champion and all 1940-46

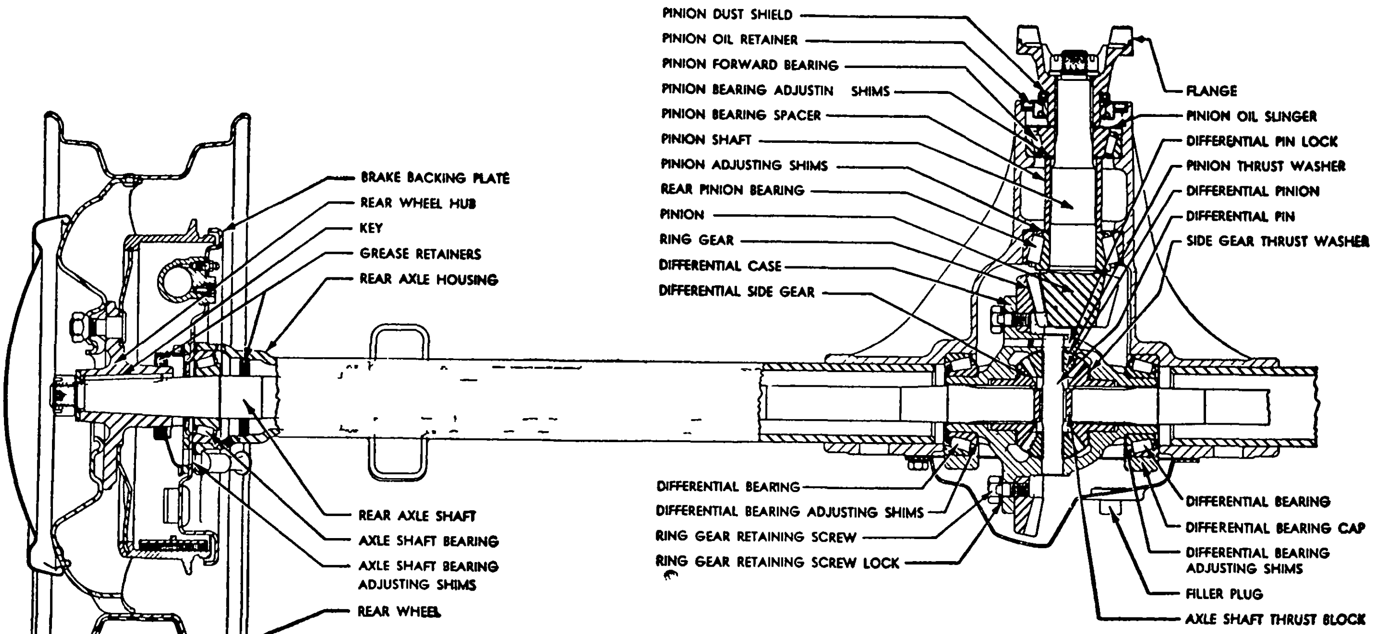
GEARSHIFT

GEARSHIFT, ADJUST

1939 Commander & President—Disconnect the control rods from the transmission levers, Fig. 75. Place the hand control lever in neutral. Disconnect the cross shift rod from the ballcrank. Place the hand lever parallel with the steering wheel and turn the cross shaft rod in its clevis until the upper edge of the slot in the clevis just lines up with the lower bracket (on steering column). Replace clevis pin.

Hold the small lever on the transmission cover in its forward position and adjust the length of the cross shift rod so that the clevis pin will just enter the clevis and the hole in the lever. Then, being guided by feeling the action of the shift rail detents, set the large transmission lever in neutral. Adjust the length of the main shift rod so the clevis pin will just enter its clevis and hole in large lever.

1939 Champion & All 1940-50—To adjust the gearshift control, disconnect



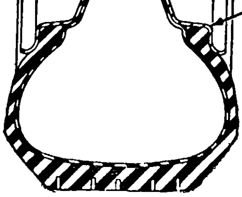


Fig. 78 Rear axle. 1935-52

the shift rods from the transmission levers Pry out the plug in the shift control box and install the gauge Fig 76 Be sure to use the correct gauge The 1939 gauge can be changed for use on 1940-46 cars by grinding 039 inch off each side of the outside face of the gauge forks The 1947-50 gauge can be ordered or made up from an earlier gauge by machining to the dimensions shown in Fig 77

With the gauge in place, check to see that the shift levers on the transmission are in neutral This can be determined by the action of the interlock By turning the threaded clevis, adjust the length of each shift rod so that the holes in the clevis and shift lever are in perfect alignment Insert the clevis pin and tighten the lock nut Repeat this procedure for the other shift rod After adjusting both shift rods, remove the adjusting gauge and install the plug

1951-52—To adjust the steering post gearshift on cars with cynchromesh transmission, first disconnect the shift rods from the transmission levers, noting the position of each clevis

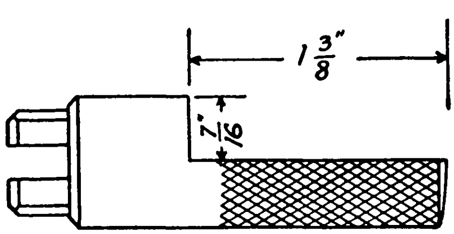


Fig. 77 G arshift adjusting gauge, 1947-50

Check to see that the shift levers on the transmission are in the neutral position This can be determined by the action of the interlock

Remove the grease fitting from the control box housing Insert Transmission Shift Rod Adjusting Gauge J-4690 through the fitting hole so that the flat on the tool engages the flats of the shift levers This puts the levers in the neutral position

By turning the threaded clevis, adjust the length of each shift rod so that the holes in the clevis and shift lever are in perfect alignment Because of the shape of the clevis, complete turns (not half turns) are necessary for adjustment Insert the clevis pin and secure the clevis in position with the lock nut

Repeat this procedure for the other shift rod After adjusting both shift rods, remove the adjusting gauge and reinstall the grease fitting

REAR AXLE

REAR AXLE SERVICE

1935-52—In this type axle, Fig 78, the drive pinion is held in position by shoulders in the differential carrier upon which the pinion bearing cups seat The pinion position is maintained by shims located between the rear bearing and the rear shoulder in the differential carrier Shims between the bearing spacer and the front bearing cone are used to adjust pinion bearings

The shimmed type of differential bearing adjustment is employed The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle Chapter*

The axle tubes are pressed into the differential carrier to form a one-piece housing To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

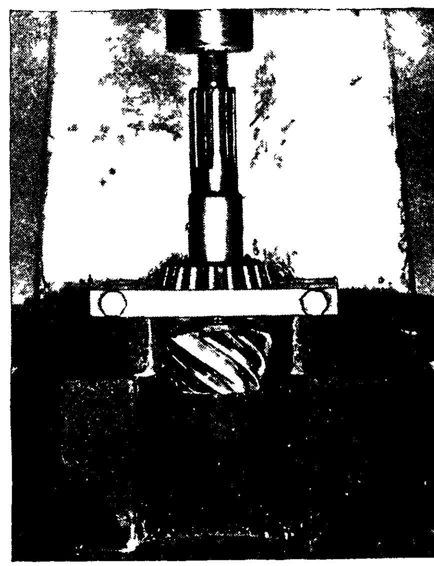


Fig. 79 Removing drive pini n bearing. 1935-52

PINION & BEARINGS, REPLACE—After removing the axle shafts and differential unit, unscrew the pinion flange retaining nut and pull off the flange The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer After the pinion is free of the front bearing, pull it out through the rear of the carrier

Mount the pinion in a press, Fig 79, and, with the bearing remover shown, press the pinion shaft out of the bearing When replacing the bearing, select a suitable sleeve or length of pipe, Fig 80, of the same diameter as the cone so the rollers or cage will not be damaged when being forced on the shaft

Drive the front bearing cup and oil seal out of the forward end of the carrier If the rear bearing cup is to be replaced or if the pinion setting is to be

Fig. 80 Installing drive pinion b aring. 1935-52

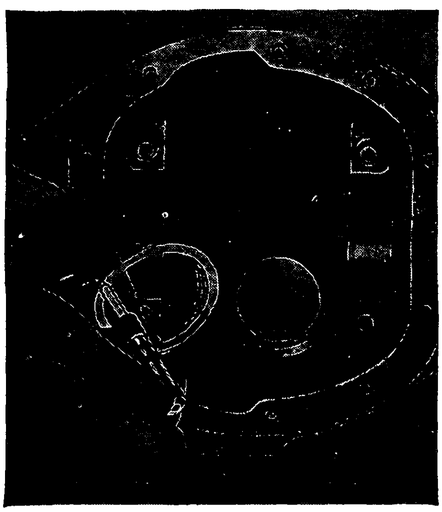


Fig. 81 Measuring thickness of pinion adjusting shims with micrometer. 1935-52

changed, remove the rear bearing cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer, Fig. 81. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used (see *Rear Axle Chapter*). After the required shims have been added or subtracted, replace the rear bearing cup.

When making a pinion adjustment, the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to retain the proper pinion bearing adjustment.

To install the pinion, support it under the head with a wood block, Fig. 82, while the pinion flange is reinstalled. The pinion oil seal should not be replaced until after the pinion setting has been checked.

PINION BEARINGS, ADJUST—The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearing are tight, but still permit rotating the pinion by hand.

PINION, ADJUST—After adjusting the pinion bearings, the position of the pinion may be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the pinion and, if it is to be moved toward the center of the axle, add shims between the rear bearing and rear shoulder in the carrier. If the pinion has to be moved away from the center of the axle, remove shims from this point.

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter*. After satisfactory tooth contact has been established, remove the pinion flange to make the installation of the oil seal. Using a compressing collar, Fig. 83, and the pinion flange retaining nut, press the new oil seal in place. Install the pinion flange, tighten the nut solidly in place and lock it with a new cotter pin.

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-52—To remove an axle shaft, jack up the wheel and pull off the hub and brake drum. Block the brake pedal in such a manner that it cannot be depressed. Disconnect the hydraulic brake line from the wheel cylinder. Remove the mounting screws and take off the outer oil seal, shims and brake support. The shaft and bearing may then be pulled out of the housing. The inner oil seal may be removed at this time.

Replace the shaft and bearings in the reverse order. If the old parts are replaced and the shims have not been disturbed, the end play should be correct when the parts are assembled. However, if a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

Axle shaft end play can be checked when all parts have been replaced except the wheel and hub. To make the check, rap each axle shaft after the nuts are tight to be sure the bearing cups are seated. Then mount a dial indicator on the axle housing with its contact button touching the end of the shaft. Work the shaft in and out by hand and note the reading on the indicator. If an adjustment is necessary, remove the oil seal and brake support and add or remove shims as required to bring the end play within the limits given in the *Rear Axle Data* table.

When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain the central position of the axle shafts.

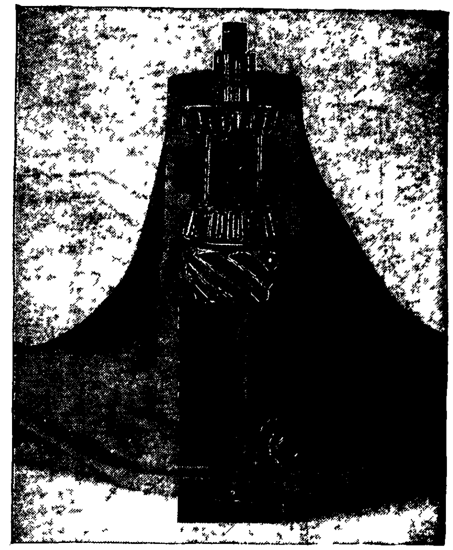


Fig. 82 Supporting driv pinion with wood block whil installing pinion flange. 1935-52

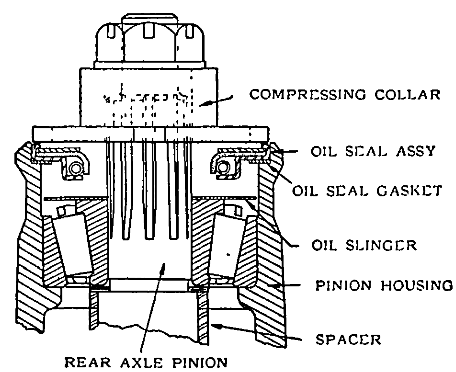


Fig. 83 Using compressing collar to install drive pinion il s al. 1935-52

WHEEL ALIGNMENT

CASTER, ADJUST

1935-37 Solid Axle—Caster up to about two degrees can be adjusted by inserting tapered caster shims between the spring seat and spring To increase caster, place the thick side of the shim toward the rear, and to decrease it, place the thick side of the shim toward the front.

1935-49 Knee Action—Caster is not adjustable on knee action models as it is controlled by the position of the front spring where it locates itself in the frame cross member channel. Incorrect caster indicates either that the kingpin and its support are not properly centered in the control arm or that chassis parts are bent.

1950-52—Caster and camber adjustments are both made at the upper control arm outer pin. To adjust caster, loosen the lock bolt. Remove the grease fitting from the front bushing and insert an Allen wrench into the opening provided in the pin. A full turn of the

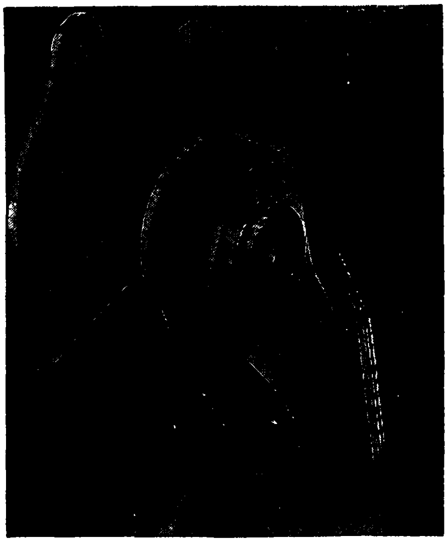


Fig. 84 Installing camber shims. 1939-40 Champion and all 1941-49

pin will change caster ½ degree. After the correct adjustment is obtained, install the grease fitting and tighten the pinch bolt.

CAMBER, ADJUST

1935-37 Solid Axle—The only way errors in camber can be corrected is to bend the axle ends.

1935 Knee Action—Camber is adjusted by shims between the upper control arm and needle bearing cages. Adding shims increases camber. Removing shims decreases camber. Shims for making this adjustment are $\frac{1}{32}$ inch thick, one of which changes camber ¼ degree. A maximum of six shims is permissible in making the adjustment.

1936-38 & Commander 1939 — Camber is adjusted by turning the eccentric pin located at outer end of the steering knuckle support arm. The eccentric pin is in neutral position when the flats are vertical. With a wrench applied to one of the flats, turn the eccentric toward the frame to increase camber and toward the wheel if it is to be decreased. To make the adjustment, loosen the clamp bolts that hold the eccentric pin and bushings, turn the pin as required and tighten the clamps.

1939-40 President; 1940 Commander — Camber is adjusted by adding or removing shims between the steering knuckle support arm bracket and the frame. Removing shims decreases camber while adding them increases it. To make the adjustment, loosen the frame bracket nuts and add or remove shims as required, then tighten the nuts.

1939-40 Champion; All 1941-49 Models —Camber is adjusted by shims placed between the steering knuckle support arm brackets and the frame, Fig. 49. When an adjustment is necessary, add or remove the same number and thickness of shims at both the front and rear support arm brackets. The addition or removal of one thin shim changes camber about ¼ degree. The thick shim

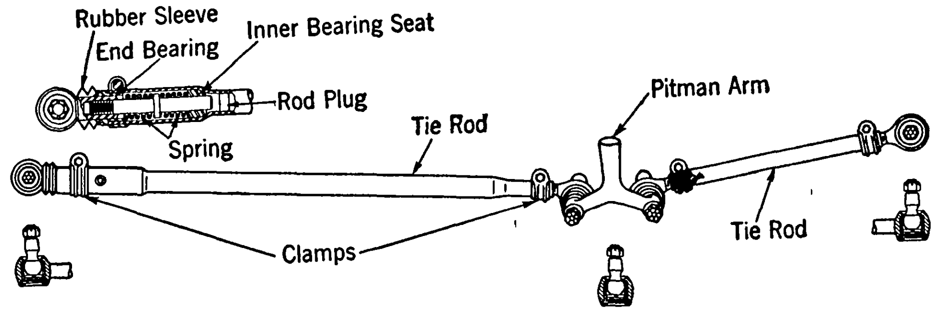


Fig. 85 1935-37 steering linkage. Spring-loaded end sh wn is used on President models to absorb road shock

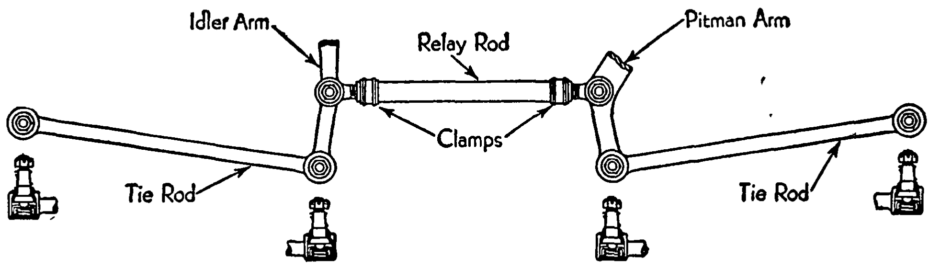


Fig. 86 1938-39 steering linkage

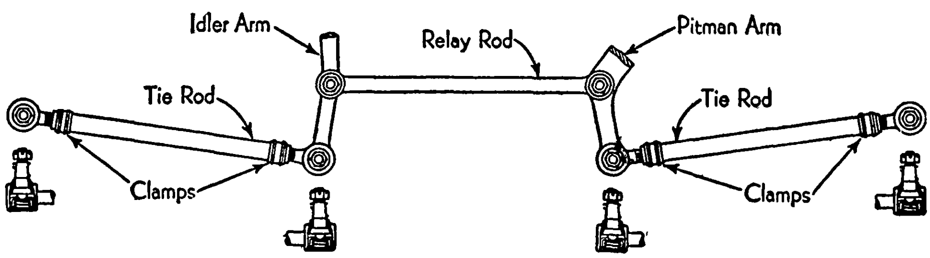


Fig. 87 1940-46 steering linkage

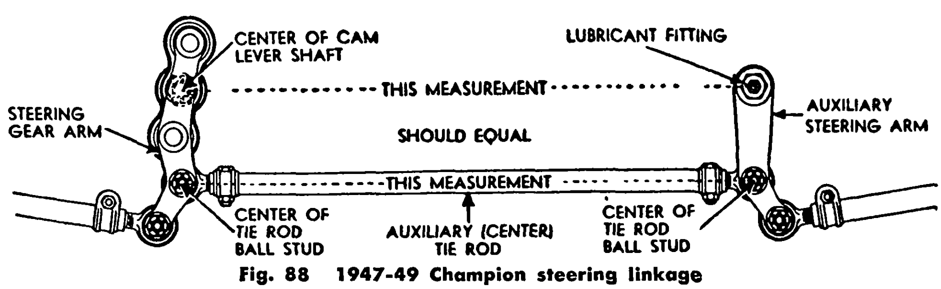


Fig. 88 1947-49 Champion steering linkage

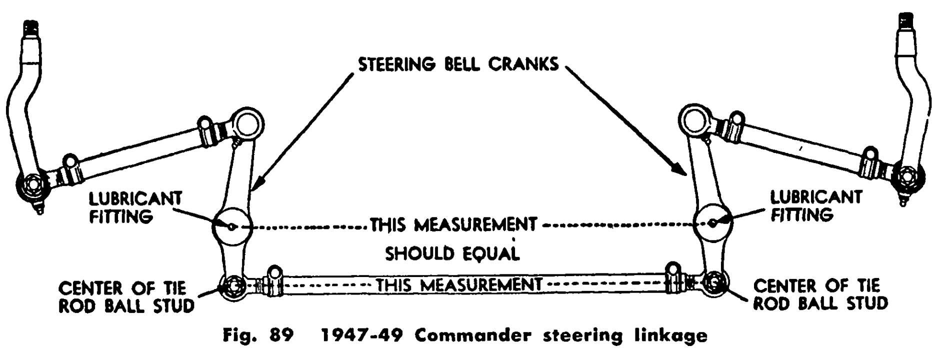


Fig. 89 1947-49 Commander steering linkage

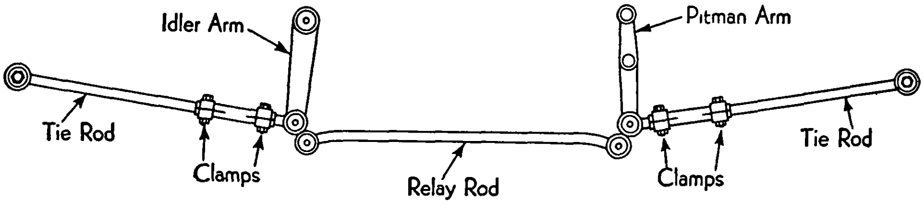


Fig. 90 1950 Champion steering linkage

is equal to four thin shims. To make the adjustment, loosen the frame bracket nuts and add or remove shims as required and tighten the nuts.

1950-52—To adjust camber, turn the upper control arm outer pin with an Allen wrench in the same manner as for caster adjustment. One half turn of the pin covers the entire range of camber adjustment. Adjusting camber will make only a slight change in the caster adjustment but recheck the caster to make sure it is within specifications.

TOE-IN, ADJUST

1935-36 Solid Axle—Loosen the clamps at both ends of the tie rod and turn the rod in the direction required to obtain the desired result.

1935-37 Knee Action—To adjust toe-in, loosen the clamps on the adjustable rod and turn the rod in the direction required to obtain the desired result. On some models, the long rod is adjustable while the short one is not; on others the short rod is adjustable while the long one is not, Fig. 85.

1938-39—Toe-in is adjusted by changing the length of the relay rod, Fig. 86. Loosen the clamp bolt at each end and turn the rod (which has a left-hand thread on one end and a right-hand thread on the other). When the adjustment is correct, tighten the clamp bolts.

1940-46—Fig. 87. To adjust toe-in, first set the steering gear in its mid-position. Then loosen the left tie rod and turn the rod so that the left front wheel is exactly straight ahead, meanwhile being sure the steering wheel remains in its mid-position. The left tie rod clamps should then be tightened and not disturbed during the remainder of the adjustment. Loosen the right tie rod clamps and turn the rod in the direction required to obtain the correct toe-in, after which tighten the clamp bolts.

1947-49 Champion & Commander—The actual toe-in adjustment is made by setting the right tie rod in the same manner described for 1940-46 models. However, after setting the left front wheel in its exact straight-ahead position and locking its clamp bolts, adjust the auxiliary (center) tie rod to the measurements indicated in Figs. 88 and 89. When the center tie rod is set properly, tighten its clamps and then adjust the toe-in by turning the right tie rod.

1950-52—Turn the left tie rod to bring the wheel in the straight-ahead position. Then adjust toe-in by turning the right tie rod. Be sure to tighten tie rod clamps securely.

FRONT END SERVICE

1935-38 All; Commander 1939—Fig. 91. Each steering knuckle support arm is mounted in rubber bushings at its inner end, while its outer extremity is equipped with bushings which thread on the knuckle support upper pin. The spring control links are rubber bushed at both ends.

The use of soft soap on the rubber bushings will greatly facilitate the installation of the bolts. Do not use grease or oil as rubber deteriorates when subjected to these petroleum products.

Steering Knuckle Support—To remove the steering knuckle support, place a stand jack under the frame side rail just back of the wheel. Raise the wheel with another jack under the spring eye. Remove the wheel and hub. Unfasten the brake support from the steering knuckle. Lift it off and lay it aside out of the way. Disconnect the tie rod from the steering knuckle arm. Take off the nut and unscrew the bolt from the spring eye and knuckle support. Remove the clamp bolts at the upper end of the knuckle support, unscrew the bushings and slip out the pin. The knuckle and its support may now be removed.

Reverse the order of the above procedure to install the knuckle support. However, be sure to centralize the spring eye in the knuckle support yoke before threading in the bolt.

Note that the pin connecting the knuckle support to the support arm is eccentric and that two circular grooves are machined on the eccentric portion. The eccentric provides a means of adjusting camber and the grooves are used to accommodate two lock bolts which centralize the pin in the knuckle support.

When the flats on the threaded portion of the pin are vertical, the camber is neutral. And when installed in this position, the camber will not be far off and may be quickly adjusted after the car is lowered to the floor and the camber is checked. After the pin lock bolts are tightened, screw the bushings all the way on the pin and tighten the bushing lock bolts to prevent their turning.

Support Arm Inner Bushings—The rubber bushings are slipped into the housing and over the support arm shaft. When installed, a flange is formed at the edge of the bushings when the washers are drawn tight against the shoulder of the support arm shaft by the retaining bolt, thus squeezing the rubber out between the washer and the

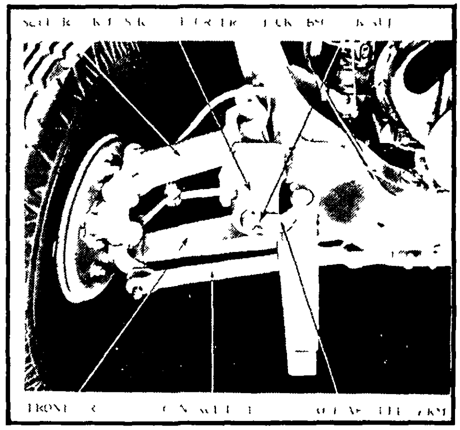


Fig. 91 Front suspensi n, all 1935-38 and Commander 1939

Fig. 94 Removing kingpin l ck pin, 1939-40 Champion and all 1941-46

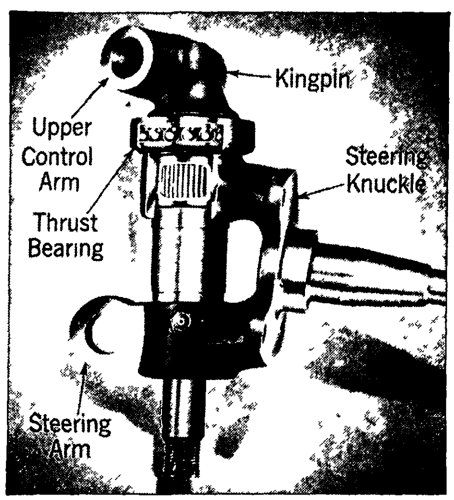


Fig. 95 Constructi n f ste ring knuckle and kingpin, 1939-40 Champi n and all 1941-46

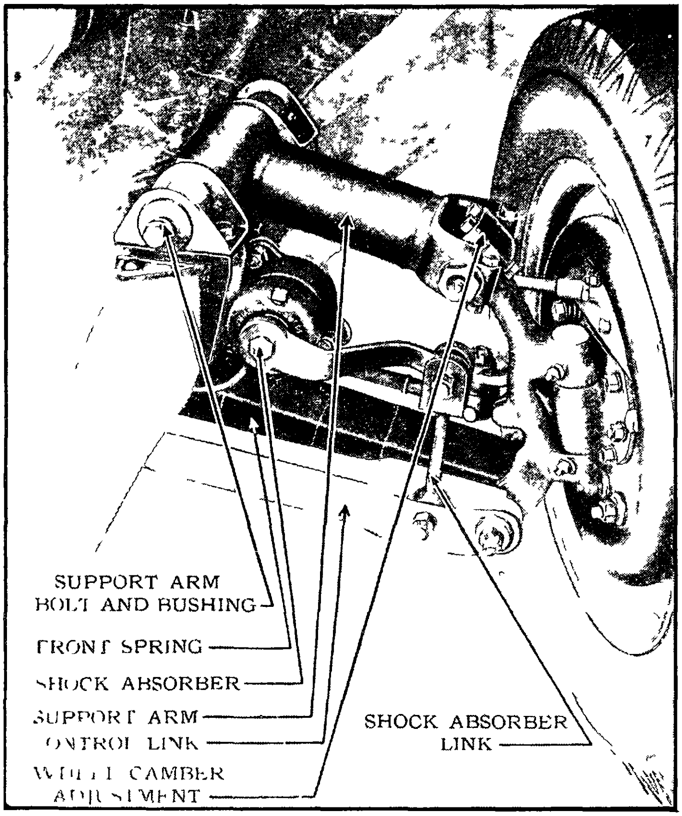


Fig. 92 Front suspension, 1939 President and 1940 Commander

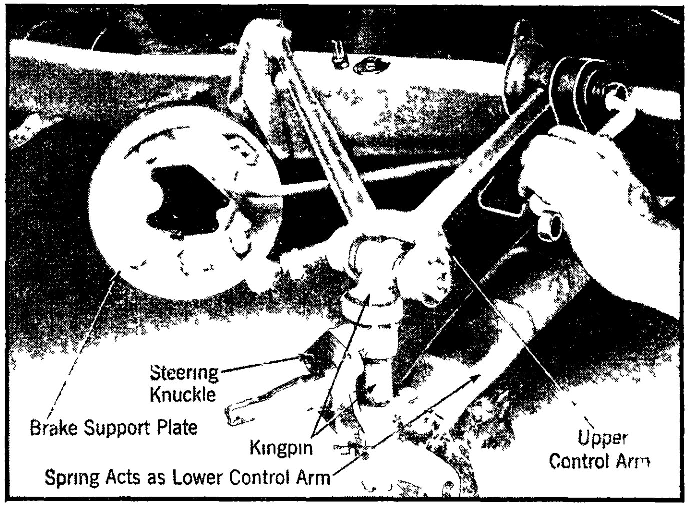


Fig. 93 Front suspension, 1939-40 Champion and all 1941-46

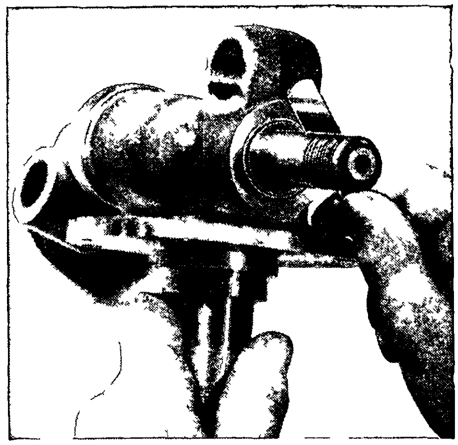


Fig. 97 Checking kingpin up and d wn play, 1939-40 Champion and all 1941-46

housing. The bushings do not turn on the pin or in the housing but rather the hinge movement is through the elasticity of the rubber.

Whenever these bushings are to be removed or the housings disconnected from the frame, support the car with a jack placed under the frame side rail.

FRONT END SERVICE

1939-40 Champion; All 1941-46—To disassemble the front suspension, see Figs. 92 and 93 and proceed as follows:

1. Disconnect tie rods from steering arm.
2. Remove spring bolt.
3. Unfasten shock absorber.
4. Remove support arm bracket bushing screws and washers.
5. Loosen the support arm bracket from the frame and take out the camber shims, noting their number and thickness.
6. The support arm and steering knuckle may now be removed.
7. To disassemble the steering knuckle, drive out the kingpin lock pin as shown in Fig. 94. The knuckle may then be disassembled (see Fig. 95).

Assembly may be made in the reverse order but special attention should be given to the following: When installing the spring bolt, be sure that equal clearance is maintained between the yoke and spring eye as shown in Fig. 96.

When replacing the support arm, it is important that it be held in a horizontal position when tightening the arm to the frame.

When installing rubber bushings, dip

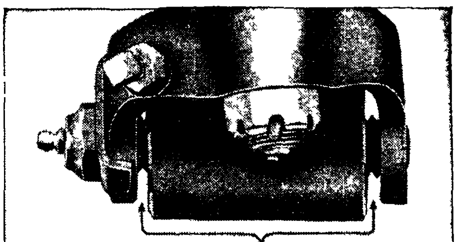


Fig. 96 Correct assembly of spring bolt, 1939-49

in gasoline before inserting them. Oil, soap or hydraulic brake fluid should not be used because the bushings must not slip in the bracket.

The up and down play of the steering knuckle pin should be from .003 to .006 inch. Place a .003 to .006 inch feeler gauge, Fig. 97, on the shoulder of the steering knuckle. The upper edge of the gauge should be flush with the edge of the shoulder on the steering knuckle pin. If it is not, remove the pin from the steering knuckles and add or remove shims as required.

Include a .010 inch feeler gauge, Fig. 98, when measuring the outside dimension of the support arm outer yoke with a pair of outside calipers. This allows the caliper measurement to be .010 inch more than the actual outside dimension of the yoke. Then install the spreader tool shown in Fig. 99, and spread the yoke until it just fits between the caliper points. When the yoke has been spread, leave the spreader in

Fig. 98 M asuring utside dimensi n f support arm uter y ke, 1939-40

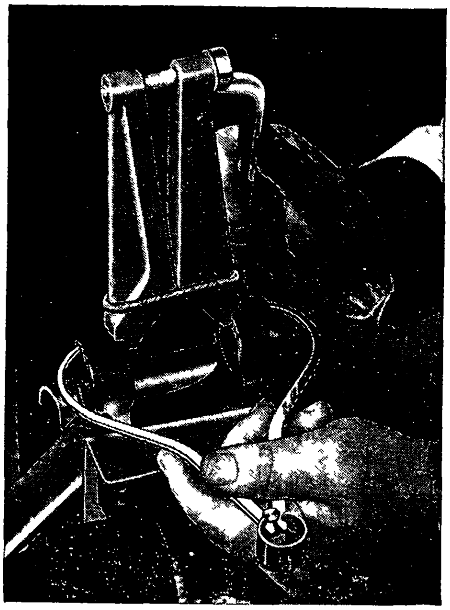


Fig. 99 Spr ading support arm outer y k b f r installing bushings, 1939-40 Champion and all 1941-46

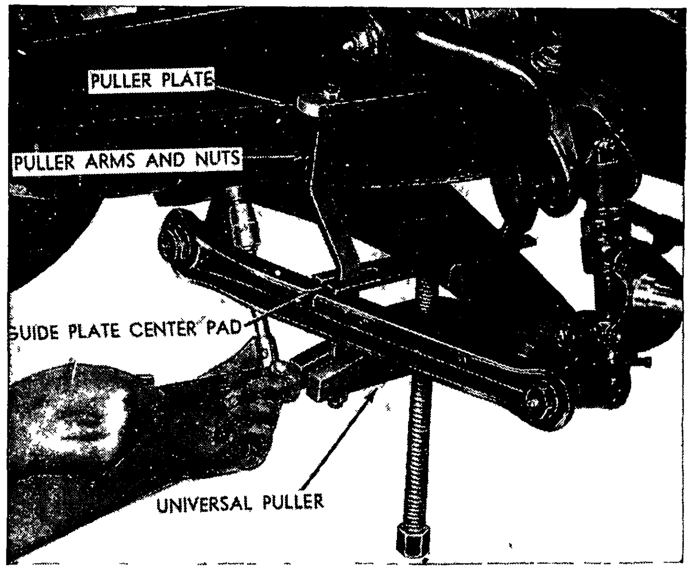


Fig. 100 R m ving fr nt suspensi n, 1947-49 Champi n and C mmander

place and install the pin bushings. After the bushings have been drawn up snug, remove the spreader.

FRONT END SERVICE

1947-49 Champion & Commander—

1. After removing wheel and tub, unfasten brake support and suspend brake out of the way.
2. Disconnect tie rod from steering arm.
3. Assemble tools shown in Fig. 100 and compress the spring by means of the puller screw until all tension is relieved from lower control arm.
4. Unfasten the lower control arm inner shaft, swing it down and remove the puller.
5. Disconnect the shock absorber arm from the upper control arm by removing the rebound bumper bolt.
6. Unfasten the upper control arm from the frame and remove the entire assembly, noting the number and thickness of camber shims taken from behind the frame brackets.

The steering knuckle and control arms may now be serviced on the bench. In assembling the unit note the following:

When pressing the bearing into the steering knuckle, be sure to apply the pressure to the lettered end of the bearing. The bearing should be pressed in until it is flush with the surface of the knuckle.

Upper and lower control arm bushing installations require the use of a Control Arm Spreader Set (tool No. 317A), similar to that shown in Fig. 99. The outer ends of the upper control arms and both ends of the lower control arms must be spread .015 inch before the threaded bushings are installed so that the proper clearance between the support and control arms will be obtained. The procedure for measuring this spread is similar to that shown in Figs. 98 and 99.

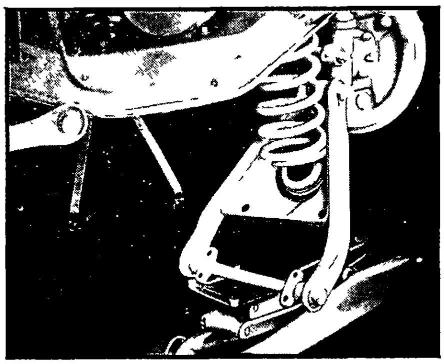


Fig. 101 1950-52. Lower control arm disconnected to allow removal of front spring

Care must be taken to see that the steering knuckle upper supports are centered in the yoke of the upper control arms. This precaution should also be taken when installing the lower control arms on the inner shafts, and on the bottom of the steering knuckle pins. The arms should work freely in the bushings after the spreaders have been removed. In assembling the inner shaft and bushings in the lower control arms, spreader tool No. J-2043 should be used.

FRONT END SERVICE, 1950-52

Lower Control Arm Removal—

1. Raise car and support it with stationary jacks under frame.
2. Remove wheel assembly.
3. Disconnect front stabilizer shaft from lower control arm and remove rubber rebound bumper.
4. On 1950 Champion and all 1951-52, remove shock absorber.
5. Inner end of lower control arm is then disconnected to allow removal of front spring and spring pads, Fig. 101.
6. Remove threaded bushings from outer end of lower control arm.
7. Using a suitable drift, remove pin which locks lower control arm outer pin to steering knuckle support.

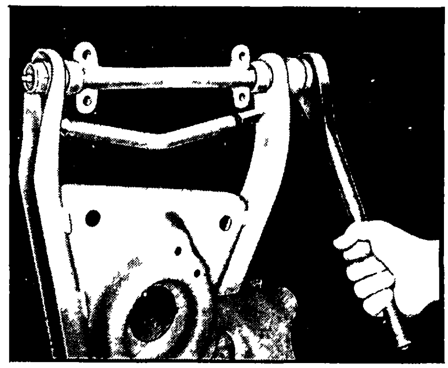


Fig. 102 1950-52. Using spr ader tool to keep lower control arm memb rs aligned to prevent binding of threaded bushings

8. Drive out outer pin with brass drift to permit removal of lower control arm and grease seals.
9. Place lower control arm in vise and remove inner shaft threaded bushings.
10. Shift inner shaft to one side as far as possible.
11. Move opposite end of shaft outward and remove shaft and grease seals from control arm.

Lower Control Arm Install—

1. Place control arm in vise.
2. Install seals on inner shaft.
3. Insert one end of inner shaft in one member of control arm, push in as far as possible, swing opposite end into position and insert it in other member of arm.
4. It is necessary to spread ends of control arm .015″ to prevent bind at threaded bushings. Install Spreader Tool Fig. 102, and tighten threaded tip of tool finger tight, then turn one-half turn more to spread ends .015″.
5. With spreader in position, place inner shaft in center between ends of control arm, being sure control arm does not bind on shaft.
6. It is also necessary to spread outer

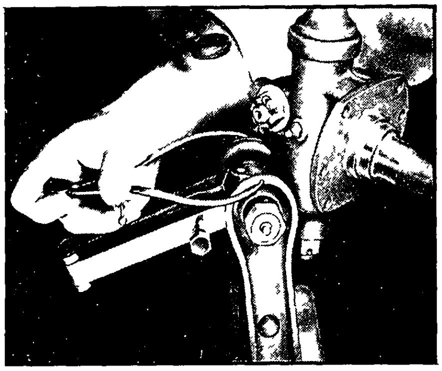


Fig. 103 1950-52. Using calipers and spreader tool to establish proper spread of outer ends of lower control arm

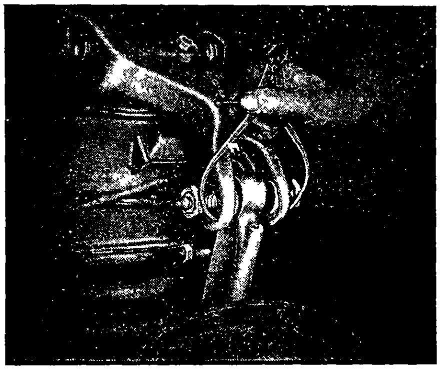


Fig. 104 1950-52. Using spreader tool to keep upper control arm inner ends aligned to prevent binding of bushings

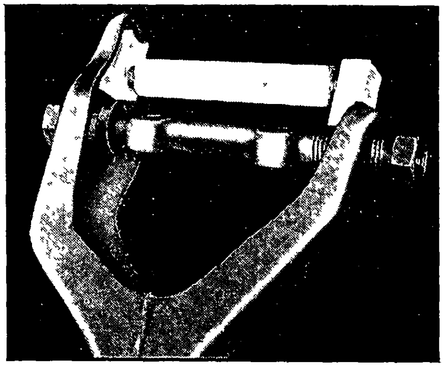


Fig. 105 1950-52. Using calipers and spreader tool to establish proper spread of outer ends of upper control arm

ends of lower control arm .015". Determine outer dimension by adjusting a pair of calipers, Fig. 103, so setting includes a .015" feeler gauge which is inserted between outside edge of control arm and one prong of calipers.

7. After setting calipers, position outer end of lower control arm at lower steering knuckle support and install outer pin, with a seal on each side of steering knuckle support.

8. Using a screwdriver in slot provided in end of outer pin, turn pin and align slot at center of outer pin and hole of knuckle support and install lock pin.

9. Then install Spreader Tool, Fig. 103, between inner surfaces of outer ends and spread ends until outside dimension is equal to setting of calipers.

10. Centralize outer end of control arm on outer pin.

11. Install bushings and tighten them securely. Then remove spreader tool, and make sure control arm turns freely on outer pin.

12. Install front spring and spring pads and complete installation of control arm.

13. On 1950 Champion and all 1951-52, install shock absorber.

14. Connect stabilizer shaft, install rebound bumper and wheel assembly.

Upper Control Arm Removal—

1. Raise car and support it at outer end of lower control arm.

2. Remove front wheel.

3. On 1950 Commander, disconnect shock absorber arm from frame bracket.

4. Remove pinch bolt which holds upper control arm in head of kingpin.

5. Remove threaded bushings and outer pin and grease seals.

6. Mark top front of control arm inner shaft so that position of shaft can be noted after assembly is removed.

7. Remove bolts and nuts which hold inner shaft to frame bracket and remove upper control arm.

8. On 1950 Commander, shock absorber is removed with upper control arm.

CAUTION—Note position of inner shaft as identified by the mark which was made during removal of arm. The holes in the inner shaft are drilled off the centerline of the shaft and turning the shaft over will increase or decrease the camber slightly less than ¾ degree. Therefore, on assembly, it is important that the shaft be installed in the original position.

Upper Control Arm Repair & Install—

1. Place upper control arm in vise.

2. Remove shock absorber and grease seal from 1950 Commander control arm.

3. Remove bushings from inner shaft.

4. Shift shaft as far as possible to one side, move opposite end of shaft out of control arm end and remove shaft and seals from arm.

5. Remove grease seals from shaft.

6. To assemble, install seals on inner shaft.

7. Insert one end of shaft into control arm, bring opposite end in position and insert in control arm.

8. It is necessary to spread inner ends of upper control arm .015". Using calipers and .015" feeler gauge, determine outside dimension of control arm.

9. Then with Spreader Tool, Fig. 104, spread inner ends of control arm until outside dimension is equal to setting of calipers.

10. With spreader tool in place, centralize inner shaft with ends of control arm and install bushings. Make sure shaft is free.

11. The outer end of the upper control arm must also be spread .015".

12. Using calipers and .015" feeler gauge, determine outside dimension.

13. Position upper control arm at kingpin and insert outer pin, with hex opening in pin toward front through one of control arm ends.

14. Install grease seal on pin, push pin through end of kingpin and install other grease seal.

15. Center outer pin in kingpin by aligning groove of outer pin with hole in kingpin and install pinch bolt.

16. Install Spreader Tool and spread ends of control arm to setting of calipers, Fig. 105.

17. Center end of kingpin in control arm and, with spreader still in place, install bushings.

18. On 1950 Commander, install shock absorber and cork grease seal on control arm.

19. With marked side of inner shaft up, align holes of inner shaft and holes of frame bracket and install retaining bolts.

20. On 1950 Commander, connect shock absorber arm link to frame bracket.

21. Install wheel.

22. Check and adjust camber and caster as outlined previously.

Steering Knuckle Service—

1. Raise car and support it at outer end of lower control arm.

2. Remove front wheel assembly.

3. Remove brake plate from knuckle flange without disturbing brake hose and suspend brake assembly in an out of the way position. Do not allow assembly to hang on hose.

4. Disconnect tie rod from knuckle arm.

5. Remove kingpin retaining nut. Then use a lead mallet to drive kingpin upward out of lower support.

6. Lift upper control arm and kingpin assembly and swing kingpin outward.

7. Remove Woodruff key from kingpin, then remove steering knuckle, shim and thrust bearing.

8. Remove cork gasket from lower end of knuckle.

To service the knuckle, proceed as follows:

1. First remove needle bearing at lower end of knuckle.

2. Insert removal adapter in knuckle and place it on upper surface of bearing.

3. Place knuckle in arbor press. Then, using the bushing of the knuckle as a pilot, insert arbor and press bearing out of knuckle.

4. To remove bushing, invert steering knuckle, insert removal adapter and place it on inner end of bushing.

5. Insert pilot in bearing end of knuckle and, using the arbor, press bushing out of knuckle.

6. To remove kingpin, remove bush-

ings and outer pin as outlined under Upper Control Arm.

7. If necessary to replace the steering knuckle arm, remove arm retaining nut and, using a suitable drift, drive the arm out of the knuckle and remove the Woodruff key from the arm.

NOTE—Assemble the steering knuckle in the reverse order. However, when pressing the bearing into the steering knuckle, be sure that the pressure is applied to the lettered end of the bearing. Then, to determine the steering knuckle end play on the kingpin, first place the kingpin in a vise and place the steering knuckle on the kingpin without the cork gasket which is normally installed on the bottom of the knuckle. Place the thrust bearing and shims on the kingpin. Insert a .003" to .006" feeler gauge between the shoulder of the kingpin and steering knuckle. Place a straightedge or small scale across the top surface of the thrust bearing and lower shoulder of the kingpin and press down on the thrust bearing. If the surface of the thrust bearing is not flush with the shoulder of the kingpin, remove or add shims as required. After proper end play is obtained, remove the knuckle, thrust bearing and shims from the kingpin. Then reassemble the parts in the reverse order of their removal.

STEERING GEAR

STEERING GEAR REMOVAL

1935-39 — To remove the gear assembly, disconnect the battery, remove the horn button and steering wheel, leaving the horn wire in the post. Unfasten the steering column bracket clamp from the instrument panel. Remove the grommet from the steering column and, on cars with remote control gearshift, take off the gearshift lever. Remove the gearshift lever box cap screws and box, prop the gearshift lever and shaft in position until the gear is replaced.

Disconnect the horn wire from the bottom of the steering post and raise the front end of the car. Remove the steering gear arm, leaving the tie rods attached. Coat the column jacket with soap and push the gear into the car first and then lift it up, forward and out of the dash and dash grommet.

Replace the gear in the reverse order and assemble the steering arm when the wheels are in their straight-ahead position and with the steering gear on the high spot, or central position.

1940—Remove the hood side panel and raise the front end of the car. Disconnect the battery on the Champion, or remove the battery and carrier on Commander and President. Remove the steering gear arm, horn button, steering wheel, gearshift lever and gearshift lever upper pivot bracket.

Take off the hood lock handle and pivot bolt. Unfasten the bracket connecting the steering column to the instrument panel. Disconnect the gearshift lever box and push the box and gearshift rods to one side. Unfasten the gear assembly from the frame and lubricate the column jacket with liquid soap. Take out the front cushion and slide the seat to the rear of the track. Raise the steering gear and remove the assembly toward the front.

Replace the gear in the reverse order and check the wheel alignment and gearshift adjustments as described under their respective headings.

1941-49 — Remove the hood side panel and raise the front end of the car. Remove the battery and disconnect the horn wire at the lower end of the steering gear. Remove the steering gear arm. Take off the left engine side pan and drive one battery carrier stud down through the fender skirt.

Remove the horn button, steering wheel, gearshift lever, gearshift shaft upper pivot bracket, steering post plate screws, steering post-to-instrument panel bracket and gearshift lever box and push the box and gearshift rods to one side. Disconnect the gear from the frame and lubricate the column jacket with liquid soap.

Remove the front seat cushion and slide the seat to the rear of the track. Raise the steering gear and remove the assembly toward the front.

Replace in the reverse order and align the front wheels, adjust gearshift rods, lubricate steering gear and test the operation of the steering gear.

1950-52—After removing horn button and steering wheel, proceed as follows:

1. Remove gearshift lever ball cap and withdraw lever from shift shaft.
2. Remove bolts holding jacket bracket to instrument panel.
3. Remove steering post collar screws.
4. Take out seat cushion.
5. Disconnect horn wire.
6. Disconnect rods from gearshift levers at control box.
7. On Commander, remove gearshift control box cap and key.
8. On Champion, loosen steering post jacket clamp.
9. Remove Pitman arm and gear housing-to-frame bolts.
10. On Commander, remove starter to make it easier to remove Pitman arm.
11. Tip upper end of steering post down and slide jacket and gearshift shaft rearward, into interior of car, off steering post.
12. Steering gear is then removed engine side of cowl.
13. Wrap a cloth around top of steering gear housing top cover to prevent spilling of lubricant.
14. Lift housing end of assembly up, swing forward over battery and remove it from chassis.

WILLYS

INDEX OF SERVICE OPERATIONS

Year	Model Designation	Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1935	Four . 77	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	5.13	48 @ 3200		35 @ 30
1936	Four 77	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	5.70	48 @ 3200		35 @ 30
1937	Four 37	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	5.70	48 @ 3200		35 @ 30
1938	Four 38	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	5.70	48 @ 3200	100 @ 1600	30 @ 30
1939	Four 48	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	5.70	48 @ 3200	100 @ 1600	35 @ 30
	Overland 4 39	100	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.35	61 @ 3600	106 @ 2200	35 @ 30
1940	Four . 440	102	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	61 @ 3600	106 @ 2200	35 @ 30
1941	Americar 4.... 441	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 3800	108 @ 1600	35 @ 30
1942	Americar 4.... . . 442	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 3800	108 @ 1600	35 @ 30
1946	Station Wagon 4. 4-63	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 4000	105 @ 2000	25 @ 30
1947	Station Wagon 4 . 4-63	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 4000	105 @ 2000	35 @ 30
1948	Station Wagon 4... 4-63	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 4000	106 @ 2000	35 @ 30
	Station Wagon 6.........6-63	104	In Block	3 x $3\frac{1}{2}$	148.5	6.42	70 @ 4000	117 @ 1600	35 @ 30
1949	Station Wagon 4.........4-63	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 4000	106 @ 2000	35 @ 30
	Station Wagon 6.........6-63	104	In Block	3 x $3\frac{1}{2}$	148.5	6.42	70 @ 4000	117 @ 1600	35 @ 30
	Jeepster 4 .... VJ2	104	In Block	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	6.48	63 @ 4000	106 @ 2000	35 @ 30
	Jeepster 6.............VJ3-6	104	In Block	3 x $3\frac{1}{2}$	148.5	6.42	70 @ 4000	117 @ 2000	35 @ 30
1950-51	Station Wagon 4.........4-73	104	A	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	7.40	72 @ 4000	114 @ 2000	35 @ 30
	Station Wagon (B).....4 x 473	$104\frac{1}{2}$	A	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	7.40	72 @ 4000	114 @ 2000	35 @ 30
	Jeepster 4.................VJ	104	A	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	7.40	72 @ 4000	114 @ 2000	35 @ 30
	Station Wagon 6.........6-73	104	In Block	$3\frac{1}{8}$ x $3\frac{1}{2}$	161.0	6.90	75 @ 4000	117 @ 1600	35 @ 30
	Jeepster 6.... . VJ	104	In Block	$3\frac{1}{8}$ x $3\frac{1}{2}$	161.0	6.90	75 @ 4000	117 @ 1600	35 @ 30
1952	F-Head Six 685	108	A	$3\frac{1}{8}$ x $3\frac{1}{2}$	161.0	7.60	90 @ 4200	135 @ 2000	35 @ 30
	Station Wagon 4 4-73	104	A	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	7.40	72 @ 4000	114 @ 2000	35 @ 30
	Station Wagon (B).....4 x 473	$104\frac{1}{2}$	A	$3\frac{1}{8}$ x $4\frac{3}{8}$	134.2	7.40	72 @ 4000	114 @ 2000	35 @ 30
	Station Wagon 6.........6-73	104	In Block	$3\frac{1}{8}$ x $3\frac{1}{2}$	161.0	6.90	75 @ 4000	117 @ 1600	35 @ 30

A—"F-Head" Engine—Intake valve in head, exhaust valve in block.
B—Four wheel drive.

TUNE UP SPECIFICATIONS

Year	Model	Spark Plugs		Breaker Gap, Inch Note E	Cam Angle, Degrees	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1935-38	All	CH-7	.025	.020	47	1342	A	Negative	350	..	60-65
1939	48	CH-J8	.025	.020	41	1342	A	Negative	350	...	60-65
	39	CH-J8	.025	.020	41	1342	B	Negative	350	.	60-65
1940-42	All	CH-J9	.030	.020	41	1342	B	Negative	350		60-65
1946-47	4-Cyl.	F	.030	.020	41	1342	B	Negative	350		60-65
1948	4-Cyl.	G	.030	.020	41	1342	B	Negative	350		60-65
	6-Cyl.	G	.030	.020	35	153624	C	Negative	350	..	60-65
1949	4-Cyl.	G	.030	.020	41	1342	B	Negative	600		60-65
	6-Cyl.	G	.030	.020	39	153624	C	Negative	600		60-65
1950	4-Cyl.	AL-AN7	.030	.020	47	1342	D	Negative	600		60-65
	6-Cyl.	AL-AN7	.030	.020	39	153624	C	Negative	500		60-65
1951-52	4-Cyl.	CH-J8	.030	.020	47	1342	D	Negative	600		60-65
	6-Cyl.	CH-J8	.030	.020	39	153624	C	Negative	575	.	60-65

A—IGN mark on flywheel.
B—Early models, IGN mark on flywheel; late models, 5 degree mark on flywheel.
C—Line on vibration damper.
D—TDC mark on flywheel.
E—Plus or minus .002".
F—Auto-Lite AN7 or Champion J9.
G—Auto-Lite A7 or Champion J7.

Year	Model	Operating Clearance Intake (Cold)	Operating Clearance Exhaust (Cold)	Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A) Intake Opens Degrees BTDC	Valve Timing (Note A) Exhaust Closes Degrees ATDC	Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance Intake	Valve Stem Clearance Exhaust	Valve Stem Diameter Intake	Valve Stem Diameter Exhaust
1935-38	All	.004	.006	.010	45	C	5	46@2¼	.002 -.004	.003 -.005	.3725	.3710
1939	48	.004	.006	.010	45	C	5	46@2¼	.002 -.004	.003 -.005	.3725	.3710
	39	.014	.014	.020	45	9	12	59@2 11/16	.0015-.003	.002 -.004	.3730	.3725
1940-49	Four	.016	.016	.020	45	9	12	53@2 7/64	.0015-.003	.002 -.004	.3730	.3725
1948-49	Six	.016	.016	.020	45	5	12	50@1⅝	.0015-.003	.0025-.0045	.3730	.3725
1950-52	Four	.018	B	.026	45	9	12	D	.0015-.003	.0025-.0045	.3730	.3725
1950-51	Six	.016	.016	.020	45	5	12	50@1⅝	.0015-.003	.0025-.0045	.3730	.3725
1952	F-Head Six	.018	.016	.018	45	5	12	D	.0007-.0022	.0025-.0045	.3735	.3400

A—BTDC means before top dead center; ATDC means after top dead center.
B—Eaton free valve .012″; Thompson Roto Valve .016″.
C—Top dead center.
D—Intake 73 @ 1 21/32; exhaust 50 @ 1⅝.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale: Removed From	Fitting Pistons With Scale: Shim Thickness To Use	Fitting Pistons With Scale: Pounds Pull on Scale	Rings: Ring Gap, Minimum (Note A) Compression	Rings: Ring Gap, Minimum (Note A) Oil	Rings: Clearance in Groove Compression	Rings: Clearance in Groove Oil	Pins: Type	Pins: Fit
1935-38	All	Above	.0025(B)	5 to 10	.008	.008	.0005-.001	.001-.0015	D	E
1939-42	All	Above	.003(B)	5 to 10	.008	.008	.0005-.001	.001-.0015	F	E
1946-52	Four	Above	.0045(B)	5 to 10	.008	.008	.0005-.0015	.0005-.0015	F	E
1948-52	Six	Above	.0025(B)	7 to 12	.008	.008	C	.001-.0025	F	E

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Feeler gauge should be ¾″ wide.
C—Top ring .002-.004″, second ring .0015-.0035″.
D—Floating type. Pin retained by snap rings in piston bosses.
E—Thumb push fit with parts at 70° (normal room temperature).
F—Locked in rod.

ENGINE BEARING DATA

Year	Model	Camshaft Bearings: Camshaft End Play, Inch	Camshaft Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Journal Diameter, Inches	Connecting Rod Bearings: Bearing Clearance, Inch	Connecting Rod Bearings: Rod End Play, Inch	Connecting Rod Bearings: Rod Bolt Tension, Lbs. Ft.	Main Bearings: Journal Diameter, Inch	Main Bearings: Bearing Clearance, Inch	Main Bearings: Crankshaft End Play, Inch Note C	Main Bearings: Main Bolt Tension, Lbs. Ft.
1935-36	77	B	.002-.0035	1.9375-1.9385	.001-.0025	.005-.009	50-55	2.1765-2.1770	.001-.0025	.004-.008	60-70
1937-42	All	B	.002-.0035	1.9375-1.9385	.001-.0025	.005-.009	50-55	2.3335-2.3340	.001-.0025	.004-.008	60-70
1946-49	Four	A	.001-.0025	1.9375-1.9385	.0005-.0025	.005-.009	50-55	2.3335-2.3340	.001-.0025	.004-.008	60-70
1948-49	Six	A	.001-.0025	1.875-	.0004-.0025	.004-.010	50-55	2.250	.0009-.003	.004-.008	65-70
1950-52	Four	A	.001-.0025	1.9375-1.9385	.0002-.0025	.004-.010	50-55	2.3331-2.3341	.0014-.0029	.004-.006	65-70
	Six	A	.001-.0025	1.875	.0005 .0025	.002-.008	50-55	2.250	.0009-.003	.002-.006	65-70

A—Controlled by thrust plate. B—Controlled by spring and plunger at front. C—Thrust is taken by the front bearing.

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE Crankcase Refill Capacity, Quarts	ENGINE Grade of Oil Above +32°F.	ENGINE Grade of Oil Above +10°F	ENGINE Grade of Oil Above −10°F.	TRANSMISSION Capacity, Pounds or Pints	TRANSMISSION Grade of Oil Summer	TRANSMISSION Grade of Oil Winter	DIFFERENTIAL Capacity, Pounds or Pints	DIFFERENTIAL Grade of Oil Summer	DIFFERENTIAL Grade of Oil Winter
1935	77	9	8	4	20	20W	10W	1	140	90	1	140	90
1936-37	All	11	8	4	20	20W	10W	1¼	140	90	1¼	140	90
1938	38	11	8	4	20	20W	10W	1¼	90	90	1¼	90	90
1939	48	11	8	4	20	20W	10W	1¼	90	90	1¼	90	90
	39	11¾	8	4	20	20W	10W	1¼	90	90	1¼	90	90
1940	440	11¾	10½	4	20	20W	10W	1	90	90	1½	90	90
1941-42	All	11¾	11½	4	20	20W	10W	1 (A)	90	90	2	90H	90H
1946-49	Four	11	15	4	20	20W	10W	1½ (B)	90	80	2	90H	90H
1948-49	Six	8¾	15	5	20	20W	10W	1½ (A)	90	80	2	90H	90H
1950-52	Four	11	15	4	30	20	10W	1½ (C)	90	80	2	90H	90H
1950-52	L-Head Six	9	15	5	30	20	10W	1½ (C)	90	80	2	90H	90H
1952	685	10	18	5	30	20	10W	1½ (C)	90	80	2	90H	90H

A—With overdrive, 3 pints. B—With overdrive, 3¼ pints. C—With overdrive, 2¼

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1935	All	+1½	+2	3/32	7½
1936	All	+1	+2	3/32	7½
1937-42	All	+3	+2	3/32	7½
1946-49	All	+1	+1	3/32	5½
1950-52	Sta. Wagon	+1	+1½	3/32	5
	Jeepster	+1	+1	3/32	5
1952	685	+1	+1	1/8	8

REAR AXLE DATA

Year	Model	Ring Gear and Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch
1935-40	All	.004-.008	Shims	Shims	.004-.006
1941-42	All	.006-.008	Shims	Shims	.004-.006
1946-49	All	.004-.008	Shims	Shims	.004-.006
1950-52	All	.004- .009	Shims	Shims	.004-.006

BRAKE DATA

Year	Model	Lining Material	Lining Dimensions Per Wheel, Inches Length	Width	Thickness	Brake Pedal Free Play, Inches
1935-38	All	Molded	19 3/16	1¾	5/32	½
1939	48	A	19 3/16	1¾	5/32	½
	39	A	B	1¾	5/32	½
1940	All	A	18⅝	1¾	3/16	½
1941-42	All	Molded	18⅝	1¾	3/16	½
1946-48	All	Molded	19	1¾	.222	½
1949-52	Except 685	Molded	19	1¾	.187	½
1952	685	Molded	17½	C	.214	½

A—Primary shoe, molded. Secondary, woven.
B—Front wheel 18 13/16"; rear wheel 16⅜".
C—Primary 2"; secondary 1¾".

FIRST SERIAL & ENGINE NUMBERS

SERIAL NUMBER LOCATION—1935-36: On left frame side rail near front spring rear hanger. 1937-42: on right side of cowl under hood. 1946-51 Station Wagon: On floor riser back of driver's seat—outside front end left frame side rail. 1949-51 Jeepster: Under edge of cowl above glove box door.

ENGINE NUMBER LOCATION—1935-42: On upper right front of cylinder block. 1946-51: On water pump boss at front of engine.

Year	Model	
1935	77	27056
1936	77	47750
1937	37	1001
1938	38	65001
1939	48	89001
	39	1001
1940	440	17001
1941	441	50001
1942	442	80101
1946	4-63	10001
1947	4-63	16535
1948	4-63	44046
	6-63	10001
1949	4-63	79716
	VJ2	10001
	VJ3-6	10001
	6-63	13119
1950-51	4-73	10000
	VJ(4)	10000
	6-73	10000
	VJ(6)	10000

ENGINE

ENGINE REMOVAL

1935-52—The general procedure for removing the engine is as follows:

1. Drain cooling system.
2. Disconnect battery.
3. Remove radiator, air cleaner and starter motor.
4. Disconnect generator and distributor wires.
5. Disconnect fuel lines, choke and throttle controls, oil line and water temperature gauge bulb.
6. Attach a hoist to the engine.
7. Unfasten exhaust pipe from manifold.
8. Remove engine mounting nuts.
9. Detach clutch housing from engine.
10. Lift engine out of car.
11. Reverse the above procedure to install the engine, being sure to apply a little grease to the clutch pilot bearing.

NOTE—On 1952, the engine, transmission and overdrive may be removed readily from below the car if a suitable dolly and lift are available. Two hours less labor is required with this method than by removing the engine from above.

CYLINDER HEAD

1935-52—Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block. File or hone all high spots.

Use a torque wrench when tightening down cylinder heads. Uneven or excessive tightening of nuts may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder heads in the sequence shown in Figs. 1 and 2, tightening them a little at a time in the proper order a couple of times around before final tightening to the torque values given in the *Tune Up Chart*. After the engine has warmed up to operating temperature, recheck the torque and tighten as required.

On 1950-52 F-Head engines, be sure to check intake valve operating clearances after the final tightening.

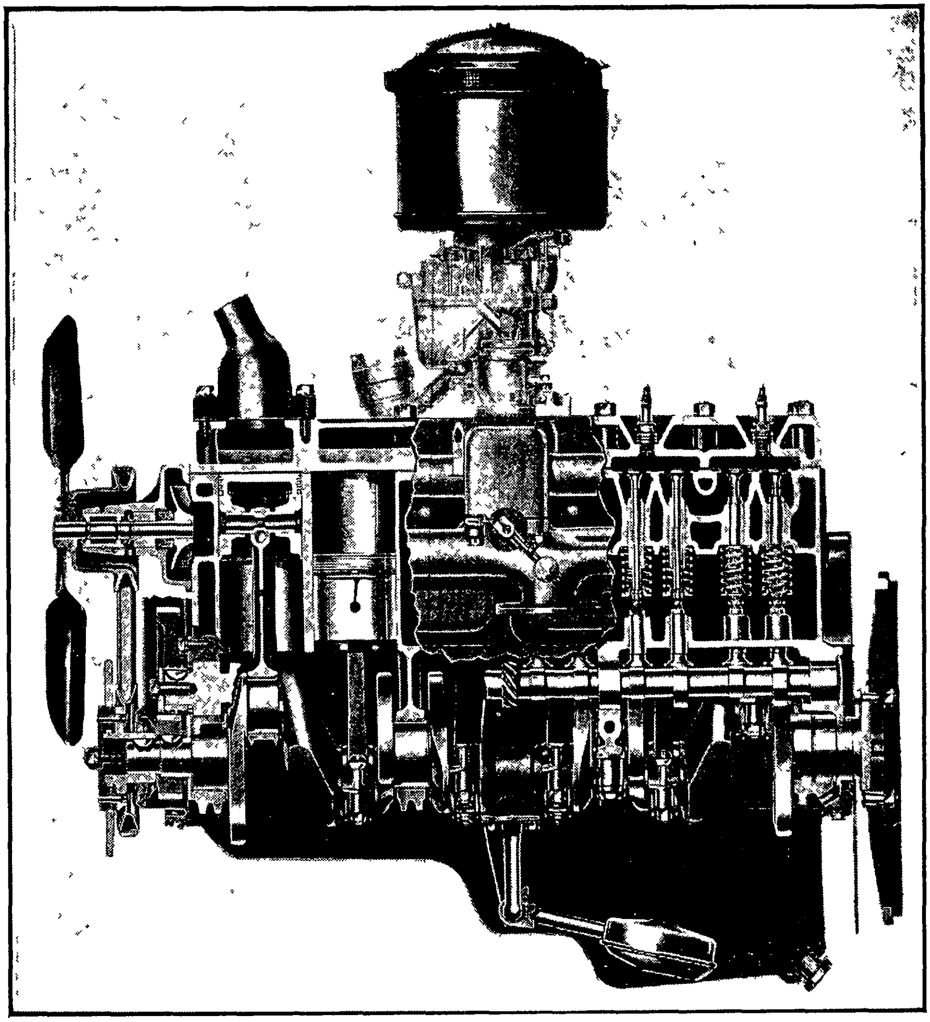


Fig. A Six cylinder L-Head engine. 1948-52

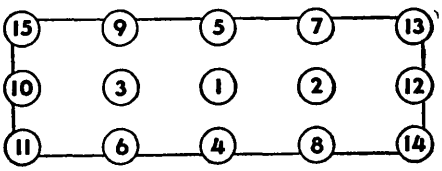


Fig 1 F ur cylinder head tightening. 1935-50 L-Head

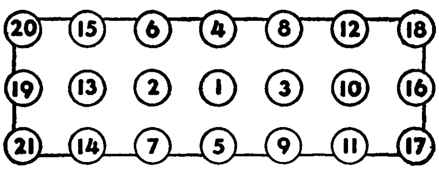


Fig. 2 Six cylinder head tight ning. 1948-52 L-Head

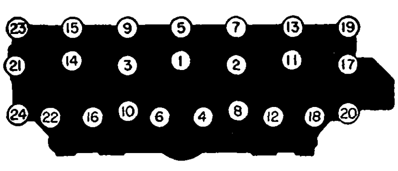


Fig. 2A Six-cylind r F-h ad ngin h ad tight ning. 1952

NOTE—Tightening cylinder heads on F-head engines without removing rocker arms may be accomplished with a wrench having an $\frac{11}{16}$" box on one end and a ½" square box on the other end. This, together with a torque wrench will do the job.

ROCKER ARMS

1950-52 F-Head Engines—To remove the rocker arm assembly, proceed as follows:

1. Remove carburetor air cleaner.
2. Disconnect spark plug wires.
3. Drain cooling system.
4. Remove rocker arm cover
5. Remove rocker arm bracket screws and lift off rocker arm assembly.

Before disassembly, mark rocker arms, brackets and shaft so they can be reassembled in the original positions.

VALVE ADJUSTMENT

1935-52 L-Head Engines — The valves may be adjusted when the engine is at normal room temperature. Crank the engine over until the valve to be adjusted is fully closed. Hold the lifter body with a tappet wrench to prevent it from turning. Then turn the tappet adjusting screw until the proper clearance is obtained. Measure the clearance with a feeler gauge and, after adjusting one tappet, proceed in like manner with the others, being certain that the valve being adjusted is fully closed.

1950-52 F-Head Engines—The exhaust valves (in block) may be adjusted in the same manner as outlined for L-head engines. However, the intake valves may best be adjusted with the engine running after it has warmed up to operating temperature.

If the cylinder head has been tightened, be sure to recheck intake valve clearances and adjust as required.

VALVES, REMOVE

1935-52 L-Head Engines—After removing the cylinder head, take off the valve chamber covers and use cloth to block off the holes in the valve chamber t prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves

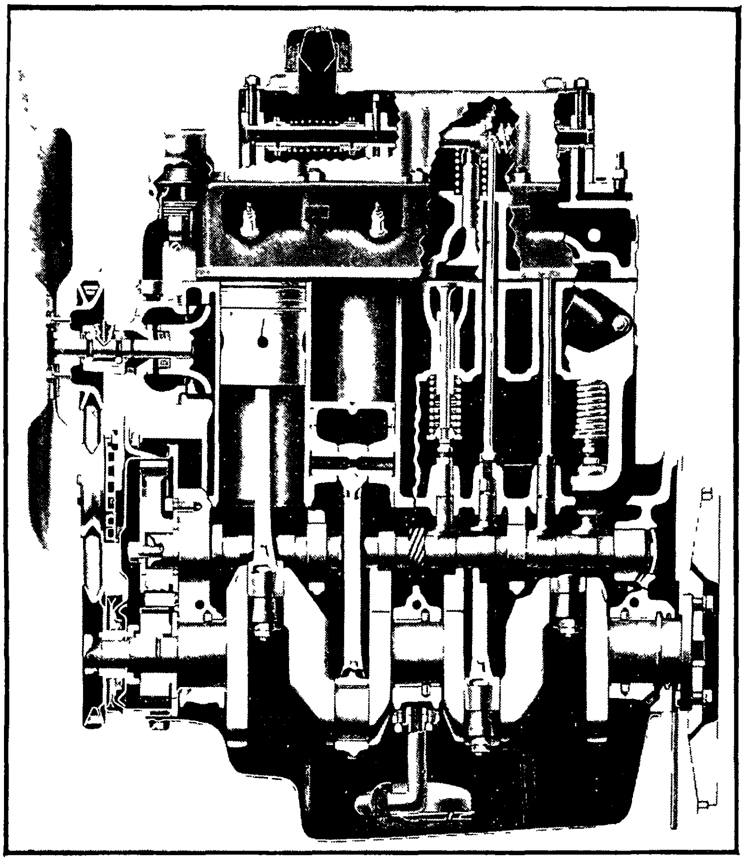


Fig. B F-Head four cylinder engine. 1950-52

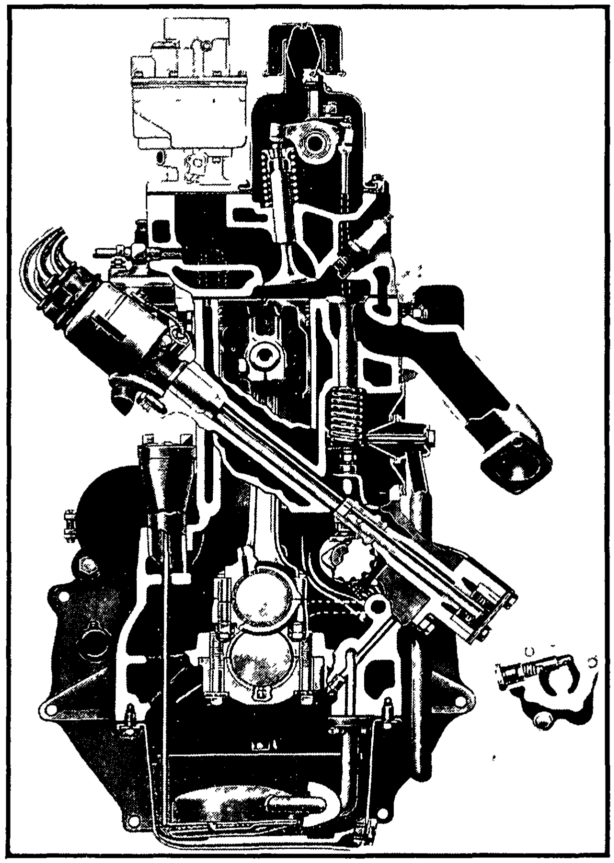


Fig. C F-Head four cylinder engine. 1950-52

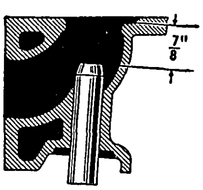


Fig. 3 P siti n f valve stem guides in six cylind r L-Head engine. 1948-52

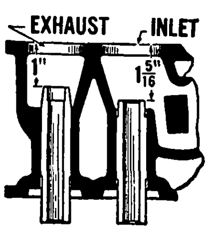


Fig. 4 P siti n of valve stem guides in f ur cylinder L-head engine. 1935-50

which are closed and remove the valve locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so they can be identified as to the valve port from which they were removed.

1950-52 F-Head Engines—Follow the same procedure in removing the exhaust valves from these engines as outlined for L-head engines.

In removing the intake valves from the head a suitable fixture is available which holds the valves closed and compresses the spring at the same time.

VALVE SPRINGS

1935-52 All Models—After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check valve spring pressure on a spring testing fixture if one is available. If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced. Likewise, any spring that stands shorter than the new spring used for comparison should be discarded.

VALVE GUIDES

1935-52 All Models—After the valves and springs have been removed, clean the valve guides with a wire brush, and clean the valves with a wire wheel brush, making sure that all carton is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the clearance between the valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between the valve stem and guide will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the valve guide. If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed.

If it is necessary to replace the valve guides, the old guides can be driven out with a special driver which is available for the purpose. However, in lieu of the driver, the guides can be pulled out by using a suitable piece of pipe together with a long bolt and suitable washers.

When replacing the guides, maximum engine performance can only be secured when the guides are installed as shown in Figs. 3 and 4. In replacing guides in F-head engines, see Fig. C and install the guides accordingly.

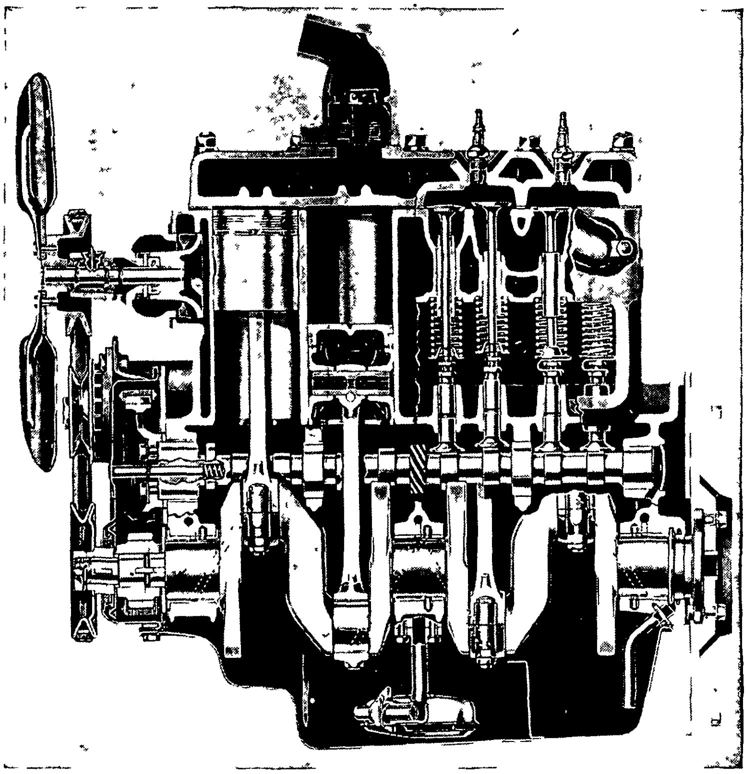
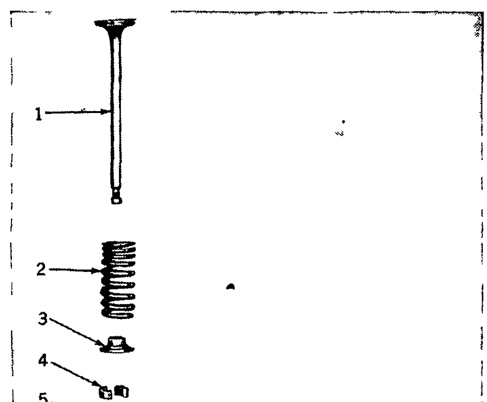
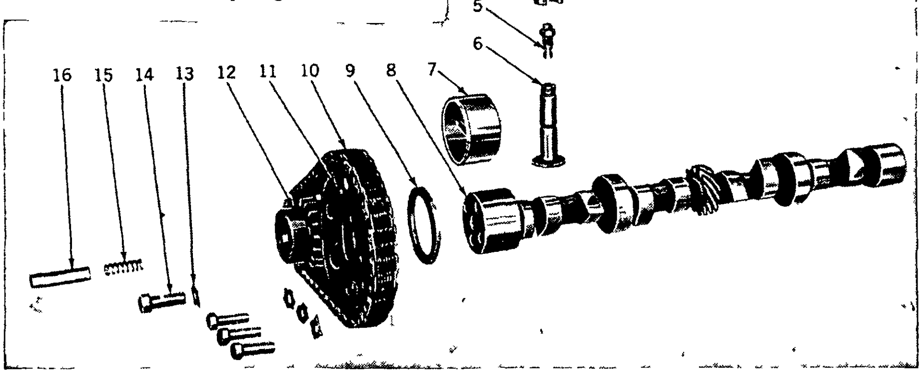


Fig. D Side sectional view of 1939-42 engine. The 1946-49 4-cyl. engine has timing gears and a new rotor type oil pump, otherwise it is quite similar to 1939-42

Fig. 5 VALVE SYSTEM, 1935-42

1 — Valv
2 — Valve spring
3 — Valve spring retainer
4 — Valv spring retainer lock
5 — Valv adjusting screw
6 — Valve lifter
7 — Fr nt camshaft bearing
8 — Camshaft
9 — Camshaft thrust washer
10 — Timing chain
11 — Camshaft sprocket
12 — Crankshaft sprocket
13 — L ck washer
14 — Camshaft sprocket screw
15 — Camshaft thrust plunger spring
16 — Camshaft thrust plunger





VALVES, REFACE

1935-52 All Models—In refacing valves, take off the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

Inspect the valve seats in the block and head for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

The valve seat width after refacing should measure not more than $\frac{1}{16}$ in. The width may be checked by placing a scale across the face of the seat.

A simple check can be made to prove the fit of the valve in the valve seat by spreading a thin film of Prussian Blue on the valve face and then inserting the valve into the valve seat. With hand pressure, rotate the valve ¼ turn and then remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indicate an inaccurate valve and valve seat refacing operation.

VALVE LIFTERS

1935-52 All Models—These lifters are of the mushroom type operating in guide holes cast in the block. This means that the camshaft will have to be removed from the engine if valve lifters require replacement.

Whenever the camshaft is removed, inspect the faces of the lifters where they contact the cams and replace any that are scored, rough or cracked. Check the clearance of the lifters in the guides, replacing those that have worn excessively. Oversize available is .004 in. and the guides must be reamed to accommodate them.

CAMSHAFT & BEARINGS

1935-52 All Models—The camshaft is mounted on four bearings but only the front bearing is replaceable, the others being machined directly in the block, Figs. 5 and 6. The front bearing is a steel-backed babbitt liner, and when necessary to replace it, be sure to stake it in place to prevent rotation and endwise movement.

CAMSHAFT, REMOVE

1935-52 All Models — After draining the cooling system, proceed as follows:

1. Remove radiator, cylinder head, manifolds, valves and valve springs.

2. Remove fuel and oil pump assemblies.

3. Remove fan belt, oil pan, vibration damper, crankshaft pulley and fan.

4. Remove front engine cover, camshaft gear (or sprocket) and camshaft thrust plate or washer, Figs. 5 and 6. Tie the valve lifters up at their highest point of travel with string wrapped

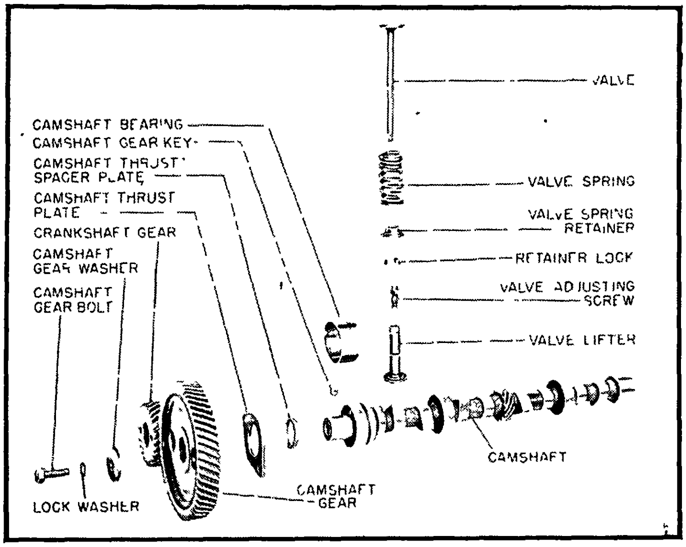


Fig. 6 Lay ut f valve system. 1946-50 four cylinder L-head engine. This is typical of the F-head engine except that the intake valve m chanism is contained in the cylinder head

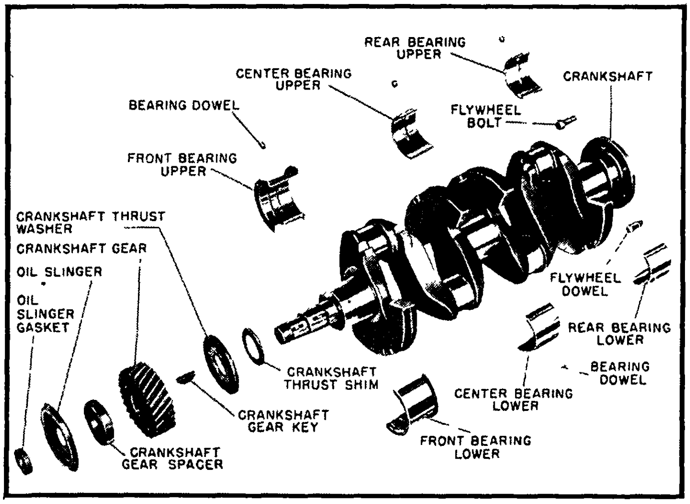


Fig. 8 Layout of crankshaft and related parts. 1946-52 four cylinder engine

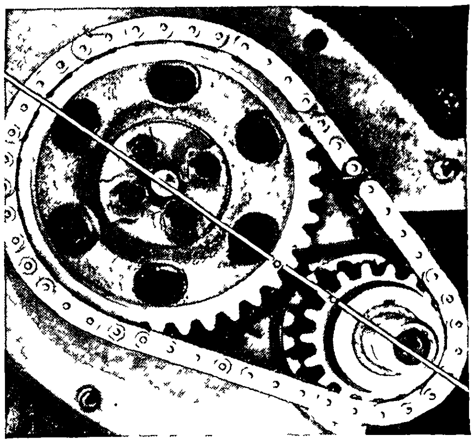


Fig. 7 Sprocket p siti n for valve timing, 1935-42

around the adjusting screws and attach to manifold studs.

6. Withdraw camshaft from engine, and, if necessary, take lifters out from below.

7. Inspect shaft for scores and roughness of cam and bearing surfaces.

8. Inspect valve lifter faces where they contact the cams and replace any that are scored, rough or cracked.

9. Install valve lifters and camshaft in reverse order of removal, being sure the cover oil seal is in good condition.

10. When installing the oil pump, refer to the section covering the *Oil Pump* because the pump gear must be properly meshed with the driving gear on the camshaft to correctly couple with the distributor shaft to maintain ignition timing.

TIMING CHAIN

1935-42 Models — When replacing the chain, turn the crankshaft to bring No. 1 piston on top dead center. Place the camshaft sprocket on the camshaft so that the punchmark on the rim of the sprocket faces a similar mark on the crankshaft sprocket, Fig. 7. Then remove crankshaft sprocket, changing the position of the camshaft sprocket within the chain until the capscrew holes in the sprocket are in line with the corresponding holes in the camshaft hub.

TIMING GEARS

1946-52 Models—The camshaft is driven by a steel gear on the crankshaft and a fibre gear on the camshaft. Lubrication is positive through a jet pressed into the crankcase directly back of the contact point of the gears. When the gears are removed, check both the jet and oil passage to make sure they are clear.

When it becomes necessary to replace the timing gears, due attention must be given to the end play of both shafts and running clearance of the gears.

End play of the crankshaft is controlled by the running clearance between the crankshaft gear and gear thrust plate, Fig. 8. The end play is adjusted by shims placed between the thrust plate and the end of the front main bearing. Shims .002 in. thick are available for this adjustment. When the thrust plate or washer is removed, be sure it is reinstalled with the beveled inner edge toward the crankcase.

End play of the camshaft is determined by the running clearance between the camshaft gear and thrust plate. The standard clearance is .003 to .0055 in. which is determined by the thickness of the camshaft gear thrust plate spacer, Fig. 6. Should a check indicate not enough clearance, place a thin shim between the thrust plate spacer and the shoulder on the camshaft. Clearance may be reduced by dressing off the spacer slightly. Whenever the spacer is installed, make sure that the beveled inner edge is toward the rear.

End play of both the camshaft and crankshaft can best be measured with a dial indicator.

Standard running clearance between the gears is .000 to .002 in., which should be checked with a dial indicator.

To set the valve timing, install the crankshaft gear followed by the camshaft gear with the camshaft positioned to allow installation with the timing gear marks meshed.

PISTONS & RODS, REMOVE

1935-52 All Models—After removing the cylinder head and oil pan, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove the connecting rod caps and push pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so they can be reinstalled in original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

1935-52 All Models—As shown in Fig. 9, pistons should be assembled to the connecting rods so that the oil spray hole in the rod faces away from the camshaft side of the engine with the vertical slot in the piston facing the camshaft side.

Unlike the four-cylinder rods which are offset, six-cylinder rods are not and, therefore, they are interchangeable.

PISTONS

1935-52 All Models—Standard size service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages. Service pistons are also furnished in .005, .010, .015, .020 and .030 in. oversizes.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin. Then select the smallest piston for the first fitting.

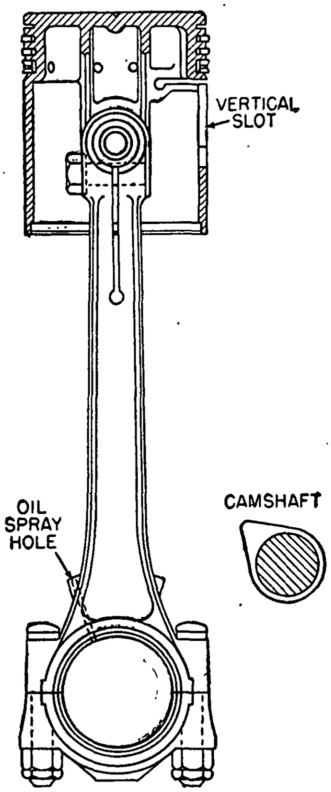


Fig. 9 Ass mble pistons and rods as shown. 1935-52

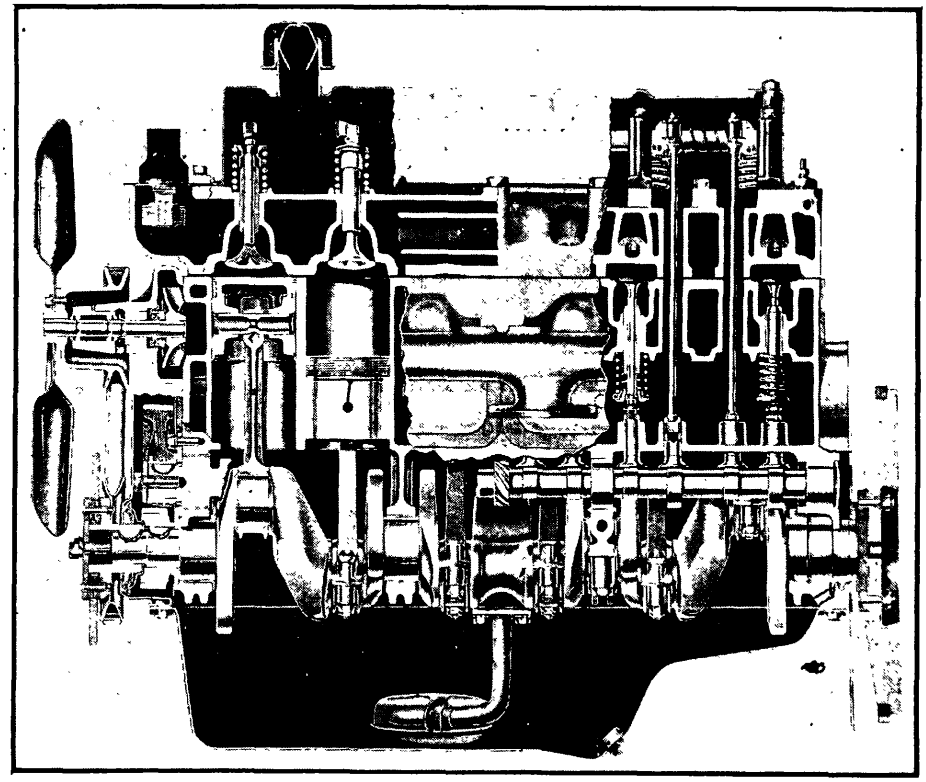


Fig. F 1952 Six-cylinder F-Head engine

The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is very important that refinished cylinder bores are trued up to have not more than .0005 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fibre brush.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore. Therefore the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees between the temperature of parts is sufficient to produce a variation of .0005 in.

To check the fit of pistons, use a feeler ribbon gauge ¾ in. wide and the thickness listed in the *Piston & Ring Data* chart. Insert the piston upside down in the cylinder bore with rings removed. Locate the feeler 90 degrees from the piston pin hole, between the thrust face of the piston and cylinder wall. Hook

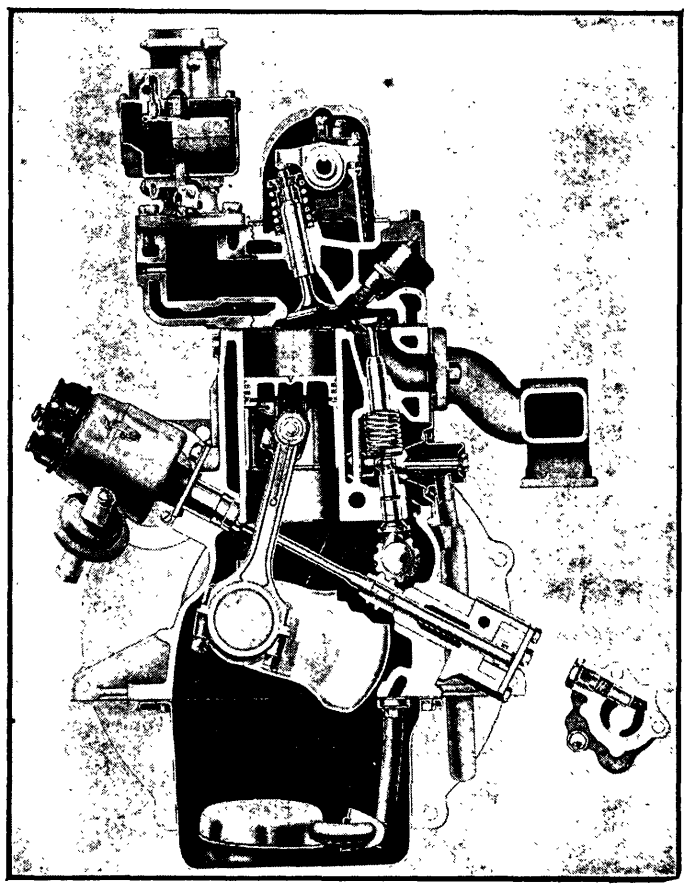


Fig. G 1952 Six-cylinder F-H ad ngin

the feeler to a spring scale. If the force required to pull the feeler out of the cylinder with the scale is as specified in the chart, the piston fit is correct. If too tight, the cylinder must be honed out until the proper clearance is obtained.

PISTON RINGS

1935-52 All Models — When new piston rings are to be installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter. This is done with a "Glazebuster" or with a hone equipped with the finest grade of stones.

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston & Ring Data* chart for ring groove clearances and end gap clearances.

To check the end gap of rings, place the ring in the cylinder in which it will be used. Square it in the bore by tapping with either end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends with a smooth file.

PISTON PINS

1935-52 All Models—On 1935-38 models the pins are of the full-floating type, being retained by snap rings which fit in grooves cut into the piston bosses.

On 1939-52 models, the pins are locked in the rods and are fitted with a clearance of .0001 to .0005 in. which is equivalent to a light thumb push fit with the parts at normal room temperature. No oversize pin is available as it is impossible to ream the connecting rod satisfactorily due to the clamp slot, and also because the piston plating should not be removed from the piston pin bore.

CONNECTING ROD BEARINGS

1935-52 All Models—Connecting rods on all models prior to Engine No. 88769 in 1942 are of the direct babbitted type. After this production engine number in 1942 and all later engines, replaceable shell type bearings are used.

When direct babbitted rod bearings are worn to the extent that they require replacement, new or rebuilt rods should be installed.

Insert type bearings consist of two half shells, the upper shell having an oil spray hole which communicates with the oil hole in the rod.

When the shells are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the shells must never be filed flush with the parting faces of the rod and cap.*

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the rod or cap be filed to adjust bearing clearance.

Service bearings are furnished in standard sizes and several undersizes, including undersizes for reground crankshafts.

The clearances of connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber and full instructions for its use are furnished with the envelope in which it is contained.

Lacking Plastigage, however, clearance may be checked with a .002 in. test shim, ¾ in. square. Place the shim between the bearing and shaft journal. Install the cap, tightening the nuts to the recommended torque. A locked bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed. Do not overlook removing the shim.

The connecting rod nuts are locked with stamped nuts which should not be used when once removed. Install the new nuts with the flat face toward the connecting rod nut. Turn the locking nut finger tight and then tighten it only a half-turn more.

CRANKSHAFT & MAIN BEARINGS

1935-52 All Models—When necessary to remove the crankshaft the engine will have to be removed from the chassis. And since the main bearings on all four-cylinder engines are held in place by dowels, the engine will have to be removed when their replacement becomes necessary.

Main bearings on six-cylinder engines may be removed and installed without removing the engine.

The bearings are made to size and do not require line reaming or adjustment.

When it is necessary to install new bearing shells it is advisable to measure the shaft journals with a micrometer for being out-of-round. If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft. Undersize bearings of .010 and .020 in. are available.

Before installing the shaft and bearings, use a rifle brush to clean the oil passages thoroughly in both the shaft and crankcase. If possible, blow out the holes with compressed air. Be sure the journals are not nicked or scored and that all parts are thoroughly clean.

After installing the bearings, check the running clearance to be sure it is standard (see *Engine Bearing Data* chart). Use Plastigage or a .002 in. test shim about one inch square. Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque. The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct. Do not overlook removing the test shim.

CRANKSHAFT END PLAY

1935-52 All Models—End play of the crankshaft is adjusted by shims placed between the crankshaft thrust washer and the face of the front main bearing. The end play is adjusted as outlined under *Timing Gears.*

REAR BEARING OIL SEAL

1935-38 Models—Oil sealing at the rear main bearing is controlled by a slinger integral with the crankshaft and a thread cut in back of the slinger which carries excess oil through the return tube to the crankcase.

1939-52 Models—The rear main bearing is sealed against external leakage in the following manner:

1. An oil slinger machined on the crankshaft rotates in a groove formed in the crankcase and bearing cap just to the rear of the bearing.
2. Braided fabric seals are pressed into the grooves formed in the crankcase and bearing cap to the rear of the oil collecting groove.
3. Rubber packings are installed between the bearing cap and crankcase. These protrude about ¼ in. from the case. However, when the oil pan is installed, it will force the packings tightly into the holes and effectively seal any opening between the bearing cap and crankcase.

The braided fabric seal can be installed in the crankcase only when the crankshaft is removed. However, the seal can be replaced in the bearing cap whenever the cap is removed. Remove the old seal and place the new seal in the groove with both ends projecting above the parting surface of the cap. Force the seal into the groove by rubbing down with a hammer handle or smooth stick until the seal projects above the groove not more than 1/16 in. Cut the ends off flush with the surface of the cap, using a sharp knife or razor blade.

Operate the engine at slow speed when first started after a new braided seal is installed.

ENGINE OILING

OIL PAN

1935-52—The floating oil intake is attached to the crankcase with two cap screws. Whenever the oil pan is removed,the float, screen and tube should be cleaned thoroughly in a suitable cleaning fluid to remove any accumulation of dirt. If the screen has been crushed, it is better to replace it rather than attempt to make a repair.

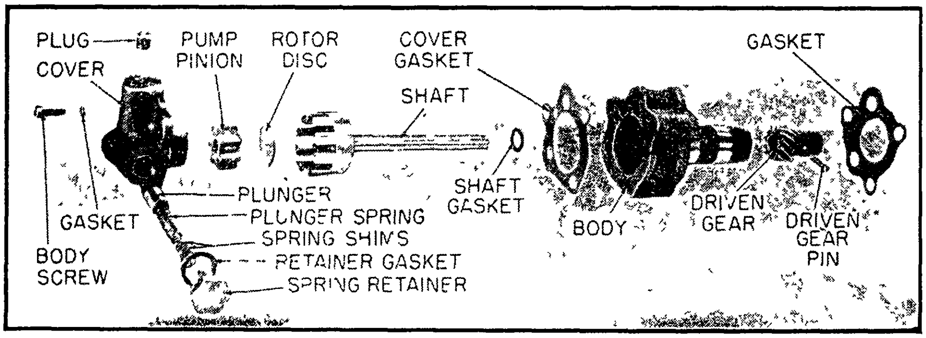


Fig. 10 Oil pump. 1935-42

NOTE—On 1952 passenger cars, due to interference of the steering tie rod with the oil pan when necessary to remove the latter, it can be overcome by removing the rear idler arm bracket attaching bolt and loosening the front bolt. Then swing the tie rod down and away from the pan, with the bracket pivoting on the loosened front bolt. In this manner, ample clearance is provided for oil pan removal.

OIL PUMP

1935-42—Fig. 10. To remove and disassemble the pump, first remove the distributor cap and rotate the engine until the rotor is in position to fire No. 1 cylinder. *Keep the engine in this position while the pump is off.* Unfasten the pump from the engine and lift it off.

Remove the screw from the pump cover and separate the cover from the housing. File off one end of the pin, drive the pin from the shaft and take off the drive gear. Take out the shaft and rotor. Remove the oil relief valve parts, being careful not to lose the pressure adjusting shims which are beneath the spring retainer. Replace worn parts and assemble the pump in the reverse order.

If the crankshaft has been moved from the No. 1 firing position while the pump was off, turn the engine over to this position and set the distributor rotor on No. 1 and install the pump, maintaining the same position for the rotor. Then reset the ignition timing.

1946-52 Models—The oil pump is located externally on the left side of the engine. When necessary to remove the pump, first take off the distributor cap and note the position of the rotor so that the pump may be reinstalled without disturbing the ignition timing.

To install the pump without disturbing the timing, the pump gear must be correctly meshed with the camshaft driving gear to allow engagement of the driving key on the distributor shaft in the pump shaft driving slot without moving the distributor rotor. Assembly can be made only in one position because the slot and driving key are machined off center.

To disassemble the pump, Fig. 11, remove the cover and gasket. Hold a hand over the cover opening and, with the pump upside down, turn the shaft until the outer rotor slips out. Drive out the pin securing the drive gear to the shaft. Press the shaft out of the gear and slide the shaft and inner rotor out of the body.

Failure of the pump to operate at full efficiency may usually be traced to excessive end play in the rotor or excessive clearance between the rotors. The clearance between the outer rotor and pump body should also be checked.

End play of the rotors is controlled by the thickness of the cover gasket which is made of special material which can only be slightly compressed. Never use other than a standard factory gasket.

In checking the pump for wear, follow the procedure outlined and illustrated in the Chrysler Chapter for the rotor type pump.

NOTE—Due to interference of the steering gear housing on 1952 passenger cars, the oil pump can easily be removed by first removing the attaching screws and pulling it from the crankcase as far as possible. Then place a screw-type hand jack between the inside of the lower control arm mounting bracket and the lower edge of the crankcase. Hold the pump to prevent it from falling to the floor as the jack is tightened slightly to move the engine ¼" to the right on its rubber mountings. When the engine is swung over, the pump will come out.

CRANKCASE VENTILATION

1946-52 Models — These engines are equipped with positive sealed type crankcase ventilation which reduces to a minimum condensation and the formation of sludge. The correct operation of the system depends upon the free flow of air from the carburetor air cleaner through the oil filler tube and engine to the control valve mounted in the intake manifold.

Be sure there is no air leakage at the tube connection, and that the oil filler tube cap gasket is in good condition. Always keep the cap locked securely.

Be sure that the ventilator valve, mounted in the intake manifold, operates at all time. Should the valve become clogged with carbon the ventilating system will not operate and a pressure will build up in the engine crankcase which may cause oil loss at the rear main bearing or by the piston rings.

Should the valve fail to seat it will be impossible to make the engine idle satisfactorily. When the valve operates correctly, a slight vacuum is present in the crankcase which is of material assistance in oil control.

Clean the ventilator valve each time the valves are ground or the engine tuned.

OIL PRESSURE REGULATOR

1935-52 All Models—The pressure of the oil pump is controlled by an oil relief valve built into the pump, Figs. 10 and 11. The pressure can be altered by installing or removing shims from between the retainer and spring. Adding shims increases pressure and removing shims decreases pressure. This adjustment will change the pressure only at higher speeds but not at idle speed.

The pressure at which the relief valve opens is approximately 30-35 lbs. at 30-40 mph. This gives an engine idle speed pressure of approximately 10 lbs.

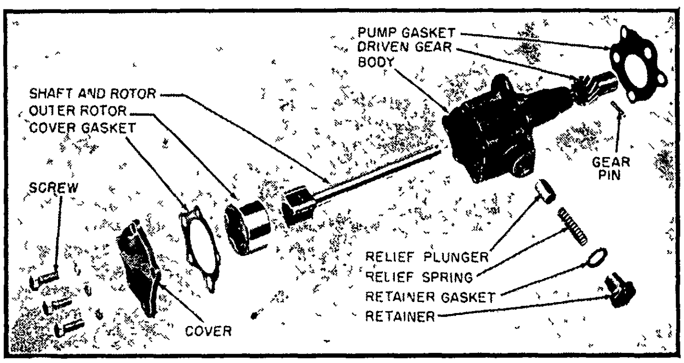


Fig. 11 Oil pump. 1946-52

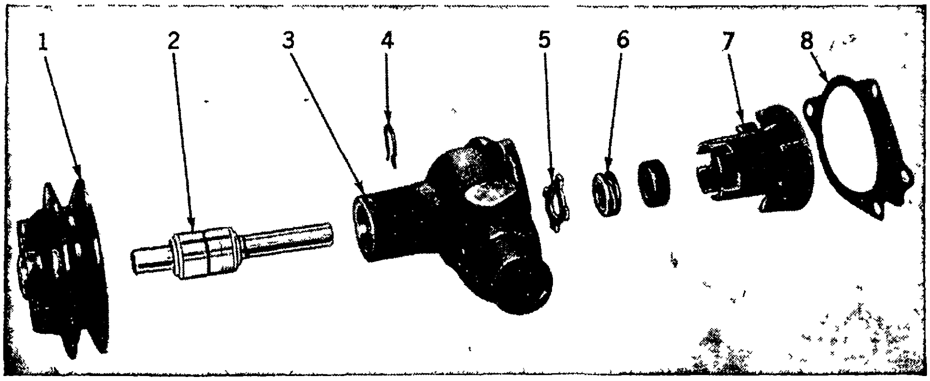


Fig. 13 WATER PUMP, 1939-50

1—Pulley 2—Shaft 3—Body 4—Bearing retainer
5—Seal washer 6—Seal spring 7—Impeller 8—Gasket

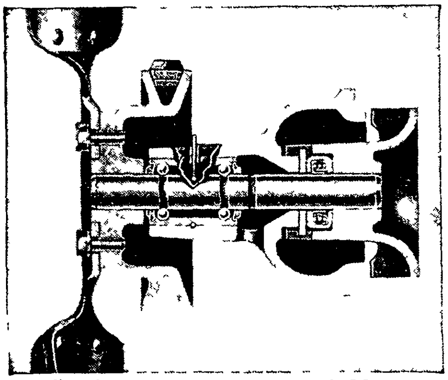


Fig. 14 Water pump, 1939-50

COOLING SYSTEM

RADIATOR CORE, REMOVE

1935-52—On 1935-36 models, take off the hood, fan blades and upper and lower hose. On all other models, raise the hood, disconnect the upper and lower hose, unfasten the core from its mounting and lift it off.

WATER PUMP, REMOVE

1935-52 — Remove the fan belt and blades, unfasten the pump from the cylinder block and lift it off. On some models, it may be necessary to loosen the radiator core and pull it forward in order to remove the water pump assembly.

WATER PUMP, OVERHAUL

1935-38—After removing the pump from the engine, use a puller to remove the fan pulley. Pull the shaft and impeller out rearward. Unscrew the packing nut and remove the packing. Press out the rear bushing and drive the front bearing out of the housing.

Assemble the pump in the reverse order, inserting the impeller shaft from the rear through the rear bushing, the packing, packing nut and front bearing. Press the hub on the shaft, being sure the key is in position and is a good fit in the keyway. Lubricate the front bearing with oil and fill the grease cup with water pump lubricant before putting the pump into operation.

1939-52—To disassemble the pump, Figs. 13 and 14, take out the bearing retaining wire and press the shaft through the impeller and pump body. Remove the seal washer and seal. Place the pump shaft and fan pulley on the press in such a position that the bearing will clear the opening and press the shaft from the pulley.

To reassemble the pump, install the long end of the shaft in the pump body from the front end until the outer end of the bearing is flush with the front end of the pump body.

Dip the seal and seal washer in brake fluid and install in the impeller. Place the impeller on the bed of the press and press the long end of the shaft into the impeller until the end of the shaft is flush with the impeller.

Support the assembly on the impeller end of the shaft and press the fan pulley on the shaft so that the end of the shaft is flush with the face of the fan pulley. Move the shaft in the body so that the grooves in the bearing and pump body line up, then lock in position with the bearing retaining wire.

ELECTRIC SYSTEM

IGNITION TIMING

1935-52—Crank the engine to bring No. 1 piston up on its compression stroke and, after removing No. 1 spark plug, continue cranking until the "IGN" mark, Fig. 15, on the flywheel appears in the center of the opening in the flywheel housing.

Rotate the distributor rotor so that it is ready to fire No. 1 cylinder—with the points just breaking. Mount the distributor on the engine and, when the end of the shaft enters the driving collar on the oil pump drive gear, rotate the distributor shaft—by means of the rotor—back and forth until the driving lug on the end of the distributor shaft enters the slot in the coupling, then push the distributor down, after which install the hold-down screw. Connect

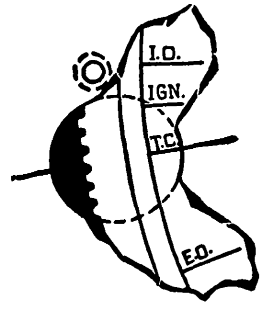


Fig. 15 Flywheel timing marks, 1935-52

the primary wire from the coil to the distributor and rotate the distributor body until the points are just breaking, after which lock in place with the clamp screw.

NOTE—For best results, check the timing with a Neon timing light or a conventional test lamp. Advance or retard the distributor to compensate for the grade of fuel being used. For best performance and fuel economy, the ignition setting should be one which will provide smooth engine performance with a slight "ping" on wide-open throttle at comparatively low car speed.

CLUTCH

CLUTCH PEDAL, ADJUST

1935-52 — The pedal free movement should be ¾" to 1". This adjustment is made by adjusting the length of the clutch control cable (see Figs. 16 and 17).

CLUTCH REMOVAL

1935-38—Remove the transmission and clutch housing. Loosen the cap screws holding the pressure plate to the flywheel, turning each screw out a little at a time around the circumference to relieve the spring tension evenly. Remove the screws and lift out the pressure plate assembly and the clutch disc. Use a bushing remover to pull the pilot bushing out of the flywheel. Assembly is done in the reverse order and the release levers are adjusted according to the instructions given in the *Clutch* chapter after the transmission and clutch housing are installed.

1939-52—Remove the transmission and clutch housing. Loosen the cap screws holding the clutch cover to the flywheel, turning each screw out a little at a time, relieving spring tension evenly. Remove the screws and lift out the clutch cover

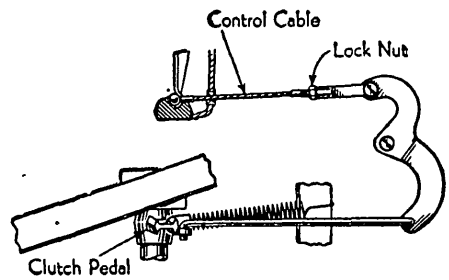


Fig. 16 Clutch pedal adjustment, 1936-42

and pressure plate. Use a bushing remover to pull the pilot bushing out of the flywheel.

Assemble in the reverse order.

TRANSMISSION

TRANSMISSION REMOVAL

1935-36 — Remove the front seat, cowl trim pads, floor boards and accelerator pedal. Disconnect the universal joints and remove the propeller shaft. Raise the engine high enough to remove the rubber mounting rings and the cap screws which attach the mounting bracket to the transmission. The upper nuts on the mounting bolts control the tension of the upper rebound rubber rings and should not be disturbed. Remove the bolts which attach the clutch housing to the engine and insert pilot studs in two upper holes. Pull the transmission back until the clutch shaft is free, then lift out the assembly.

1937-42—

1. Remove floor mat and floor boards.
2. Disconnect remote control shift rods at transmission. If equipped with cane type shift, unscrew retaining collar at bottom of lever and remove lever.
3. Disconnect clutch control cable at clevis end.
4. Disconnect radiator-to-body brace rod at radiator and loosen radiator hold-down bolts.
5. Disconnect propeller shaft and speedometer cable at transmission.
6. Remove *lower* nuts from mounting bolts at rear of transmission.
7. Protect rear end of oil pan with a board and raise engine until mounting bracket at rear of transmission can be removed. Raise transmission until it clears cross member.
8. Thread out four screws which attach transmission to bell housing as far as possible and retain transmission weight. Pull transmission back to bolt heads and reach through clutch inspection opening to disengage clutch release fork from release bearing carrier.
9. Pull transmission back until clutch shaft clears bell housing and remove assembly through floor opening.

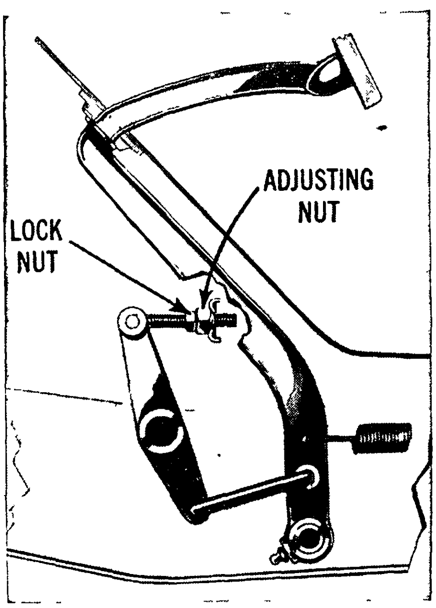


Fig. 17 Clutch pedal adjustm nt, 1946-51

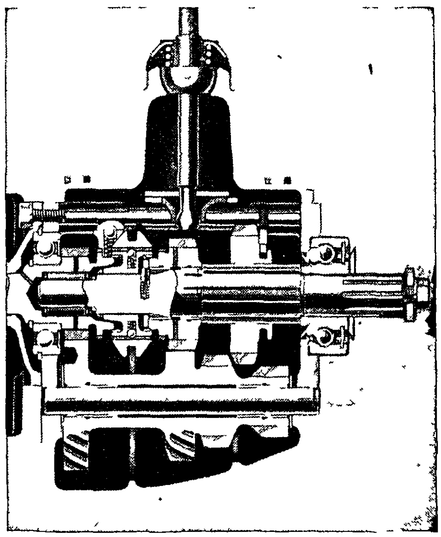


Fig. 18 Transmission, 1937-40 with cane type shift

1941-42 Transmission and Overdrive—

1. Cover door trim panels and seat cushions. Slide front seat to rear position or remove. Remove front floor mat. Disconnect battery.
2. Remove front floor boards in following sequence: right hand toe board, left hand toe board, center floor board.
3. Disconnect and remove propeller shaft and both universal joints.
4. Remove transmission remote control rods at transmission and disconnect overdrive control wire and conduit.
5. Remove wires from overdrive solenoid, *tagging both wires and terminals for correct reassembly.* Disconnect speedometer cable at transmission.
6. Remove clevis pin in clutch release cable yoke. Remove capscrews attaching transmission to mounting bracket on frame cross member. Unfasten mounting bracket from cross member.
7. Remove overdrive auxiliary support bracket from cross member, using care not to lose spacing washers which are between these parts.
8. Remove fan and loosen radiator stay rod.
9. Drive wooden wedges between front floor pan and frame "X" member to increase clearance between floor and transmission so transmission can be removed from vehicle.
10. Place a jack and block of wood under oil pan, raising engine to carry weight and remove transmission mounting bracket from frame cross member.
11. Thread out four screws which attach transmission to bell housing as far as possible and still hold transmission. Reach through clutch inspection opening in bell housing and disengage clutch release fork from release bearing carrier.
12. Place rope around transmission to support weight, complete removal of transmission attaching screws and work the transmission out of the vehicle as follows: One man should work transmission back until clutch shaft is clear of bell housing as the other man raises and lowers the jack under the engine. It will require some maneuvering of both the engine and transmission to clear bell housing. Remove transmission through floor opening in vehicle.

1946-51 Jeeps and Four-Wheel Drive Models—The following outline is specifically for Jeeps but it also applies to Model 4-WD except for small details which are obvious.

1. Remove front and rear propeller shafts. If vehicle is equipped with power take-off, disconnect transfer case end of power take-off drive shaft.
2. Disconnect speedometer cable at transfer case. Disconnect brake cable.
3. Place jacks under engine and transmission, protecting engine oil pan with a piece of wood.
4. Remove nuts holding rear mounting to frame cross member.
5. Remove transfer case snubbing rubber bolt nut at cross member.
6. Disconnect remote control rods at transmission. If equipped with cane type shift, remove shift lever.
7. Disconnect clutch release cable at bell crank at yoke end. Remove floor board inspection plate.
8. Remove transfer case shift lever pivot pin screw. Remove transfer case levers.
9. Remove frame center cross member.
10. Unfasten transmission from flywheel housing. Force transmission to right to disengage clutch control lever ball joint.
11. Lower jacks under engine and transmission. Slide transmission and transfer case assemblies toward rear of vehicle until clutch shaft clears bell housing.
12. Lower jack under transmission and remove transmission and transfer case from under vehicle.

1946-52 Two-Wheel Drive Models—The following outline covers removal of transmission and overdrive. If not so equipped, disregard operations pertaining to overdrive.

1. Disconnect remote control rods at transmission.
2. Disconnect two wires from overdrive solenoid. *Tag wires and terminals to assure correct assembly.*
3. Disconnect two wires at overdrive rail switch. *Tag wires and terminals to assure correct assembly.*
4. Disconnect front universal joint, and speedometer cable at transmission. Have available an ordinary cork of correct size to close cable opening to prevent leakage of lubricant.
5. Disconnect overdrive control cable and conduit.
6. Remove rubber mounted saddle support at rear end of overdrive. Use care not to lose spacers. Remove overdrive governor.
7. Place jack under flywheel bell

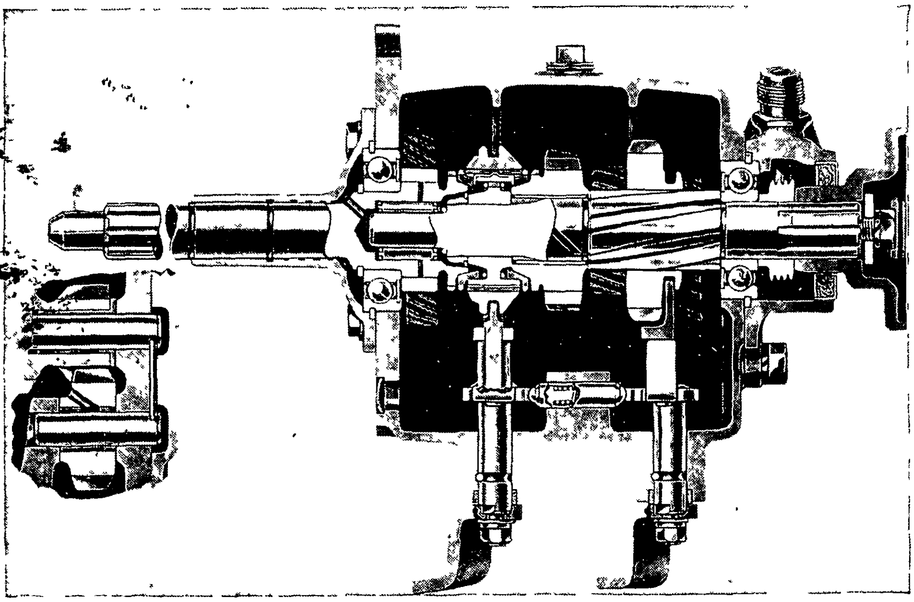


Fig. 19 Transmission, 1940-42

housing and raise it to support weight of housing.

8. Remove frame cross member with rubber insulators attached.

9. Place jack under engine to support engine when transmission is removed.

10. Thread out four screws attaching transmission to bell housing as far as possible and yet support weight of transmission. Pull transmission back to bolt heads which will provide approximately ¾" opening between the two housings and at the same time relieve pressure on clutch release fork in bell housing.

11. Use a long screwdriver through opening in side of bell housing to pry clutch release fork from engagement with clutch release bearing carrier.

12. Complete removal of four transmission attaching screws and pull transmission back until clutch shaft clears bell housing and remove the assembly with release bearing carrier attached.

TRANSMISSION, OVERHAUL

1935-36—Remove cover assembly. Remove the main drive gear bearing and oil seal. Drive main drive gear assembly forward. Pull universal flange and remove speedometer driven gear. Remove rear bearing retainer by turning it out of the slot at end of countershaft. Drive mainshaft and rear bearing rearward until free of case. Hold the sliding gears while drawing the mainshaft rearward. Drive countershaft out rearward and lift out cluster.

Reverse procedure to assemble.

1937-40 Models With Cane Type Shift—

1. Drain lubricant from housing and wash with a suitable solvent, Fig. 18.

2. Place gears in neutral and remove gearshift housing. Remove shifter plate, using care not to lose spring washer.

3. Remove front bearing retainer, universal joint companion flange, rear bearing retainer and speedometer gear.

4. Remove set screws from shifter forks and push out shift rails, using care not to lose balls and springs from rail interlock.

5. Push out shift fork guide rail and remove shift forks.

6. Remove countershaft lock plate.

7. Use a brass drift to drive countershaft out through rear of case, allowing cluster gear to drop to bottom of case.

8. Remove main drive gear with bearing through front of case. (This gear cannot be removed without damage when countershaft is in position.)

9. Tap mainshaft to rear until rear bearing clears case. Remove mainshaft bearing.

10. Remove synchronizer and low gear from mainshaft and lift mainshaft and second speed gear through top.

11. Lift out cluster gear.

12. Drive reverse idler shaft out toward rear and lift out gear.

13. Examine all parts and secure those that require replacement; then assemble transmission in the reverse order of disassembly.

1940-42 With Remote Control Shift and Without Overdrive — Service on this transmission is the same as the unit described above except that the synchronizer and shifting forks are operated by remote control from the steering post, Fig. 19.

Note that it is necessary to drop the countershaft gears before the main drive gear can be taken out.

To remove the shifting fork and shoe, remove the mainshaft rear bearing retainer and slide the mainshaft to the rear until the rear bearing is clear of the case and the pilot is removed from the main drive gear. The mainshaft may then be shifted to the side of the case sufficiently for removal of the fork and shoe.

It is also necessary to remove the synchronizer before the mainshaft can be taken out.

To assemble the synchronizer, first install the two springs in the clutch hub; these springs must be installed with the spring tension opposed. Place the right lipped end of a spring in a slot of the hub and place the spring in the hub. Turn the hub around and make exactly the same installation with the other spring, starting with the same slot. Install the three synchronizer shifting plates in the three slots in the hub with the smooth side of the plates out. Hold the plates in position and slip the clutch sleeve over the hub. Install the two blocking rings, one on each side of the hub.

If ever it becomes necessary to remove the shift lever shafts from the case, remove the taper retaining pins from the bottom to remove the levers and slide the shafts out. Check the oil seals and when reassembling, be sure the shifting lever poppet assembly is correctly installed.

1941-42 Transmission and Overdrive—The transmission proper is the same as the standard unit without overdrive except the mainshaft which is longer and extends into the overdrive case. Overhaul routine as outlined above for 1940-42 applies to the transmission section of the unit. Service on the overdrive unit is given in detail in the *Overdrive* chapter.

1946-52 Transmission and Overdrive—The transmission proper is the same as the standard unit without overdrive except that the mainshaft is longer and extends into the overdrive case. Service on the overdrive unit is given in detail in the *Overdrive* chapter. Overhaul routine on the transmission as outlined previously for 1940-42 applies to the transmission section of this unit except for the differences given below.

The transmission mainshaft pilot bearing is not contained in a case. Thirteen needle type rollers are used and care must be exercised when disassembling to see that they are not lost. When installing the mainshaft assembly, place some heavy grease in the mainshaft pilot and position the rollers, using the grease to hold them in position until assembly is completed.

The countershaft is mounted on two rows of needle bearings which are aligned with spacers. To install the countershaft, a suitable installing arbor should be used to hold the needle bearings and thrust washers in position. Place the tool through the countershaft gearset and insert the long spacer, positioning it at the center of the gearset. Place a set of 20 rollers at each end of the spacer, followed by a spacer washer at each end. The tool is shoved through the case when the countershaft is installed.

The interlock sleeve and poppet assembly must be carefully fitted. Should this assembly be too long, it will be impossible to shift gears; if too short, it will fail to function as an interlock to prevent shifting into two gears at one time. Use a feeler gauge to check the clearance which must be from .001" to .007". Make this measurement between the end of the interlock sleeve and shift lever land when one lever is in neutral and

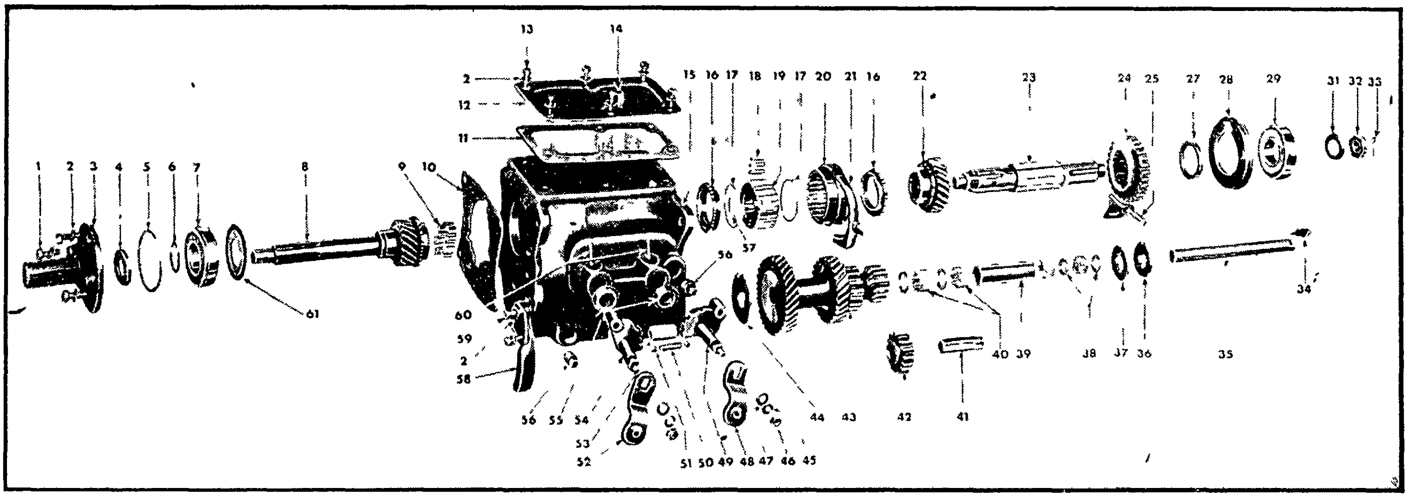


Fig. 20 TRANSMISSION WITH REMOTE CONTROL GEARSHIFT USED ON STATION WAGONS WITH FOUR-WHEEL DRIVE

1 — Bearing retainer bolt
2 — Gasket
3 — Bearing retainer
4 — Retainer oil seal
5 — Bearing snap ring
6 — Snap ring
7 — Bearing
8 — Main drive gear
9 — Pilot roller bearing
10 — Gasket
11 — Cover gasket
12 — Cover
13 — Cover bolt
14 — Breather
15 — Case
16 — Blocking ring
17 — Synchronizer spring
18 — Shifting plate
19 — Clutch hub
20 — Clutch sleeve
21 — Shifting fork
22 — Second speed gear
23 — Mainshaft
24 — Low and reverse gear
25 — Low and reverse shoe
27 — Bearing spacer
28 — Bearing adapter
29 — Rear bearing
31 — Washer
32 — Nut
33 — Cotter pin
34 — Countershaft lock plate
35 — Countershaft
36 — Thrust washer
37 — Bronze thrust washer
38 — Bearing spacer
39 — Bearing spacer (long)
40 — Countershaft bearing rollers
41 — Reverse gear shaft
42 — Reverse idler gear
43 — Countershaft gearset
44 — Thrust washer
45 — Lockwasher
46 — Nut
47 — Control lever washer
48 — Outer lever (low and reverse)
49 — Shift lever (low and reverse)
50 — Poppet spring
51 — Poppet ball
52 — Outer lever (second and high)
53 — Interlock sleeve
54 — Shift lever (second and high)
55 — Shift lever oil seal
56 — Plug
57 — Clutch hub snap ring
58 — Oil collector
59 — Oil collector screw
60 — Shift shaft pin
61 — Oil retaining washer

the other is shifted into gear. To obtain correct clearance, four interlock sleeves are available for selective fits. The length of the sleeves available are 1.299", 1.295", 1.291", 1.287" and 1.303".

1949-51 Station Wagon with Four Wheel Drive—Fig. 20 shows an exploded view of the transmission used on these models. Except for slight details the same unit is used on 1946-51 Two Wheel Drive vehicles described above. To disassemble it, proceed as follows:

1. Drain lubricant from case and clean case with a suitable solvent.

2. If transfer case is attached, remove its rear cover.

3. If equipped with a power take-off, remove the shift unit which replaces the cover.

4. Remove transfer case main drive gear.

5. Remove transmission cover.

6. Loop a piece of wire around mainshaft directly back of mainshaft second speed gear. Twist wire and attach one end to right hand front cover screw and other end to left front screw. Draw wire tightly to prevent mainshaft from pulling out of transmission case when transfer case is removed. Should mainshaft come out, synchronizer parts will drop into bottom of case.

7. Support transfer case and, with a rawhide mallet or brass drift and hammer, tap lightly on end of transmission mainshaft to separate the two units. The transmission mainshaft bearing should slide out of transfer case and remain in transmission.

8. Remove drive gear bearing retainer.

9. Remove lock plate and drive countershaft out through rear.

10. Remove mainshaft rear bearing adapter.

11. Move mainshaft away from shifter fork and shoe and take out fork and shoe.

12. Remove mainshaft and gear assembly through transfer case opening.

13. Remove countershaft gearset and thrust washers, noting position of washers.

14. Drive reverse idler shaft out rearward and lift out gear.

ASSEMBLY—Reverse the order of the above procedure to assemble the transmission, being sure to observe the following precautions:

Be sure the interlock sleeve is of the correct length. (For method of checking clearance, refer to instructions given for 1946-51 Standard units.)

The countershaft gearset should have from .012" to .018" end play when assembled in the case. This clearance is obtained by selective thickness of the rear steel thrust washer, which is available in two thicknesses. Assemble the larger bronze washer at the front of the case with the lip entered in the slot in the case. The bronze faced steel washer goes next to the gear at the rear end, and the steel washer next to the case. Use a loading sleeve to assemble the countershaft roller bearings.

GEARSHIFT

GEARSHIFT, ADJUST

1940-51—To make an adjustment, Fig. 21, shift the hand control lever to its neutral position. Align the pin holes in the levers at the bottom of the main shifting rod to hold them in their neutral positions. Disconnect the control rods from the levers at the transmission and place the transmission levers in neutral. Finally, adjust the length of the control rods so that they will just slip into their respective levers on the

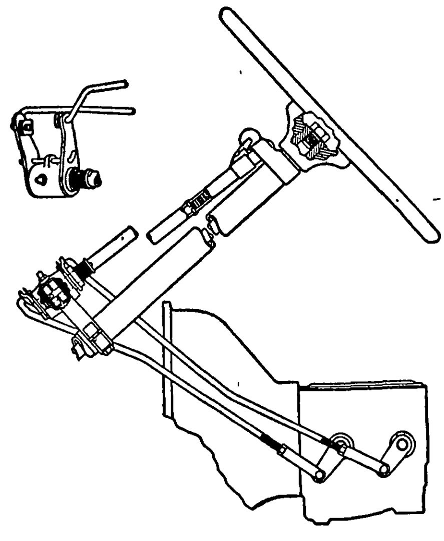


Fig. 21 G arshift, 1940-51. N te aligning pin in position for making adjustment (upper left)

transmission without moving the levers from their neutral positions.

TRANSFER CASE

1949-51 Station Wagon

NOTE—In removing the transfer case, follow the procedure outlined under transmission removal. Then see Fig 22 and dismantle the case as follows:

1. Remove propeller shaft flange, brake assembly and linkage.
2. Remove lower cover.
3. Remove lock plate.
4. Drive intermediate shaft to rear of case, being careful not to lose thrust washers.
5. Remove intermediate gear, thrust washers and roller bearings through bottom of case.
6. Shift front wheel drive to engaged position (shaft forward) and remove poppet plugs, springs and balls on both sides of output bearing cap.
7. Remove output bearing cap together with the universal joint end yoke, clutch shaft, bearing, clutch gear, fork and shift rod. Use care not to lose the interlock.
8. Remove output shaft snap ring and thrust washer.
9. Use a rawhide mallet to drive against the front end of the mainshaft to start the rear bearing from the case. As the shaft is removed, the gears will remain in the case and can be taken out through the bottom, also the snap ring and thrust washer.
10. Remove set screw in sliding gear shift fork and take out the shift rod.
11. Disassemble the front and rear bearing caps as required.

ASSEMBLY — Reverse the order of the above procedure to assemble the transfer case. But when rear bearing cap assembly is installed, check the end movement of the mainshaft which determines the adjustment of the tapered roller bearings. For correct bearing adjustment, the shaft should have from .004" to .008" end play. Adjustment is made by selective shim installation between the cap and case. Shims .003", .010" and .031" thicknesses are available for this adjustment. Do not install the rear cap oil seal until the bearings are properly adjusted.

REAR AXLE

REAR AXLE ASSEMBLY, REMOVE

1935-52—To remove the rear axle, raise the rear of the car and support the frame with blocks just ahead of the rear springs. Remove the wheels and disconnect the propeller shaft. Disconnect the brake rods and, on cars with hydraulic brakes, disconnect the brake line from the hose at the frame and remove the lock clip. Remove the spring clips and the spring front bolts, after which slide the assembly from under the chassis.

REAR AXLE SERVICE

1937-52—Fig. 23 shows the axle employed on 1937-42 models, while Figs. 24 and 25 are views of the 1946-52 type. The basic design of both units is alike except that in Fig. 23 the differential bearings are adjusted by spacers, whereas in Fig. 24 shims are used. The procedure for making this adjustment, as well as the assembly of the differential case, replacing the ring, gear, checking ring gear and pinion backlash, and other differential case operations, is given in the *Rear Axle Chapter*.

The axle tubes are pressed into the differential carrier to form a one-piece housing. To overhaul the unit, therefore, the rear axle assembly must be removed from the chassis.

PINION & BEARINGS, REPLACE — After removing the axle shafts and differential unit, unscrew the pinion flange retaining nut and pull off the flange. The pinion may then be removed from the carrier by driving it out of the front bearing with a brass drift and hammer. After the pinion is free of the front bearing, pull it out through the rear of the carrier.

Mount the pinion in a press and press the rear bearing cone from the shaft. When replacing the cone, select a suitable sleeve or length of pipe of the same diameter as the cone so the rollers or cage will not be damaged when being pressed on the shaft.

Drive out the front bearing cup and oil seal. If the rear bearing cup is to be replaced or if the pinion setting is to be changed, remove the rear cup.

To change the pinion setting, the shims behind the rear bearing cup should be measured with a micrometer. The necessary shims may then be removed or added to obtain the proper pinion setting as indicated when a pinion setting gauge is used. After the required shims have been added or subtracted, the rear bearing cup may be replaced.

When making a pinion adjustment the same thickness of pinion bearing adjusting shims should be added or removed at the rear bearing cup to retain the proper pinion bearing adjustment.

To install the pinion, support it under the head with a wood block while the pinion flange is being installed. The pinion oil seal should not be replaced until after the pinion setting has been checked.

PINION BEARINGS, ADJUST — The only occasion for adjusting the drive pinion bearings is when a new pinion or differential carrier is installed. To make the adjustment, install sufficient shims between the bearing spacer and the front bearing so that when the pinion retaining nut is tightened against the pinion flange, all rollers in the bearings are tight, but still permit rotating the pinion by hand.

PINION, ADJUST—After adjusting the pinion bearings, the position of the pinion should be checked. If a pinion setting gauge is available, check the pinion depth as outlined in the *Rear Axle Chapter*. If a correction is necessary, disassemble the pinion and, if the pinion is to be moved toward the center of the

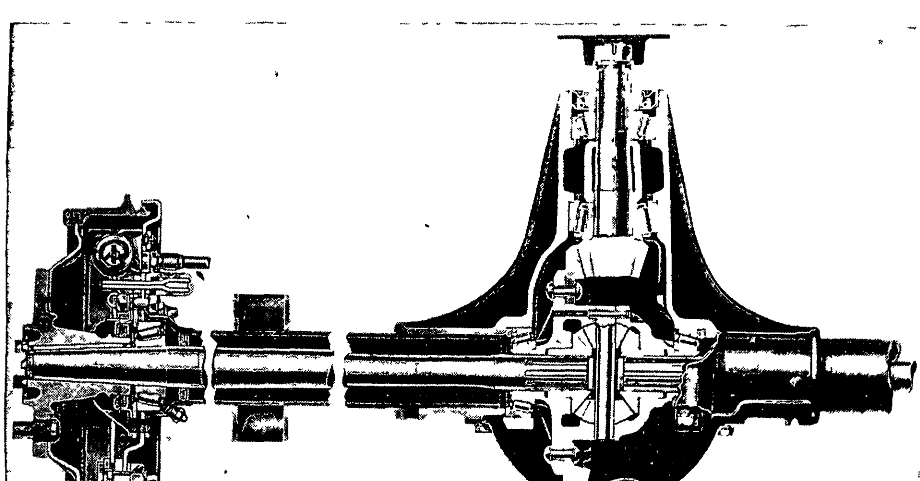
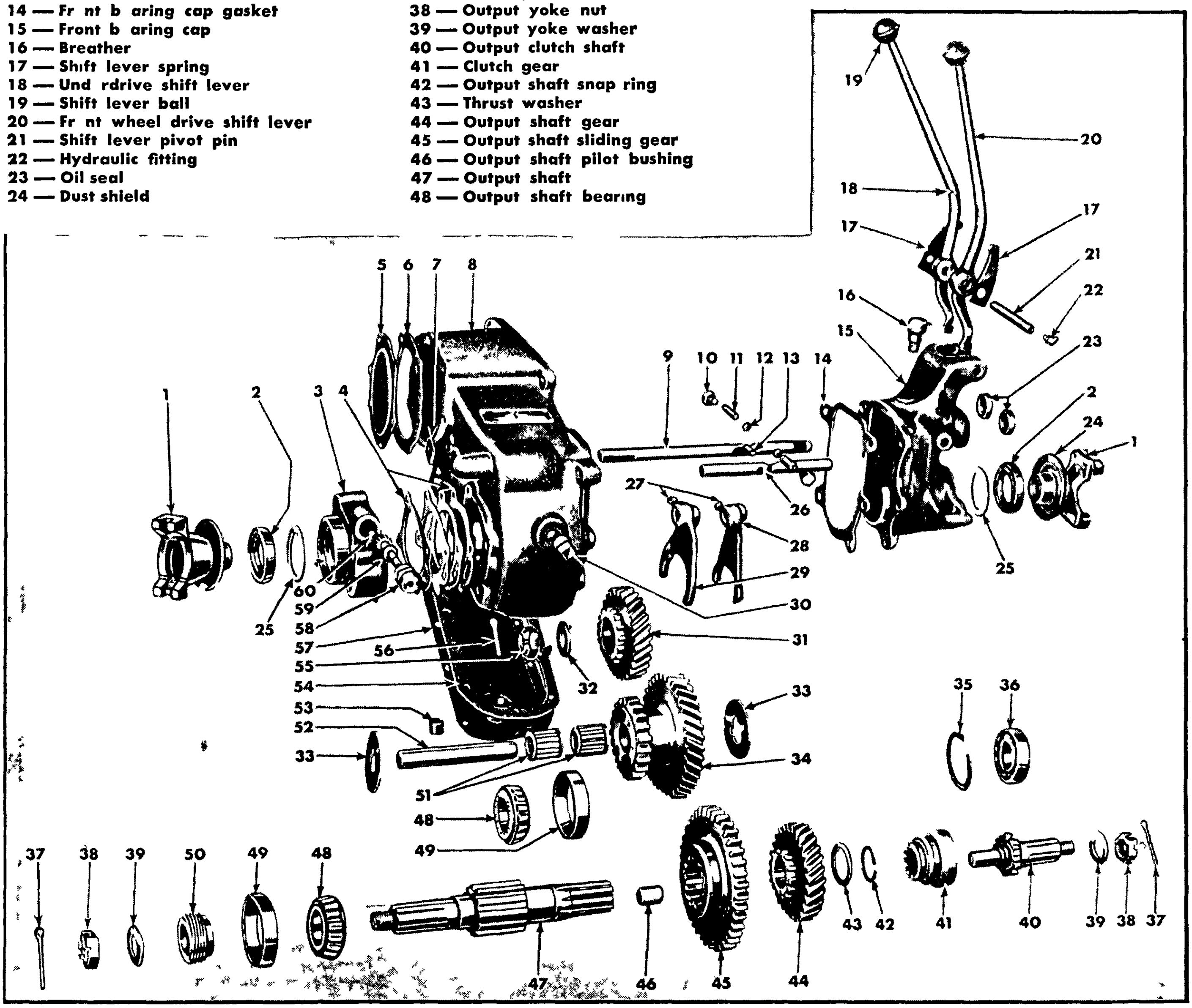


Fig. 23 Rear axl , 1937-42

Fig. 22 TRANSFER CASE, STATION WAGONS WITH FOUR-WHEEL DRIVE

1 — Output shaft y ke end
2 — Output shaft il seal
3 — Rear bearing cap
4 — R ar b aring adjusting shims
5 — Rear c ver
6 — Rear c ver gasket
7 — L ck plate
8 — Transf r case housing
9 — Und rdrive and direct shift rod
10 — P ppet plug
11 — Poppet spring
12 — P pp t ball
13 — Shift r d interlock
14 — Fr nt b aring cap gasket
15 — Front b aring cap
16 — Breather
17 — Shift lever spring
18 — Und rdrive shift lever
19 — Shift lever ball
20 — Fr nt wheel drive shift lever
21 — Shift lever pivot pin
22 — Hydraulic fitting
23 — Oil seal
24 — Dust shield
25 — Oil seal gasket
26 — Fr nt wheel drive shift r d
27 — Set screw
28 — Front wheel drive shift fork
29 — Underdrive shift fork
30 — Filler pipe
31 — Main drive gear
32 — Mainshaft washer
33 — Thrust washer
34 — Intermediate gear
35 — Snap ring
36 — Clutch shaft bearing
37 — Cotter pin
38 — Output yoke nut
39 — Output yoke washer
40 — Output clutch shaft
41 — Clutch gear
42 — Output shaft snap ring
43 — Thrust washer
44 — Output shaft gear
45 — Output shaft sliding gear
46 — Output shaft pilot bushing
47 — Output shaft
48 — Output shaft bearing
49 — Output shaft b aring cup
50 — Sp edom t r drive gear
51 — Interm diate gear bearing
52 — Intermediate shaft
53 — Drain plug
54 — Bottom cover gasket
55 — Output shaft nut
56 — Cotter pin
57 — Bottom cover
58 — Speedometer gear sl eve
59 — Speedometer driven gear
60 — Speedometer driven gear bushing



axle, add shims between the rear bearing and the rear shoulder in the carrier If the pinion has to be moved away from the center of the axle, remove shims from this point

If no pinion setting gauge is available, assemble the differential unit in the carrier and check the tooth contact by painting the ring gear teeth as described in the *Rear Axle Chapter* After satisfactory tooth contact has been established, remove the pinion flange and install the oil seal

AXLE SHAFTS, BEARINGS & OIL SEALS

1935-52—To remove an axle shaft, raise the rear end of the car and remove the rear wheel Use a suitable puller to take off the hub and brake drum assembly.

Block the brake pedal from the floor board so that it cannot be depressed, then disconnect the hydraulic brake line from the wheel cylinder Unscrew the stud nuts which hold the oil seal and brake support to the axle housing and remove the oil seals, brake support and shims

With a suitable puller, remove the

axle shaft and bearing assembly, and, if necessary, the bearing may be pulled off at this time. The oil seals can be pulled out of the housing with an oil seal puller

END PLAY ADJUSTMENT—The axle shaft end play can be checked when all the parts have been replaced except the wheel and hub. To make this check, rap each axle shaft, after the nuts are tight, to be sure the bearing cups are seated Then place an indicator on the axle shaft and housing to determine the amount of end play of the shaft by pushing in and pulling out the shaft. If an adjustment is necessary, remove the oil seal and brake support, then add or remove shims as required to obtain the desired result When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain a central position of the thrust block, located in the differential.

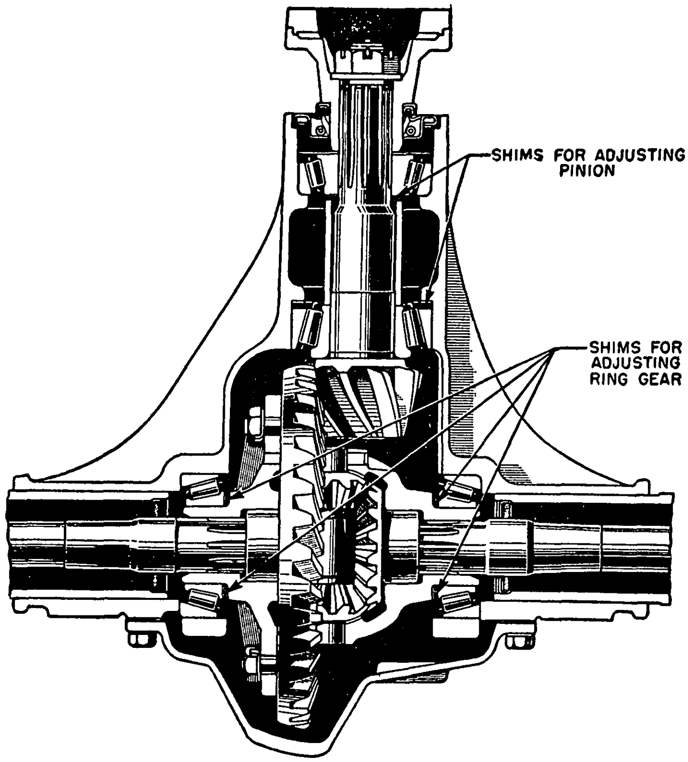


Fig. 24 Rear axle, 1946-52

WHEEL ALIGNMENT

CAMBER & CASTER, ADJUST

1935-42 — Caster up to about two degrees can be corrected by the use of tapered caster plates inserted between the spring seat and the spring To increase caster, place the thick side of the plate toward the front When the caster is out more than two degrees, the axle should be straightened to change the angle of the spring seats

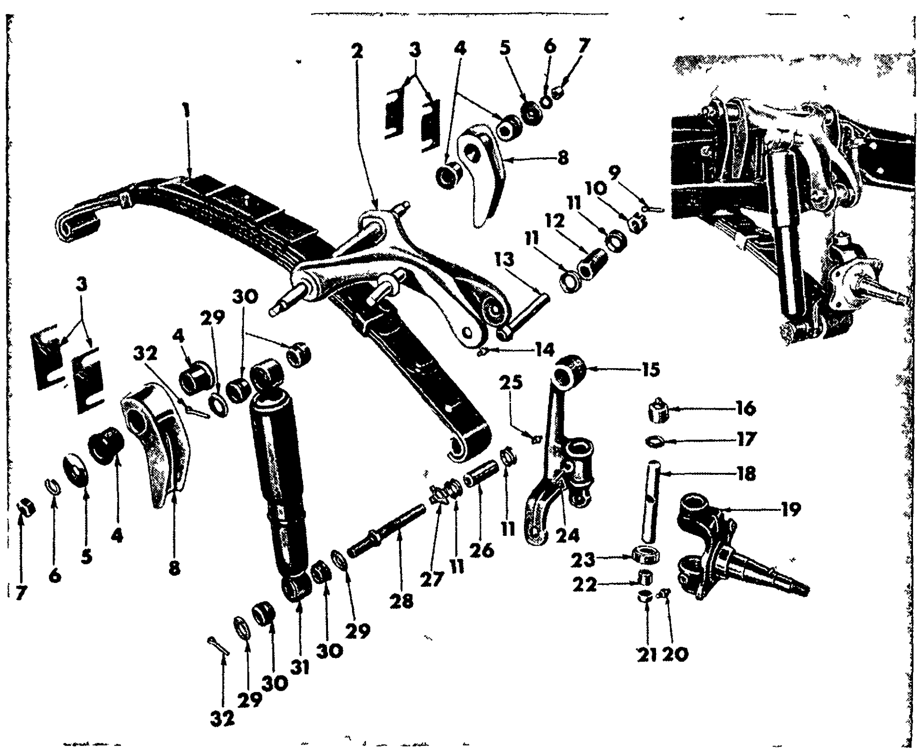
Camber can be corrected by bending the axle ends.

1946-51—Camber is adjusted by adding or removing shims as required from behind the upper control arm frame bracket, Fig 26

Caster is controlled by the relationship between the position of the front spring and its location in the frame cross member channel. If caster is out, examine the suspension for worn or damaged parts

1952—To adjust caster, loosen the nuts at the inner end of the lower control arm pivot bar mounting screws and insert additional spacer shims at either the front or rear bolt as required. Adding shims at the rear bolt decreases caster and adding them at the front bolt increases caster.

Fig. 26 FRONT SUSPENSION, 1946-51



1 — Front spring
2 — Control arm
3 — Camber shims
4 — Rubber bushing
5 — Control arm washer
6 — Lock washer
7 — Nut
8 — Frame bracket
9 — Cotter pin
10 — Nut
11 — Dust seal
12 — Arm pin bushing
13 — Control arm pin
14 — Grease fitting
15 — Knuckle support
16 — Knuckle bearing
17 — Bearing washer
18 — Kingpin
19 — Knuckle
20 — Grease fitting
21 — Expansion plug
22 — Knuckle bushing
23 — Thrust bearing
24 — Kingpin lock pin
25 — Grease fitting
26 — Spring bushing
27 — Bolt lock
28 — Pivot b lt
29 — Pin washer
30 — Rubb r bushing
31 — Sh ck abs rber
32 — C tt r pin

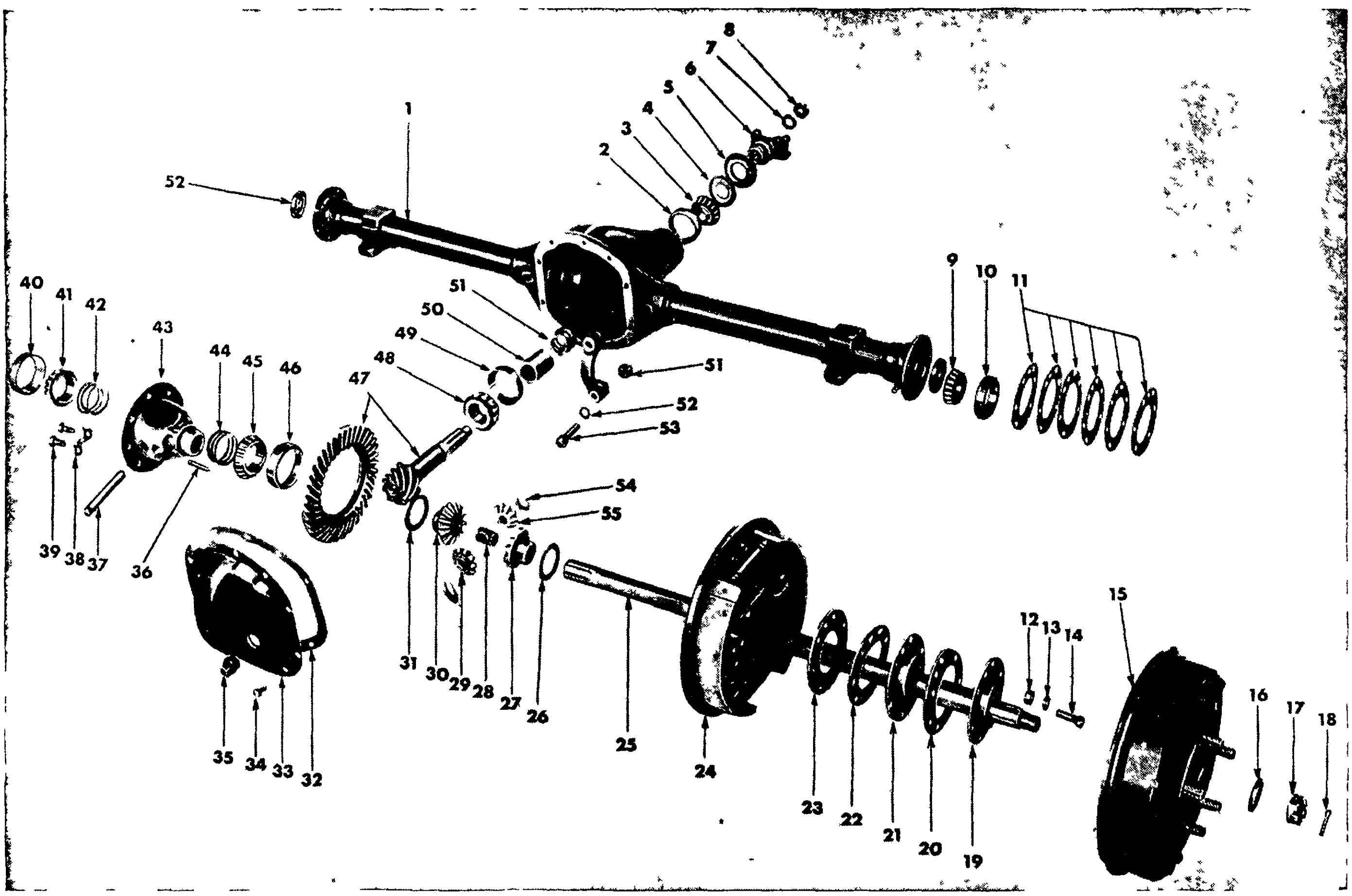


Fig. 25 REAR AXLE, 1946-52. 1937-42 axles are the same except that differential bearings are now adjusted by shims instead of the spacers used in earlier units

1 — H using	15 — Drum and hub	29 — Pinion	43 — Differential cas
2 — B aring cup	16 — Washer	30 — Side gear	44 — Shim
3 — Bearing cone	17 — Axle nut	31 — Thrust washer	45 — Bearing c ne
4 — Oil slinger	18 — Cotter pin	32 — Cover gasket	46 — Bearing cup
5 — Oil s al	19 — Grease protector	33 — Housing cover	47 — Ring gear and pini n
6 — Y ke	20 — Gasket	34 — Cover bolt	48 — Bearing c n
7 — Washer	21 — Grease retainer	35 — Filler plug	49 — Bearing cup
8 — Pinion nut	22 — Gasket	36 — Pinion shaft lock pin	50 — Bearing spacer
9 — Bearing cone	23 — Reinforcement plate	37 — Pinion shaft	51 — Shim and drain plug
10 — Bearing cup	24 — Rear brake	38 — Lock strap	52 — Lock washer
11 — Shim	25 — Axle shaft	39 — Gear bolt	53 — Bolt
12 — Nut	26 — Thrust washer	40 — Bearing cup	54 — Thrust washer
13 — Lock washer	27 — Side gear	41 — Bearing cone	55 — Pinion
14 — Bolt	28 — Spacer block	42 — Shim	

To increase the camber angle, add an equal number of shims at the front and rear bolts. To decrease camber, remove an equal number of shims from both bolts.

TOE-IN, Adjust

1935-42—Toe-in is adjusted by loosening the tie rod clamps and turning the rod in the desired direction to obtain the correct measurement.

1946-51 Two Wheel Drive Models—Load the front end of the vehicle by weights or persons so that the front spring main leaf is flat. Flatness of the front spring main leaf may be checked by holding a straight edge or string below the main leaf, and parallel with it.

Roll the vehicle backward and forward so that all parts will attain a normal position. With suitable trams or gauge, measure the distance between the wheels at the rear and then at the front. These measured distances should be equal (for zero toe-in).

If the distances are not equal, readjust the tie rods as required to make the distance equal.

When the load is removed from the front of the vehicle, it will be found that the wheels will attain a slight toe-in, ranging from $\frac{1}{8}$ to $\frac{3}{16}$ in., depending upon the arch of the front spring. This is normal and will give satisfactory results in respect to tire wear and proper handling of the vehicle.

1952—To adjust toe-in, loosen the clamps at both ends of the adjustable tubes on each tie rod. Turn the tubes an equal amount until toe-in is correct. Turning the right tube in the direction the wheels revolve when the car is going forward increases toe-in and turning the left tube in the opposite direction increases toe-in.

To decrease toe-in turn the right tube backward and the left tube forward. It is important that both tubes be turned an equal amount in order to maintain the correct position of the steering wheel. When adjustment is completed, tighten all clamp bolts.

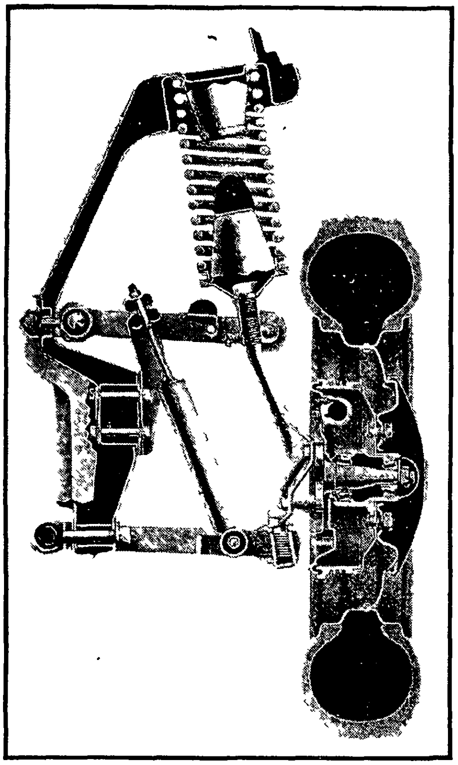


Fig. 27 1952 Front suspension

FRONT END SERVICE

1946-51 TWO WHEEL DRIVE MODELS

Kingpins & Bushings—The following text applies to earlier models insofar as this operation is concerned.

1. Remove wheel hub and dust caps.
2. Take off wheel and hub, bearings and oil seal.
3. Disconnect hydraulic brake tube and remove brake backing plate with brake assembly attached.
4. Drive out kingpin lock pin.
5. Use a sharp drift to remove the kingpin lower expansion plug.
6. Use a brass drift to drive the kingpin up until the upper needle bearing is removed.
7. Use a brass drift to drive the kingpin out through the bottom.
8. Remove the bushing from the lower part of the spindle.

Assembly is the reverse of the above. When reaming the bushing to size, use a pilot type reamer to be sure that the bushing is square with the upper needle bearing. Examine the ball thrust bearing and replace it if worn or damaged. Do not overlook bleeding the brakes.

Steering Knuckle Supports—Should it be necessary to disassemble the front suspension, be sure that the steering knuckle supports are reinstalled on the proper side. The left support will interchange with the right but the wheel camber will be incorrect, resulting in unstable steering. The supports have the part number on the forging for identification—641026 left side, 641027 right side. Later production parts may be identified by the letter L for left and R for right.

When mounting the upper control arm pin bushing in the steering knuckle support, tighten it to 175 lbs. ft. torque. Centralize the control arm over the knuckle support before starting to thread the pivot pin through the support. This is necessary to provide the proper caster effect and equal clearance at each side of the support for the rubber dust seals. Also for the same reasons centralize the spring eye in the lower end of the knuckle support before starting the spring pivot bolt.

FRONT END SERVICE, 1952

In contrast to the conventional type knee action, this design, Fig. 27, has the springs located above the upper control arms and can be removed and replaced with the use of a special spring compressor. To do this, support the front end of the car with a stationary jack under the frame and place an adjustable jack under the suspension unit. Take off the wheel and lower the suspension so the spring is distended. Then install the special spring compressor on the coils of the spring and compress the spring by means of the turnbuckle on the tool. When sufficiently compressed, lift the spring from its lower seat and take it out of its upper seat.

As shown in Fig. 29, the two mounting bosses of the lower trunnion are manufactured 2½ degrees off the trunnion centerline. Because of this offset angle, the upper spindle threads will not align with the upper trunnion when the spindle is installed in the lower trunnion. It is necessary, therefore, to pull the spindle forward to align it with the upper trunnion to attach the spindle to the trunnion.

The reason for the 2½ degree offset is simply to provide the desired friction in the spindle support threads.

To make the installation, first mount the lower trunnion in the support arm with the seals properly placed and with the lower angled boss pointed to the rear of the vehicle. With the rubber seal installed, thread the spindle support into the trunnion until there is a slight pressure on the seal. Thread the upper trunnion onto the spindle until the 10¾" spacing, Fig. 29, is secured. Pull the spindle forward, align it with the upper arm and install the upper seals and bolts.

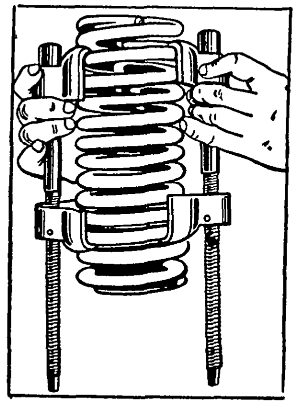


Fig. 28 Showing applicati n f spring clamps when removing and installing front spring on 1952 passenger car

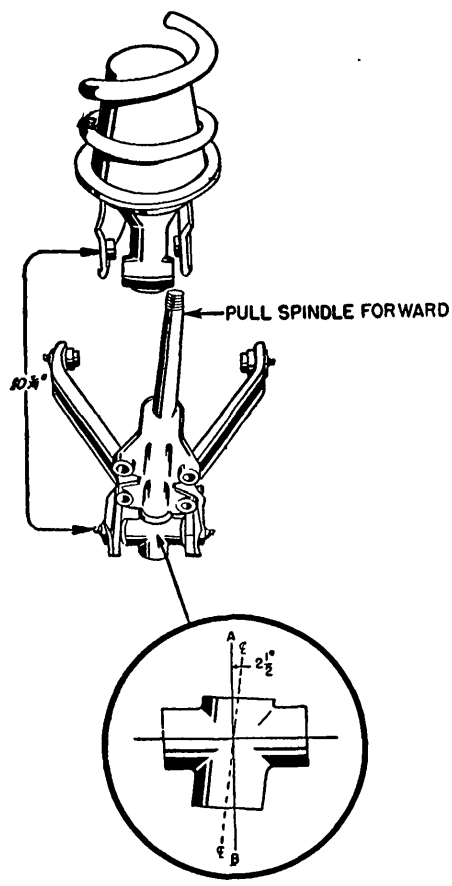


Fig. 29 Trunnion installation on 1952 passeng r car

STEERING GEAR

STEERING GEAR REMOVAL

1935-52—Disconnect the horn wire at the bottom of the steering gear. Remove the horn button, unscrew the steering wheel nut and, with a puller, remove the steering wheel. Disconnect the steering column from the instrument panel and, on cars with steering gearshift, unfasten the controls from the steering column. Remove the nut which fastens the steering gear arm to the gear and use a puller to remove the arm. Unscrew the bolts which fasten the steering gear to the frame and, after removing the engine side pan, withdraw the gear from below.

Replace in the reverse order and, if necessary, see *Gearshift* for adjustment instructions on cars with steering gearshift. If the steering gear requires service, see the *Steering Gear* chapter for adjustment procedure.

CARTER FOUR-BARREL CARBURETOR

Courtesy Carter Carburetor Corp.

MODEL WCFB

1952 BUICK & OLDSMOBILE—Modeled after the dual carburetor used formerly, the new four-barrel carburetor is designed primarily to increase the power output of the engine at high speeds. Essentially, the carburetor consists of two dual caburetors mounted back to back in a single housing. The section containing the metering rods, accelerating pump and choke is termed the primary side of the carburetor; the other section is called the secondary side. The carburetor has the five conventional systems or circuits, which are:

Two float circuits.
Two low speed circuits.
Two high speed circuits.
One pump circuit.
One choke circuit.

FLOAT CIRCUIT—Fig. C1. The primary and secondary float bowls are separated by a partition. The fuel line connection is above the secondary needle and seat. Fuel is supplied to the primary needle and seat through the passage in the bowl cover.

Intake needles and seats are carefully matched during manufacture. Do not use the primary needle in the secondary seat or vice versa. To avoid unnecessary bending, both floats should be reinstalled in their original positions and then adjusted.

The bowls are vented to the inside of the air horn. They are calibrated to provide air pressure above the fuel at all times. To assure a positive seal, always use a new bowl cover gasket and a new dust cover gasket when reassembling.

A connecting passage along the outside of the body effects a balance of the fuel levels and air pressures between the two bowls.

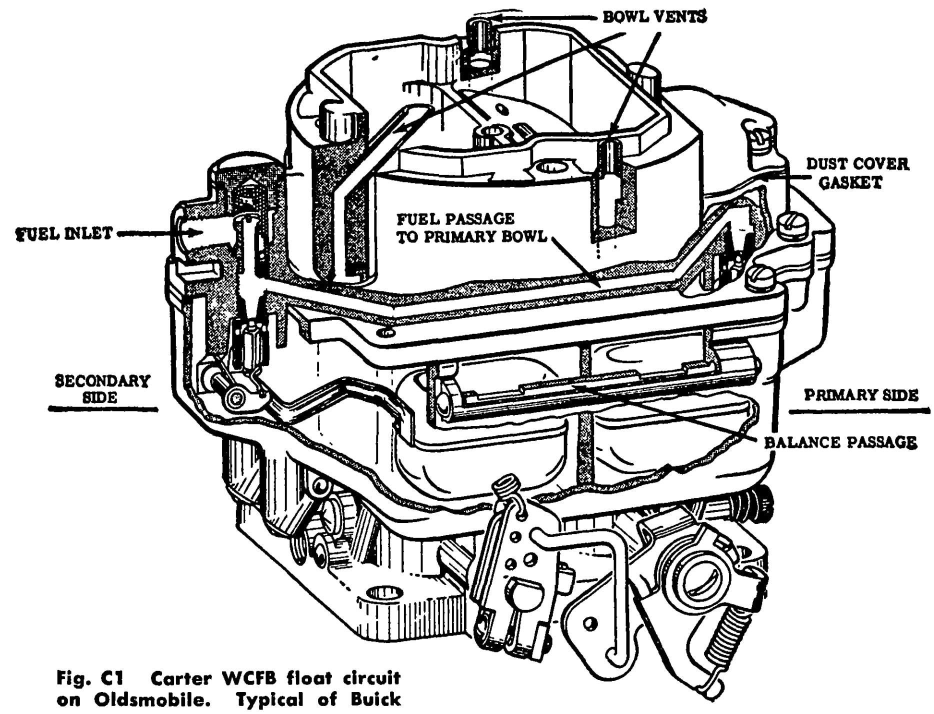


Fig. C1 Carter WCFB float circuit on Oldsmobile. Typical of Buick

LOW SPEED CIRCUITS—Fig. C2. Fuel for idle and early part throttle operation is metered through the low speed circuits. Gasoline enters the idle wells through the metering rod jets on the primary side of the carburetor and through the main metering jets on the secondary side.

The low speed jets measure the amount of fuel for idle and early part throttle operation. The air by-pass passages, economizers and idle air bleeds are carefully calibrated and serve to break up the liquid fuel and mix it with the air as it moves through the passages to the idle ports and idle adjustment screw ports.

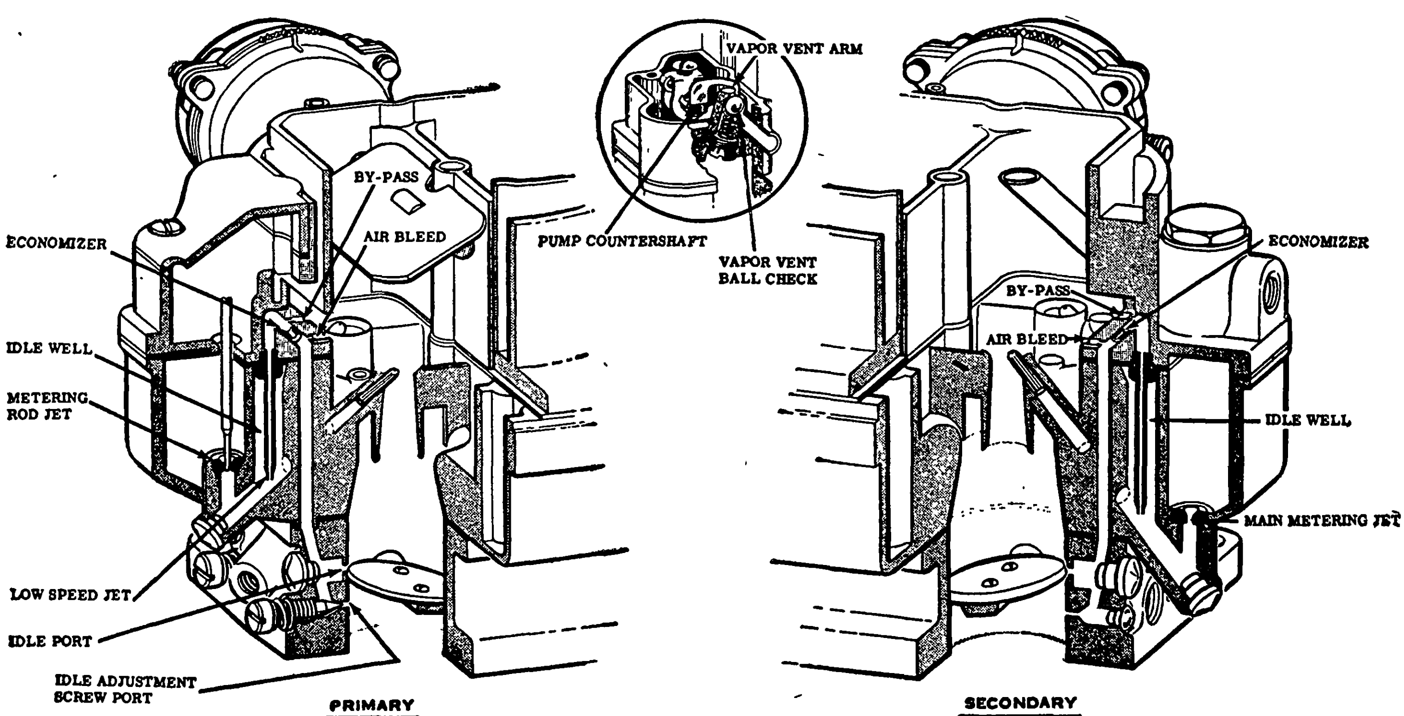


Fig. C2 Carter WCFB l w sp d circuit n Oldsm bil . Buick units empl y auxiliary throttle valv s ab v secondary thr ttle valves

Courtesy Carter Carburetor Corp.

Turning the idle adjustment screws toward their seats reduces the quantity of fuel mixture supplied by the idle circuit. There are no idle adjustment screws on the secondary side of the carburetor.

The idle ports are slot shaped. As the throttle valves are opened, more of the idle ports are uncovered, allowing a greater quantity of the gasoline and air mixture to enter the carburetor bores. The secondary throttle valves (and auxiliary throttle valves on Buick) remain closed at idle.

The vapor vent ball check, operated by the arm on the countershaft, provides a vent for fuel vapors to escape from the carburetor bowls to the outside at idle and when the engine is not in operation.

All by-passes, economizers, idle ports, idle adjustment screw ports, as well as the bore of the carburetor flange must be clean and free of carbon. Obstructions will cause poor low speed engine operation. Worn or damaged idle adjustment screws or low speed jets should be replaced.

HIGH SPEED CIRCUITS—Fig. C3. On the primary side, the position of the metering rods in the metering rod jets controls the amount of fuel flowing in the high speed circuit of the carburetor. The position of the metering rods is dual controlled, mechanically by movement of the throttle, and by manifold vacuum applied to the vacuum piston on the vacumeter link.

On the secondary side, fuel is metered at the main metering jets (no metering rods used.). Throttle valves in the secondary side remain closed until the primary throttle valves have been opened a predetermined amount. They arrive at wide open throttle position at the same time the primary throttle does. This is accomplished by linkage between the throttle levers. On Buick units, air velocity through the carburetor controls the position of the auxiliary throttle valves.

Secondary throttle valves (and auxiliary throttle valves on Buick) are locked closed during choke operation to insure faster cold engine starting.

ANTI-PERCOLATOR — To prevent the vapor bubbles in the nozzle passages and low speed wells (caused by heat) from forcing fuel out of the nozzles, anti-percolator passages, Fig. C3, and calibrated plugs or bushings are used. Their purpose is to vent the vapors and relieve the pressure before it is sufficient to push the fuel out of the nozzles and into the intake manifold.

Anti-percolator plugs, bushings and main nozzles are permanently installed and must not be removed in service.

PUMP CIRCUIT—Fig. C4. The pump circuit is found only in the primary side of the carburetor. It provides a measured amount of fuel, which is necessary to insure smooth engine operation for acceleration at speeds below approximately 30 mph.

When the throttle is closed the pump plunger moves upward in its cylinder and fuel is drawn into the pump cylinder through the intake check. The discharge check is seated at this time to prevent air being drawn into the cylinder. When the throttle is opened the pump plunger moves downward, forcing fuel out through the discharge passage, past the discharge check, and out of the pump jets. When the plunger moves downward the intake check is closed, preventing fuel from being forced back into the bowl.

If the throttle is opened suddenly the upper pump spring will be compressed by the plunger shaft telescoping, resulting in a smoother pump discharge of longer duration.

At speeds above approximately 30 mph, pump discharge is no longer necessary to insure smooth acceleration. When the throttle valves are opened, the pump plunger bottoms in the pump cylinder, eliminating pump discharge due to pump plunger movement at high speeds.

During high speed operation a vacuum exists at the pump jets. To prevent fuel from being drawn through the pump circuit, the passage through the pump jets is vented by a cross passage to the carburetor bowl above the fuel level. This allows air instead of fuel to be drawn off the pump jets.

CHOKE CIRCUIT—The choke is controlled by the conventional Carter Climatic Control, the operation of which is given in the *Automatic Chokes* chapter, page 168.

CARBURETOR ADJUSTMENTS

FLOAT ADJUSTMENTS—Two separate float adjustments must be made—lateral and vertical.

For the lateral adjustment, place the proper float gauge, Fig. C5, under the float with the notched portion of gauge fitted over edge of casting. Sides of float should just clear the vertical uprights of the gauge. Adjust by bending arms of float.

For the vertical adjustment, the floats should just clear the horizontal portion of gauge. Adjust by bending at center portion of float arms.

PUMP ADJUSTMENT — Back out throttle stop screw and fast idle screw. Hold throttle valve completely closed; the upper end of pump arm must be parallel with machined surface of dust cover, Fig. C6. Adjustment is made by bending connector rod at lower end.

METERING ROD ADJUSTMENT—Fig. C7. No metering rod gauges are re-

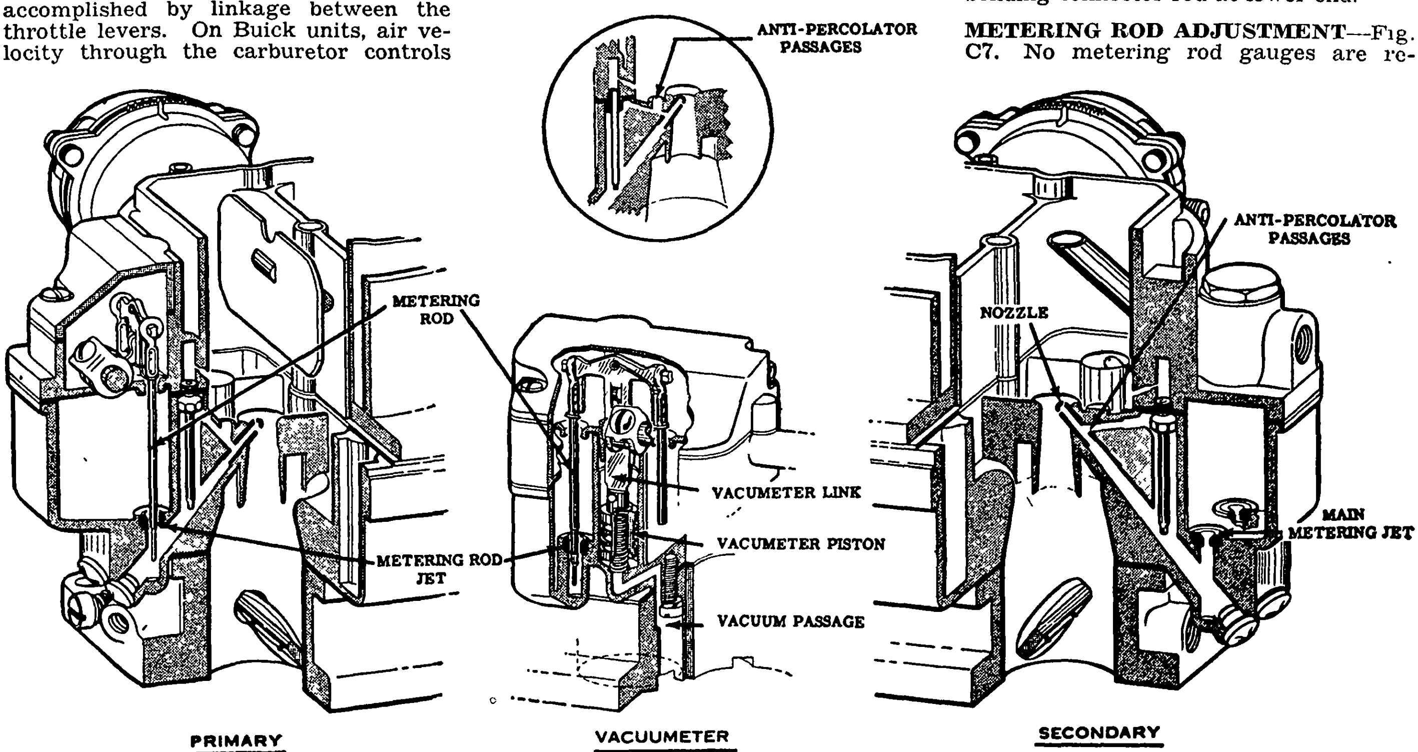


Fig. C3 Carter WCFB high sp ed circuit on Oldsm bile. Buick mpl ys auxiliary thr ttl valves abov sec ndary throttl valves

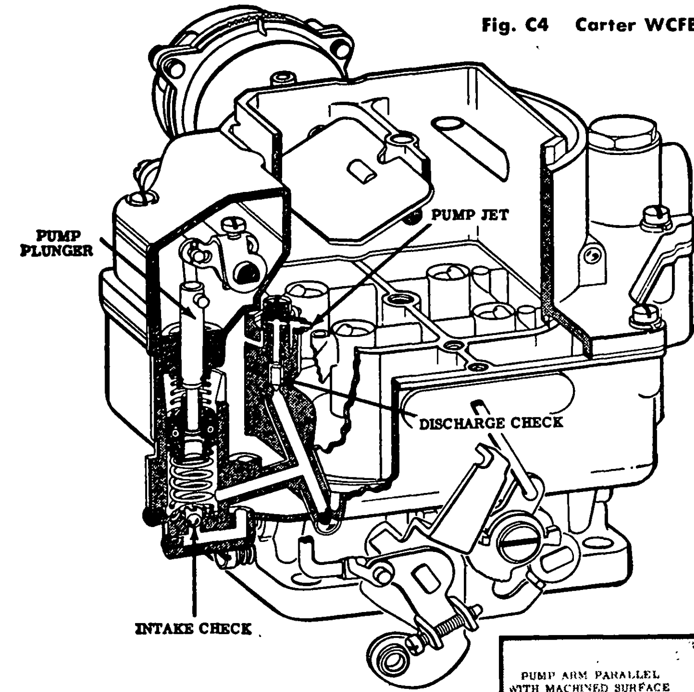


Fig. C4 Carter WCFB pump circuit

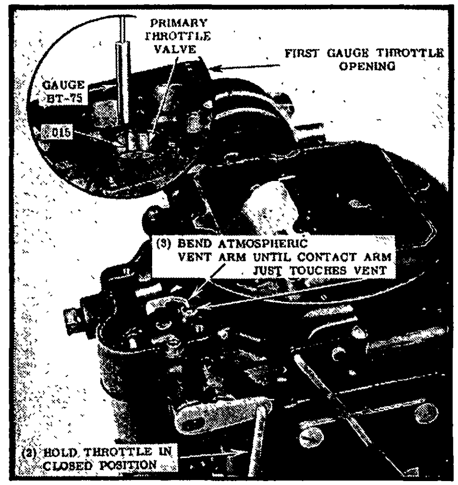


Fig. C8 Carter WCFB atmospheric air vent adjustment

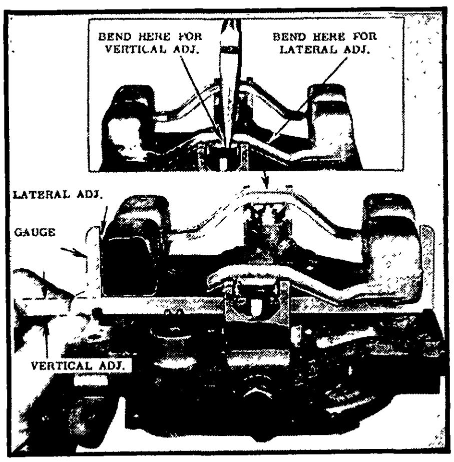


Fig. C5 Carter WCFB float adjustments

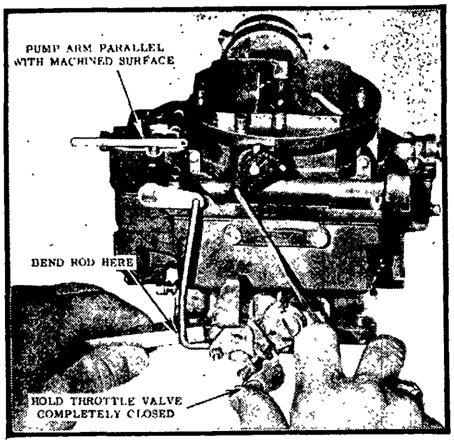


Fig. C6 Carter WCFB pump adjustments

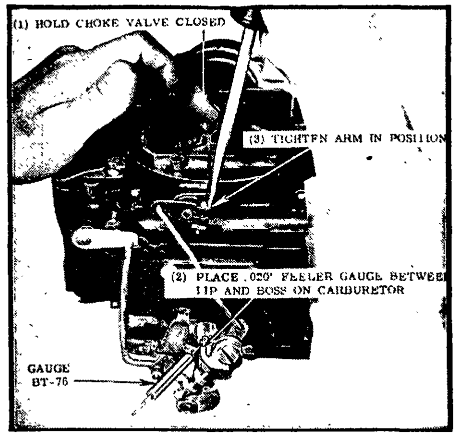


Fig. C9 Carter WCFB fast idl adjustment, first step

quired. With idle stop screw backed out, hold throttle lever closed so the throttle valves are seated in bores of carburetor. Press down on vacuum piston link until metering rods bottom in carburetor bowl casting. Holding rods in this downward position, and with throttle valves seated, revolve metering rod arm until finger on arm contacts lip of vacumeter link. Hold in place and carefully tighten clamp screw.

ATMOSPHERIC VENT ADJUSTMENT—Adjust idle stop screw to obtain .015" clearance between primary throttle valve and carburetor bore (opposite idle adjustment screws), Fig. C8. Remove gauge and hold idle stop screw in closed position (against casting). Bend atmospheric vent contact arm until it just touches vent in air horn. Install new dust cover gasket, dust cover and retain with screws and lockwashers.

FAST IDLE ADJUSTMENT — Three separate fast idle adjustments must be made. They are as follows:

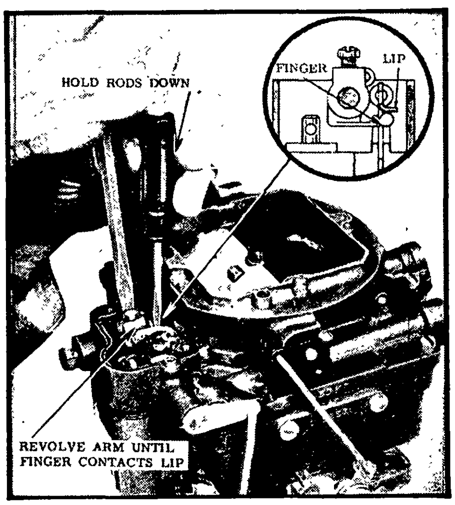


Fig. C7 Cart r WCFB m - tering r d adjustment

Clearance Adjustment: Hold choke valve tightly closed. Insert a .020" feeler gauge, Fig. C9, between tang on fast idle cam and boss of carburetor casting. Rotate choke lever toward closed position until all slack is removed from linkage. Hold in this position and tighten choke lever clamp screw.

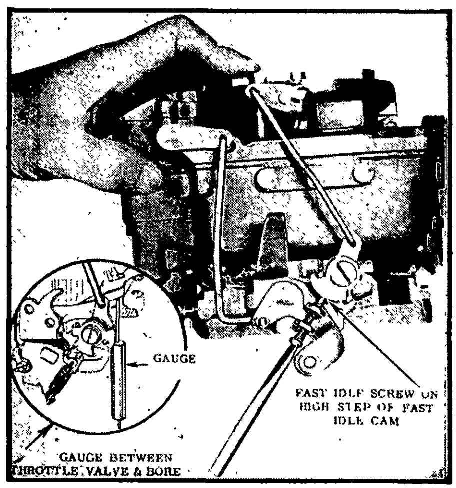


Fig. C10 Carter WCFB fast idl adjustment, s c nd step

Throttle Valve Opening Adjustment: Back out throttle stop screw, Fig. C10. Hold choke valve tightly closed. Tighten fast idle adjusting screw against high step of fast idle cam until there is .015" opening between throttle valve and bore of carburetor (side opposite idle adjustment screws).

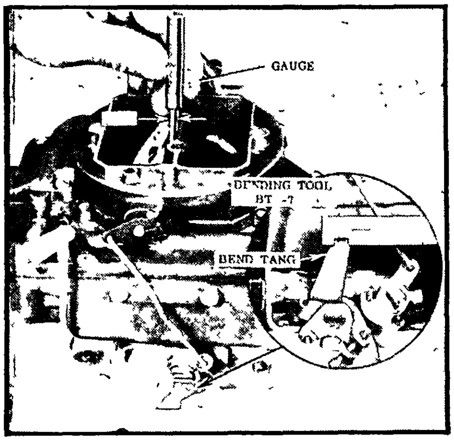


Fig. C11 Carter WCFB unloader adjustment

Adjustment on Engine: With engine and transmission warm, place shift lever in neutral. Place fast idle screw to rest on high step of fast idle cam. With air cleaner removed, hold choke valve open and adjust fast idle screw to obtain 1600 engine rpm.

UNLOADER ADJUSTMENT—Fig. C11. Hold throttle lever wide open. Gauge clearance between upper edge of choke valve and inner wall of air horn, using a 1/8" gauge on Oldsmobile or a 3/16" gauge on Buick. Adjustment is made by bending tang on throttle lever as shown.

ROCHESTER FOUR-BARREL CARBURETOR

MODEL 4GC

1952 CADILLAC & OLDSMOBILE—This model carburetor has two complete carburetor systems, called primary and secondary, each with two barrels. The two primary barrels function for starting, warm-up and part throttle driving. The two secondary barrels go into action when the primary system is operated at half throttle and above, Figs. R1 and R2. The secondary barrels add greater breathing capacity to increase the power output of the engine.

This four-barrel design obtains much better air and fuel distribution within the engine and far superior flexibility and response than could be obtained with an oversize dual carburetor.

Each of the primary and secondary carburetor systems has its own bowl and float assembly, Fig. R3. The bowls are interconnected only by the fuel level equalizing passage which maintains the float level with relation to the nozzle at all angles in both carburetor systems. Thus, the proper float or fuel level is maintained at all times in both bowls, whether the car is parked or operating on the level or on the steepest grades.

The automatic choke operates only on the primary carburetor. An interlock device on the secondary throttle shaft is connected to the choke so that the secondary carburetor does not operate until the engine is warmed up and the choke is completely off.

The idling system is adjustable only on the primary carburetor, Fig. R4. The secondary idling system is fixed, permanently calibrated at the factory, with no further adjustment necessary.

Both fuel bowls of the carburetor are internally vented so that they are self-compensating for variations of air cleaner restriction and also changes in altitude from sea level to 10,000 feet. This eliminates the necessity of changing carburetor jets for operation at high altitude.

In addition to the internal bowl vents, the carburetor has an anti-percolation device on the primary system. This device vents the primary bowl to the atmosphere when the throttle is at idle position, allowing vapors to escape in order to assure good "hot-starts" and a smooth "hot-idle".

The primary section of the carburetor contains an accelerating pump, Fig. R5. The normal operating duration of this pump extends beyond half-throttle position to provide the necessary accelerating fuel charge for the secondary throttle as well as the primary.

There are aluminum sight plugs in the side of the carburetor to permit a visual check of the float chambers for the fuel level after the mechanical setting is made. This facilitates servicing the carburetor and makes it easy to ascertain a flooded condition.

SERVICE FEATURES

As is the case with all Rochester carburetors, this model is basically simple for ease of service. A major portion of the calibrated metering parts is contained in the venturi clusters, located in the float bowl and may be readily serviced by removing the air horn assembly.

The idle tubes and main discharge nozzles, being pressed into the venturi clusters, need not be serviced separately.

The power restrictions and pump jets are also pressed in at the factory, thereby making individual replacement unnecessary.

After the idling RPM has been set, no further adjustment of the idle, part throttle, power and targeting of the pump jets is necessary.

CARBURETOR ADJUSTMENTS

NOTE—The tools and gauges shown in the accompanying illustrations may be obtained from the Burroughs Tool Company, Kalamazoo, Mich.

FLOAT LEVEL—Both sets of floats are adjusted in the same manner—with the air horn gasket in position and the air horn inverted on a flat surface.

1. Carefully bend float arms vertically until floats appear level in relation to each other.
2. Place float gauge in position, Fig. R6, so that gauge is located against the curvature in the bore of the carburetor air horn.
3. Bend float arms at rear of float assembly until the floats just touch the top portion of the gauge between the gauge legs. (The scale dimension from the gasket to the bottom of each float should be 1⅜").

FLOAT DROP—Both sets of floats should be adjusted in the following manner, Fig. R7.

Bend the float tang (at rear of float) against the balance spring to lessen the drop and away from the balance spring

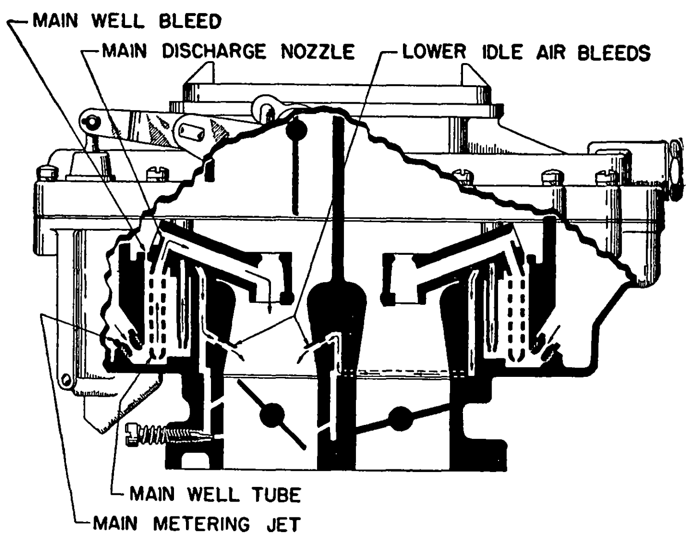


Fig. R1 Part throttle system. Rochester Model 4GC

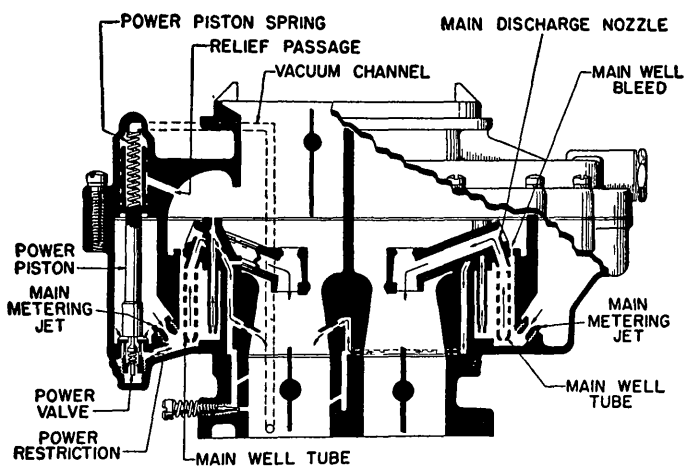


Fig. R2 Power system. Rochester Model 4GC

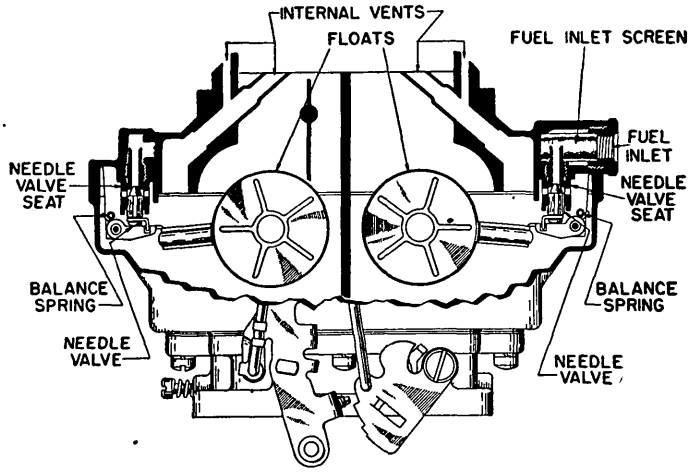


Fig. R3 Float system. Rochester Model 4GC

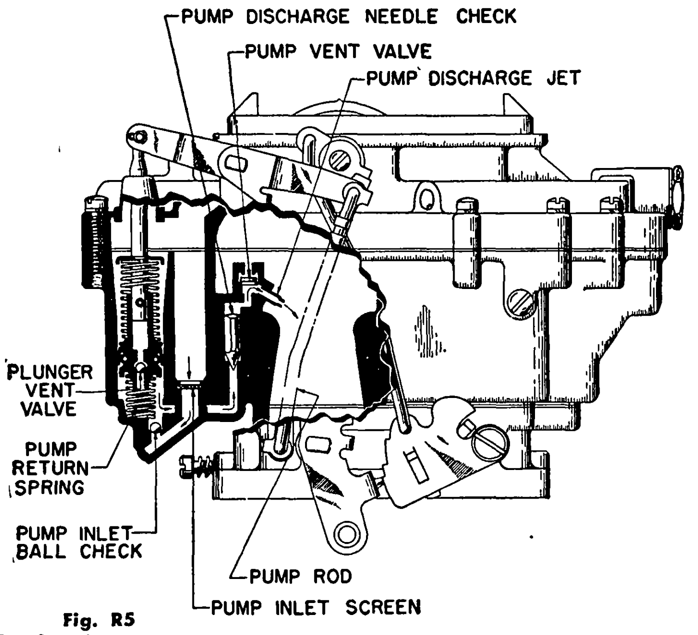


Fig. R5
Accelerating system.
Rochester Model 4GC

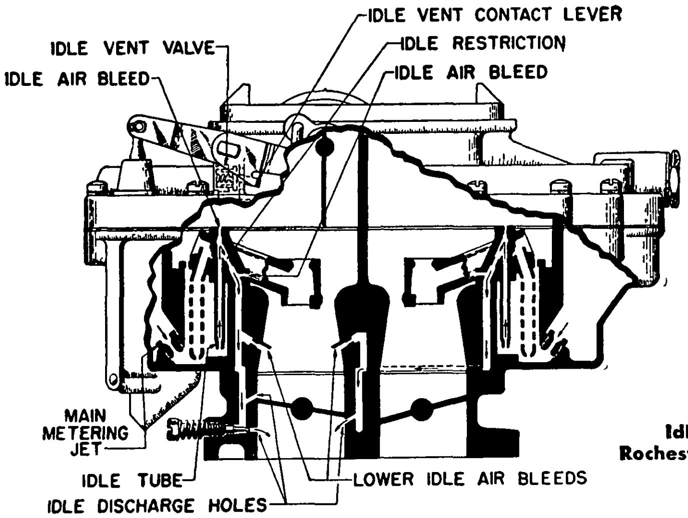


Fig. R4
Idling system.
Rochester Model 4GC

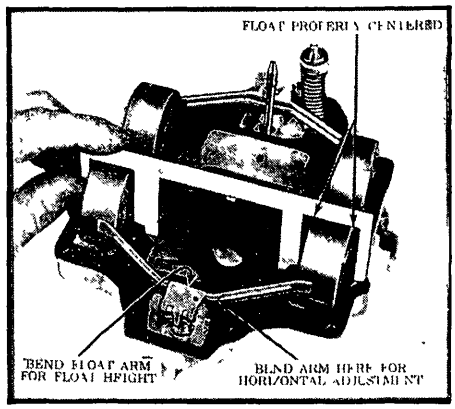


Fig. R6 Float level adjustment.
Rochester M del 4GC

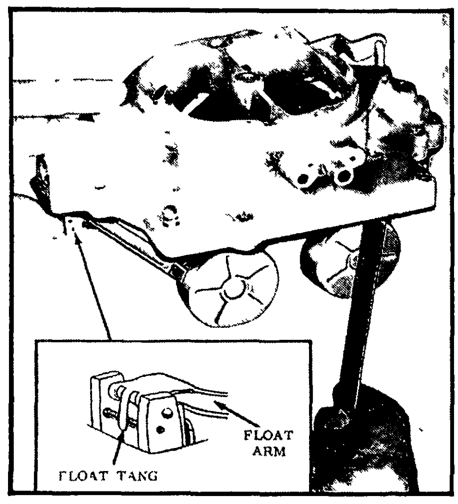


Fig. R7 Fl at dr p adjustment.
R ch ster M del 4GC

to increase the drop. The tension is correct when the distance from the bottom of the air horn gasket to the bottom of the floats—with the air horn held in an upright position—is $1\frac{11}{16}$″.

PUMP ROD—Fig. R8. Back off the idle stop and fast idle screws so that the throttle valves are fully closed. With the throttle lever held in this position, carefully bend the pump rod until the dimension from the air horn surface to the bottom edge of the pump plunger rod is $\frac{15}{16}$″ on Cadillac or $1\frac{1}{16}$″ on Oldsmobile.

NOTE—The choke modifier adjustments should be made at this point. With both screws still backed off, rotate the choke modifier index pointer until it is one notch rich on Cadillac or on the index for Oldsmobile units.

CHOKE ROD—With choke modifier set as indicated above, turn the fast idle screw until it contacts the second step on the fast idle cam against the shoulder of the highest step, Fig. R9. Be certain choke trip lever is in contact with the choke counterweight.

With the fast idle screw and fast idle cam in this position, carefully bend the choke rod to obtain a clearance of .031″ on Cadillac or .053″ on Oldsmobile between the top edge of the choke valve and the dividing wall between the two carburetor air horns.

UNLOADER ADJUSTMENT — With thermostat cover set as indicated in the "NOTE" above, move the throttle to full open position, Fig. R10. Hold the trip lever down so that it is in contact with the choke counterweight. With the levers held in this position, carefully bend the tang of the fast idle cam to obtain a clearance of .067″ on Cadillac or .092″ on Oldsmobile between the two carburetor air horns.

FAST IDLE ADJUSTMENT—With the thermostat cover set as specified above, move the fast idle cam so that the choke valve is fully closed. Hold the throttle lever in the closed position so that the fast idle screw rests on the highest step of the fast idle cam, Fig. R11. Then adjust the fast idle screw to obtain a clearance of .028″ on Cadillac or .020″ on Oldsmobile between the throttle valves and the primary bores of the throttle body on the side opposite the idle adjusting needles.

NOTE—If this adjustment is made with the carburetor mounted on the engine, have the engine and transmission hot. With the fast idle screw resting on the high step of the fast idle cam, adjust the screw to give an engine speed of 1700 rpm on Cadillac or 1450 rpm on Oldsmobile in neutral with the air cleaner on.

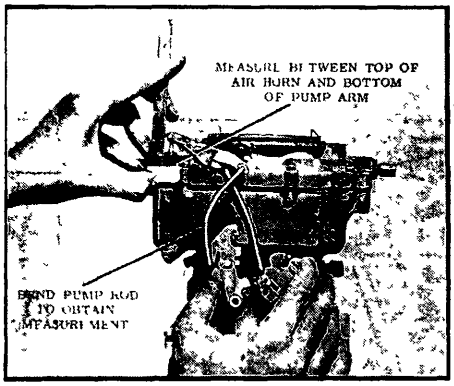


Fig. R8 Pump rod adjustment. R ch st r Model 4GC

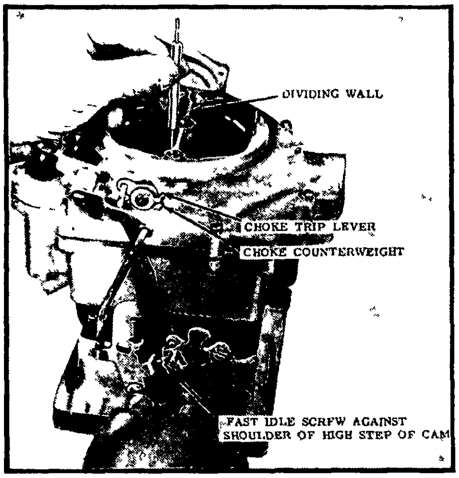


Fig. R9 Choke rod adjustment. R ch ster Model 4GC

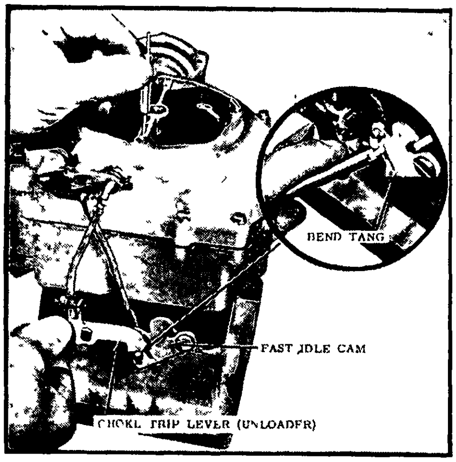


Fig. R10 Unl ader adjustment. R chest r Model 4GC

ATMOSPHERIC IDLE VENT ADJUSTMENT—Fig. R12. Insert a .063″ gauge on Cadillac or a .040″ gauge on Oldsmobile between the throttle valves and the primary bores of the throttle body on the sides opposite the idle adjusting needles. With the throttle valves closed against the gauge, bend the atmospheric vent contact arm until it just contacts the atmospheric vent valve in the carburetor air horn. This adjustment insures proper vent opening at various throttle positions.

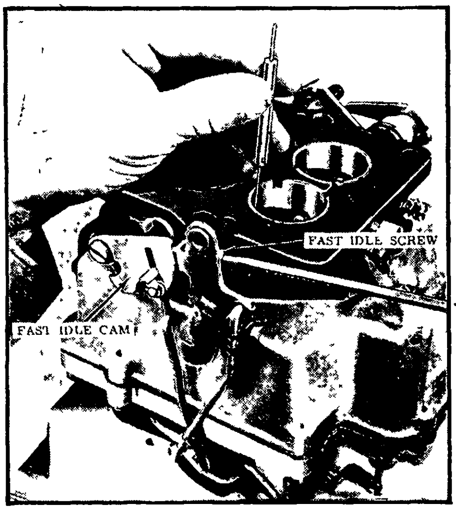


Fig. R11 Fast idle adjustment. Rochester Model 4GC

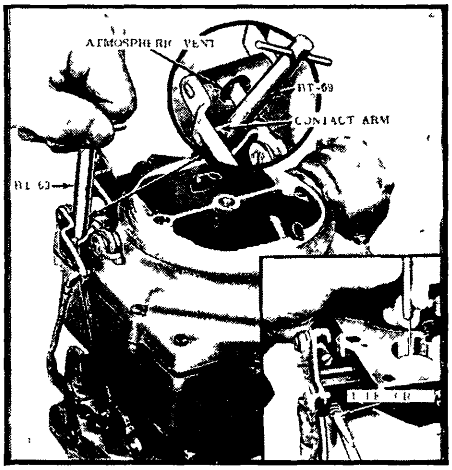


Fig. R12 Atmospheric air vent adjustment. Rochester Model 4GC

SECONDARY THROTTLE LOCKOUT—With the choke valve partially closed and the fast idle cam and secondary lockout lever in the position shown in Fig. R13, there should be a clearance of .015″ between the lever and cam. Bend the lever to obtain this clearance.

SECONDARY THROTTLE CLEARANCE—With the choke valve wide open and fast idle cam and secondary lockout lever in the position shown in Fig. R14, there should be a clearance of .015″ on Cadillac or .035″ on Oldsmobile between the lever and cam. Bend the lever to obtain this clearance.

ROCHESTER BC CARBURETOR

1952 CHEVROLET WITH POWERGLIDE—This unit is the same as the BC model employed on Pontiac and which is described in the Rochester section of the carburetor chapter. The adjustments are as follows:

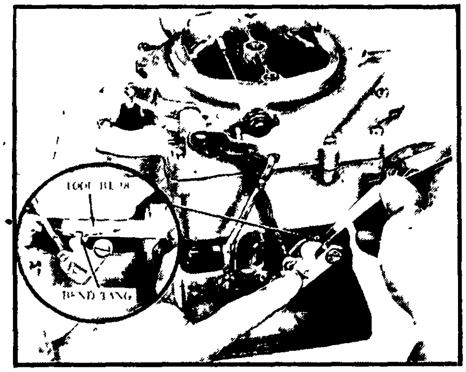


Fig. R13 Secondary throttle l ck ut adjustment. Rochester M d l 4GC

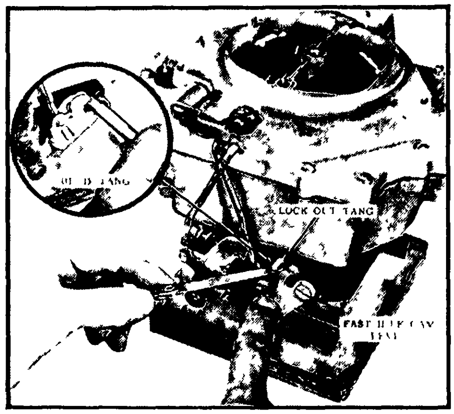


Fig. R14 Secondary throttl cl arance adjustment. Rochester Model 4GC

NOTE—The tools and gauges shown in the accompanying illustrations may be obtained from the Burroughs Tool Company, Kalamazoo, Mich.

FLOAT LEVEL—With the air horn fully assembled, gasket in position and assembly up-ended on a flat surface, Fig. R15, proceed as follows:

1. Place float level gauge in position with gauge tang inserted in discharge nozzle.
2. Bend float arms vertically so that each float just touches top portion of gauge.
3. Bend float arms horizontally so that each float is centered in gauge.
4. Tilt assembly 90° each side and check to see that floats do not touch gauge.

FLOAT DROP—As shown in Fig. R16, to insure sufficient entry of fuel under high speed operation, it is necessary to check and adjust the float drop.

With the air horn held right side up and floats suspended freely, carefully bend the float tang at the rear of the float assembly so that the bottom of the float is 1¾″ below the gasket surface. Install air horn assembly to float bowl and tighten screws evenly and securely.

CHOKE ROD — With the thermostat cover set so that the scribed index mark on the cover is in line with the long cast mark on the choke housing, turn the

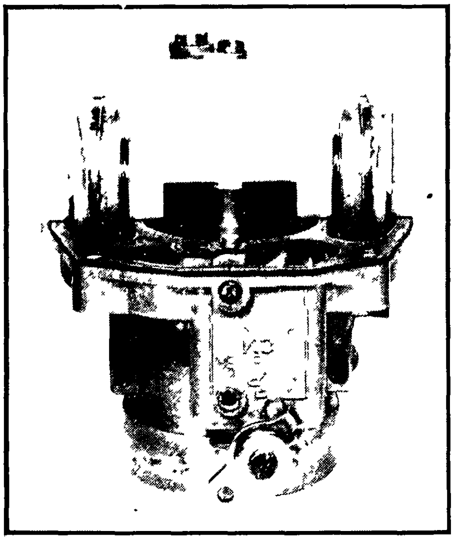


Fig. R15 Float level adjustment. R chest r Model BC, 1952 Chevrolet

idle screw in until it contacts the second step of the fast idle cam against the shoulder of the first step, Fig. R17.

Holding the screw tightly against the cam, bend the choke rod at the dog leg until a .073" gauge just slides easily between the lower edge of the choke valve and the bore of the carburetor air horn.

UNLOADER ADJUSTMENT—Fig. R18. With the throttle lever in the full wide open position, there should be a clearance between the lower edge of the choke valve and the bore of the carburetor air horn so that a .166" gauge will just slide freely. Bend the tang on the throttle lever to obtain the necessary clearance.

THROTTLE RETURN CHECK—Install carburetor and throttle return check assembly on engine manifold, Fig. R19. Connect the carburetor controls, gasoline, and vacuum spark control lines. Be certain that accelerator pull back spring No. 3695705 is used. Then make the adjustment as follows:

1. Check the alignment of the throttle return check adjusting screw with the contact arm on the throttle lever, Fig. R19. It may be necessary to bend the throttle return check bracket or throttle lever contact arm to center the adjusting screw on the radius of the contact arm.
2. Connect a tachometer to the engine. Place the transmission control in the Park position. Start the engine and run it at a fast idle to warm it up.
3. Adjust the throttle stop screw and idle adjusting needle in combination with each other to secure a smooth idle at 500 rpm in "N" position. This adjustment should be made with the choke valve in the wide open position and the throttle stop screw resting on the low step of the fast idle cam.
4. Shut off engine. With choke in closed position, locate the throttle stop screw so that it rests on the highest step on the fast idle cam, Fig. R19.
5. Then, using a 3/8" wrench, turn the Throttle Return Check Adjusting Screw until it just contacts the throttle lever contact arm. Hold flats on shaft with a wrench whenever adjusting screw is turned.
6. Install air cleaner. Start engine and recheck idling adjustment.

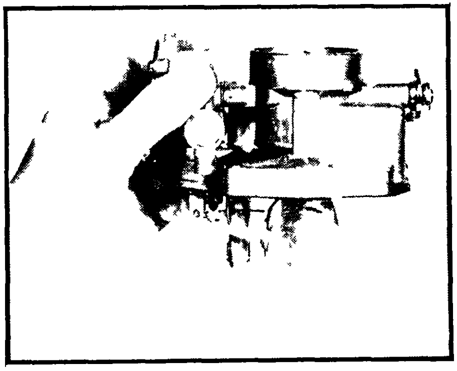


Fig. R16 Float drop adjustment. Rochester Model BC, 1952 Chevrolet

Fig. R17 Choke rod adjustment. Rochester Model BC, 1952 Chevrolet

Fig. R18 Unl ader adjustment. R chester M del BC, 1952 Chevr l t

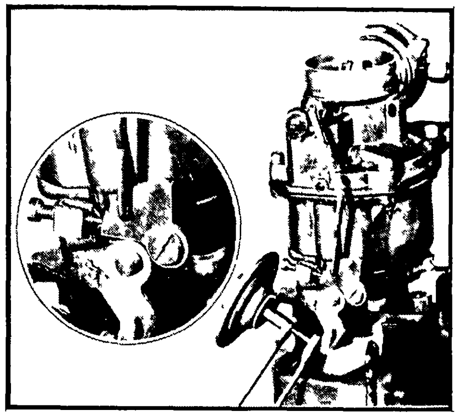


Fig. R19 Throttl r e t u r n check adjustment. R ch ster Model BC, 1952 Ch vrol t

STROMBERG SERIES 4A

FOUR-BARREL CARBURETOR

1952 BUICK 70—This unit is basically two dual carburetors contained in one housing. It combines the advantage of a small carburetor for economy with the availability of a secondary source of supply for additional speed and power when it is required. It has, however, only one accelerating pump, one power system, and one set of idle needle valves. These features are all incorporated in the primary or front barrels. The rear of the unit, which contains only a float system, idle system and main metering system, is called the secondary carburetor

The air horn intake is divided into two sections with the hot air automatic choke control in the front or primary section.

The primary throttle valves are directly connected to the accelerator pedal. The secondary throttle valves are connected to the primary valve shaft by linkage designed to operate the secondary valves at pre-determined car speeds or engine loads.

In the secondary valves there is a set of auxiliary valves (or damper valves) located above the secondary throttle valves. These auxiliary valves are offset and have a counterweight on the end of the shaft.

FLOAT SYSTEM—Fig. S1. The carburetor has two separate and distinct float systems. When fuel reaches the prescribed level in each chamber, the float moves the needle valve against its seat to shut off the flow to that particular float chamber.

On the secondary side the needle valve is spring-loaded and the float lever operates against a small plunger in the core of the needle valve. Since the requirements for large quantities of fuel from the secondary float chamber are not continuous, this valve is spring-loaded to hold against the fuel pressure in order better to maintain the required fuel level.

The float chambers are vented both internally and externally in a manner that insures balanced pressure under all operating conditions

There are also air passages down from the air cleaner mounting flange with an external bleed hole in the side of each passage This design is primarily to permit excessive fumes to escape from the float chambers when the engine is stopped after extremely hot operation

IDLE SYSTEM—Fig S2 The general operation of the idle system in all barrels of the carburetor is identical Fuel is delivered to the engine through the idle system on the primary side at closed throttle and light load speeds At curb idle or closed throttle operation, the fuel air mixture is delivered only from the lower or primary discharge holes As the throttle is opened, the secondary discharge holes are exposed and fuel is discharged from both the upper and lower holes on the primary side

Fuel is delivered from the lower discharge holes on the secondary side continuously during normal idle and intermediate speeds of the engine When the secondary throttle valves are opened, additional fuel is discharged from the upper idle discharge holes Further opening of the throttle valves results in a transfer from the idle to the main metering system

MAIN METERING SYSTEM—The main metering system, Fig S3, controls the flow of fuel on the primary side during the intermediate or part throttle range of operation up to approximately 80 mph

The operation of the main system in each barrel of the primary side is identical The primary and auxiliary venturi tubes increase the velocity of air passing through the unit which creates low pressure at the tip of the main discharge jets This causes fuel to flow from the float chamber, through the metering jets and into the main discharge jets

Air is drawn into the system through the high speed bleeders so that a mixture of fuel and air is discharged from the jets into the air stream passing through the auxiliary venturi in the barrels of the carburetor

As the primary throttle valves are opened to a pre-determined point, the secondary valves are proportionately opened by direct linkage with the primary throttle shaft These valves begin to open at approximately 80 mph when the throttle is gradually opened, or at much lower speeds when the throttle is opened for performance under load

At this point the air flow through the secondary barrels is sufficient to force the weighted auxiliary valves open, Fig S4, and the main metering system on the secondary side begins to function

Opening of the auxiliary valves is wholly dependent on the air flow through the secondary barrels

NOTE—The main discharge jets and metering jets are of different construction in the primary and secondary sides The primary discharge jet has the open end in the tip of the jet and the metering jet used with it has a plain shank The secondary main discharge jet has a notch tip as shown in Fig S4, and the metering

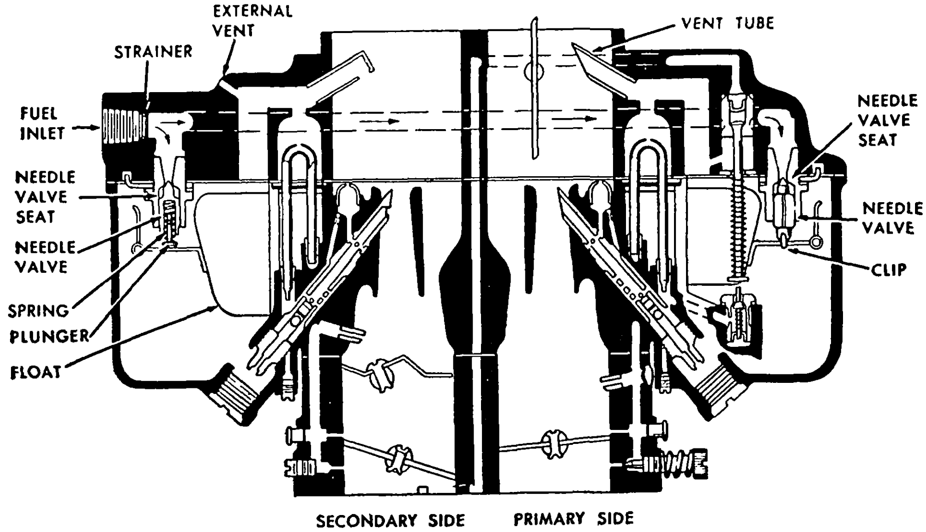


Fig. S1 Float system. Stromberg Series 4A

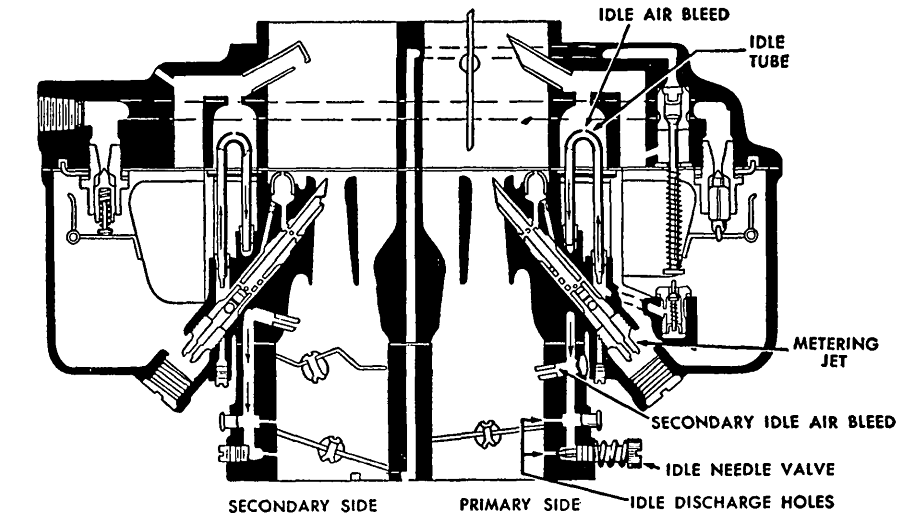


Fig. S2 Idle system. Stromberg Series 4A

jet has a narrow groove around the shank for identification

POWER SYSTEM—Fig S5 For maximum power under load or extremely high speed operation, a richer mixture is required than that necessary for normal throttle operation This additional fuel is supplied by one power system connected to the main metering systems on the primary side

The power piston cylinder in the air horn of the carburetor is connected by a channel to the face of the mounting flange so it is subject to intake manifold vacuum

At part throttle position the vacuum above the power piston is sufficient so that air pressure will hold the piston in its "up" position against the tension of the piston spring

When the throttle valves are opened to a point where manifold vacuum drops to approximately 4½-5 inches of mercury, and additional fuel is required for satisfactory operation the piston spring moves the piston down to open the power by-pass jet as shown in Fig S5 This allows additional fuel to enter the main discharge jets on the primary side through a channel which by-passes the metering jets

ACCELERATING SYSTEM — Fig S6. For smooth and rapid acceleration it is necessary to supply an extra quantity of fuel momentarily when the throttle is opened suddenly This is accomplished by one accelerating pump piston which is directly connected to the primary throttle shaft by means of a rod and pump lever

When the throttle is closed, the pump piston moves up as shown, and draws a supply of fuel from the float chamber through the inlet strainer past the inlet ball check valve and into the pump cylinder

When the throttle is opened, the piston on its downward stroke exerts pressure on the fuel which closes the inlet check valve and opens the outlet check valve A metered quantity of fuel is discharged through the pump discharge nozzles into each barrel on the primary side of the carburetor This occurs only momen-

tarily during the accelerating period.

When the desired speed is reached, and the throttle is held in fixed position, the pressure on the fuel decreases sufficiently so that the outlet check valve closes and fuel ceases to discharge from the pump nozzles.

The pump system operates only on the primary side.

SERVICE ADJUSTMENTS

FUEL LEVEL—The float system is designed for 5 lbs. fuei pump pressure at the fuel inlet and this is essential if fuel level is to be accurately controlled. Fuel level in the primary (front) float chamber should be set at $\frac{11}{16}$" below the top surface of the main body (without the gasket). This dimension corresponds to the bottom of the threads in the fuel level inspection hole on the primary side, which makes it possible to check fuel level by merely removing the plug.

If a float adjustment is necessary, or if the unit has been disassembled for overhaul, proceed as follows:

Invert the air horn and make certain that the float stamped "522" on the lever is assembled on the primary side. Position float setting gauge No. T-25489 on the air horn gasket with the locating buttons on the bottom of the gauge in the two holes along the centerline of the air horn casting. The gauge must rest flat and secure against the casting.

Check the distance between the top center of the float pontoon and the gasket with a $\frac{3}{64}$" drill, Fig. S7. If necessary, bend the float arm near the lever to secure the proper clearance. Make certain the sides of the float pontoons just clear the uprights on the float gauge so there is free movement of the float assembly. The primary side of the air horn is adjacent to the vacuum piston.

The procedure for the secondary side is identical but the fuel level should measure $\frac{5}{8}$" below the top surface of the main body (or to bottom of inspection hole threads). The clearance between the top of the float pontoons and gasket surface must be $\frac{1}{32}$". The secondary float is identified by the number "520" on the float lever.

IDLE TUBES, REPLACE—Under normal service conditions is should not become necessary to remove the idle tubes. Idle channel plugs in the base of the main body provide easy access for cleaning. If the tubes are removed, scrap them and install new tube and wedge assemblies. On the primary side, the outlet side of the tube is longer. Do not damage gasket surface of main body when removing tubes.

To install a new tube, place the positioning tool (T-25525), Fig. S8, across the top of the main body with the flatted sides vertical, and fit the idle tube over it. With the top of the tube held against the tool, slide the wedges down into their respective holes and seat snugly with a hammer and Wedge Driver No. T-25488.

SECONDARY THROTTLE LINKAGE—It is important that the opening of the secondary throttle valves be properly coordinated with the opening of the primary valves. This relationship should be checked at wide open throttle position and at part throttle as follows:

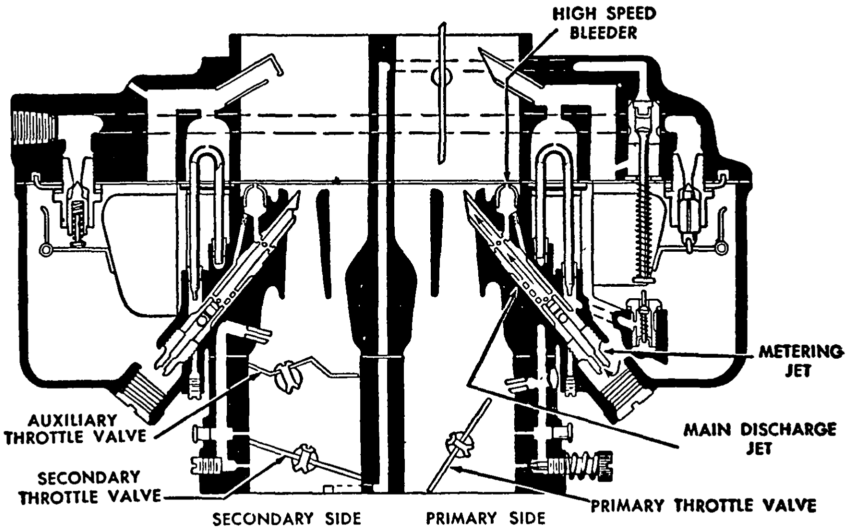


Fig. S3 Main metering system under part throttle operation. Stromberg Series 4A

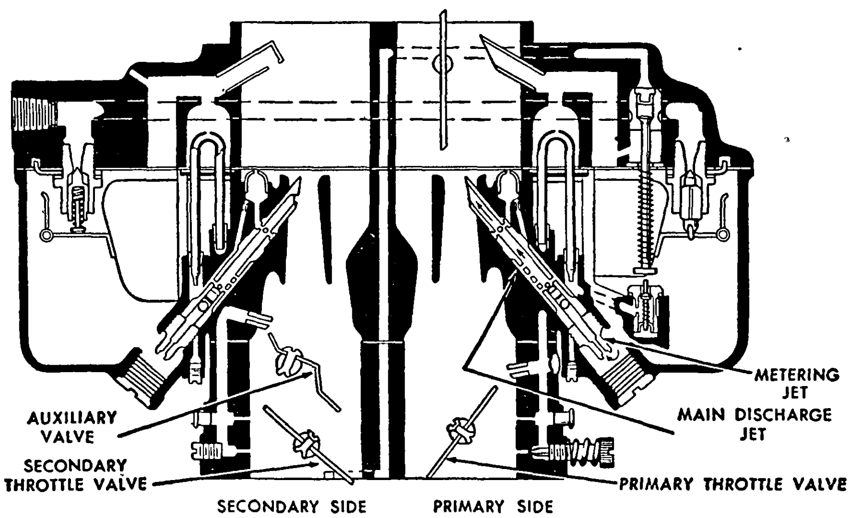


Fig. S4 Main metering system under full throttle operation. Stromberg Series 4A

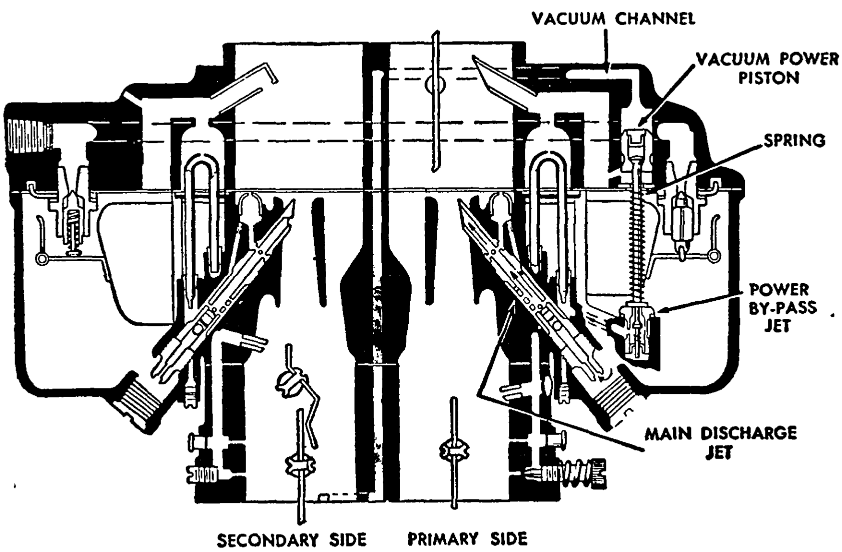


Fig. S5 P wer system. Str mb rg S ri s 4A

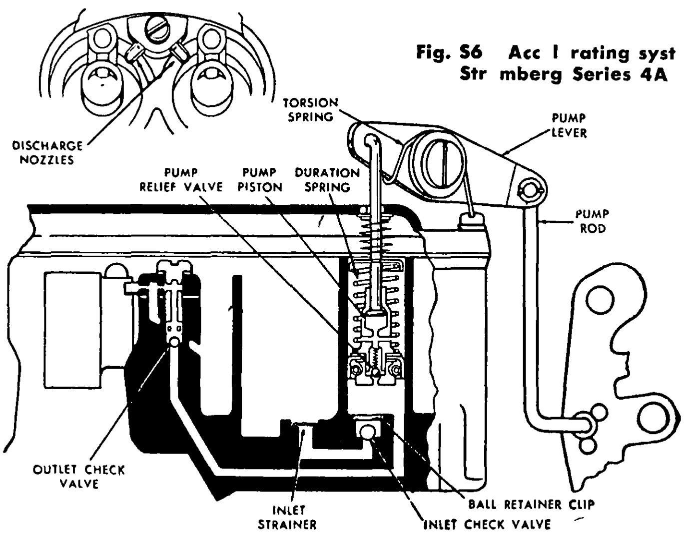


Fig. S6 Acc l rating syst m. Str mberg Series 4A

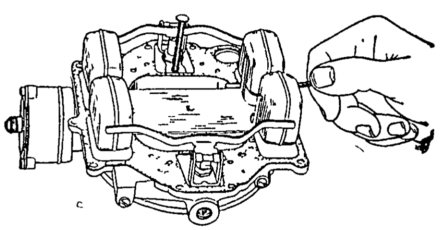


Fig. S7 Gauging float level with drill. Str mberg Series 4A

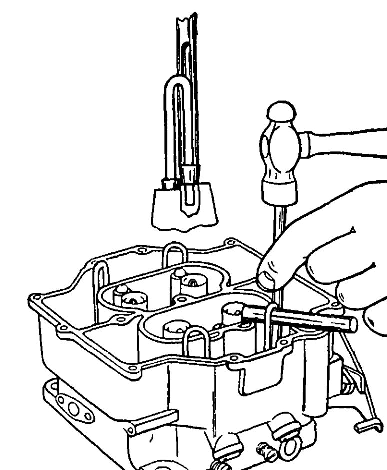


Fig. S8 Installing idle tube. Str mberg Series 4A

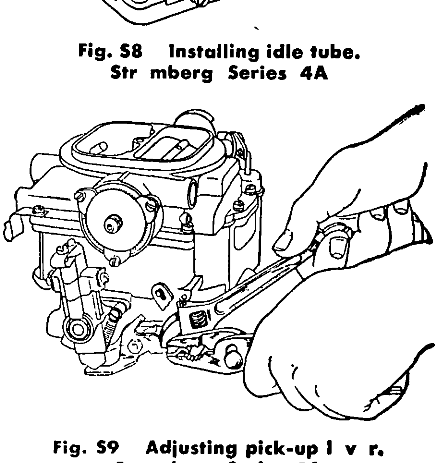


Fig. S9 Adjusting pick-up l v r. Stromb rg Series 4A

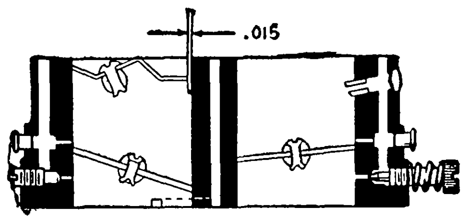


Fig. S10 Auxiliary valve setting. Stromberg Series 4A

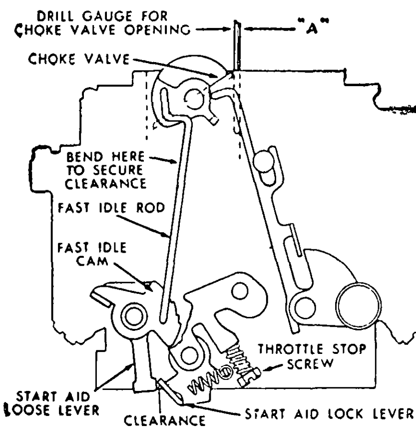


Fig. S11 Fast idle and start aid adjustment. Stromberg Series 4A

Turn the throttle shaft so the primary valves are in wide open position. The secondary valves should also reach wide open position. If the secondary valves fail to reach wide open position or if the secondary shaft lever ear hits the stop on the throttle body before the primary valves are wide open, an adjustment of the pick-up lever is necessary.

To make this adjustment, hold the flat section of the lever with a small crescent wrench, Fig. S9, at a point next to the throttle body and near the throttle shaft. Then use pliers to bend the end of the lever ear up or down as required and recheck valve openings.

For a part throttle check, hold the secondary valves closed and open the primary throttle valves until all slack is taken up in the transfer linkage and the secondary valves are just ready to open. The distance between the lower edge of the primary valves and the throttle barrel wall must be at least .125" and not more than .180". If necessary, bend the throttle control rod at the large bend in the primary end of the rod. The control rod ends should measure $2\frac{11}{16}$" between centers.

After bending the rod or pick-up ear, check both the wide open and part throttle settings.

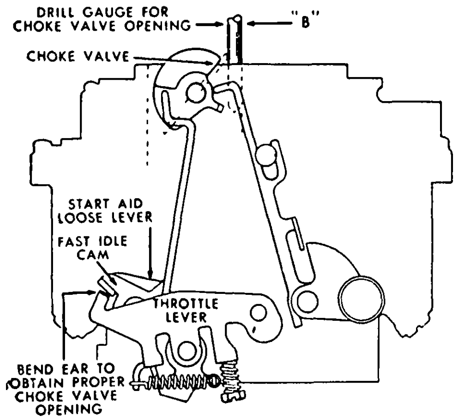


Fig. S12 Wide-open kick adjustment. Stromb rg S ri s 4A

AUXILIARY VALVE SETTING — The auxiliary valves must be positioned on their shaft so that no binding takes place throughout their full travel.

In closed position the inside edge of the valve (the larger side) should be .015" from the barrel wall, Fig. S10 This can be measured with a $\frac{1}{64}$" drill as illustrated.

If the opening is not correct, loosen the valve attaching screws and move the valves to the proper position. Tighten screws, recheck setting and check for free movement.

CHOKE ADJUSTMENTS & SETTINGS FAST IDLE & START AID—Checking the start aid mechanism automatically sets the fast idle cam.

With the air cleaner removed, place a No. 53 drill between the wall of the air horn and the center of the upper edge of the choke valve and hold the valve closed against the drill shank.

Turn the primary throttle shaft toward the open position. The start aid lock lever should just clear the start aid loose lever. If necessary, bend the fast idle rod at the point indicated in Fig. S11, to lengthen or shorten it as required for the proper lever clearance. This, of course, will move the fast idle cam to its proper position. Make certain that the fast idle rod does not bind and the fast idle cam spring is not distorted.

WIDE OPEN KICK—In order to secure the proper choke valve opening for good operation of the wide-open kick feature, move the throttle to the wide open position. The clearance between the center of the top of the choke valve and the air horn wall should be $\frac{7}{32}$". Measure with a No. 2 drill as shown in Fig. S12. If necessary, bend the throttle lever ear indicated, either up or down, to secure the desired choke valve opening.

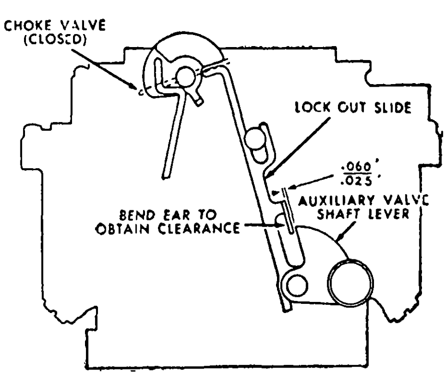


Fig. S13 Lockout slide adjustment with choke valve closed. Str mberg Series 4A

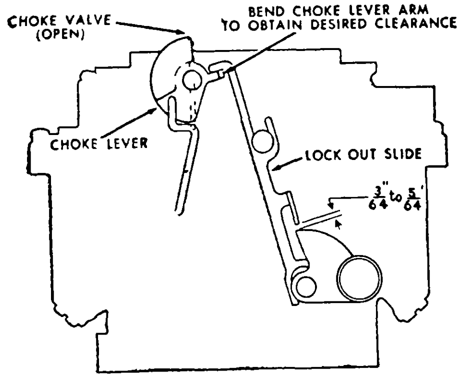


Fig. S14 Lockout slide adjustment with choke valve open. Stromberg Series 4A

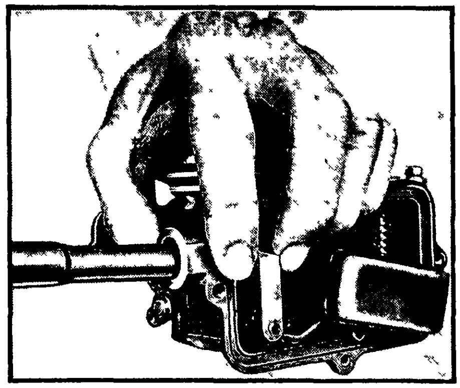


Fig. H2 Removing fl at. Holley Visi-Flo carburet r

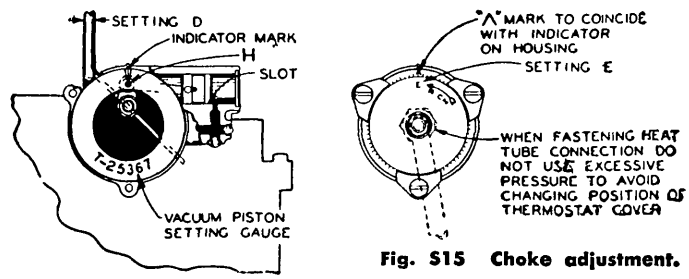


Fig. S15 Choke adjustment. Stromberg Series 4A

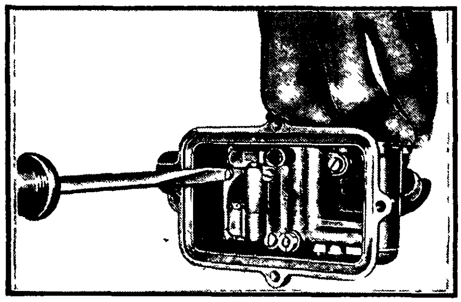


Fig. H3 Removing c mpl te metering unit. Holley Visi-Fl carbur t r

LOCKOUT SLIDE — When the choke valve and auxiliary valves are closed, the slide should be in its "down" position as shown in Fig. S13.

The ear on the slide should be bent so it is not in contact with the weighted lever on the auxiliary valve shaft. A clearance of from .025" to .060" is recommended and this can be checked with a feeler gauge.

When the choke valve is moved to wide open position, the choke lever arm moves the slide to its "up" position, Fig. S14.

When the choke valve is wide open and the auxiliary valves are turned to wide open position, the slide ear must clear the auxiliary shaft lever by $\frac{3}{64}$" to $\frac{5}{64}$". Bend the choke lever arm as required to secure this clearance.

CHOKE VACUUM PISTON—In order to secure the proper choke valve opening when making a cold start, the choke valve piston must be set in correct relationship to the choke valve.

Remove the thermostat cover and loosen the lever attaching nut. Place the piston setting gauge, Fig. S15, in the choke housing so the hole in the gauge fits over the pin on the piston lever.

Turn the gauge so the two indicator lines on its face are aligned with the projection at the top center of the choke housing. Install two lug washers and cover screws to hold the gauge securely in place.

Insert a No. 29 drill between the choke valve and air horn wall and hold the valve closed against the drill shank. Then lightly tighten the piston lever nut. Remove the drill and setting gauge, hold the choke valve tightly closed and tighten the lock nut. Recheck the setting to make sure the adjustment did not slip.

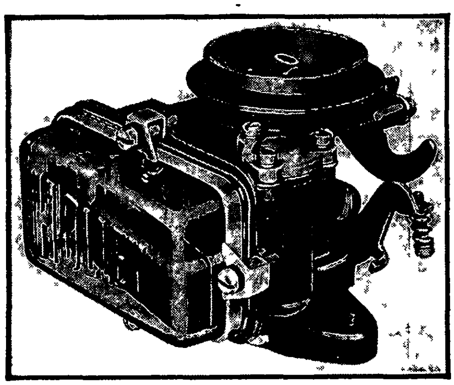


Fig. H1 Holley Visi-Flo carburetor

HOLLEY VISI-FLO CARBURETOR

MODEL 1904

1952 FORD SIX—The fuel bowl of this carburetor, Fig. H1, is made of clear glass. This feature permits the observance of the fuel level in order to check for sediment or water in the gasoline, uninterrupted fuel flow, flooding and action of the float.

From a service standpoint, all the important metering parts are contained in one complete assembly. The glass fuel bowl and replaceable metering unit reduce carburetor overhaul to four simple steps:

1. Examine fuel level and condition of float. Remove glass bowl.
2. Remove complete float unit (one screw), Fig. H2.
3. Remove complete metering unit (five screws), Fig. H3.
4. Replace worn parts and reassemble.

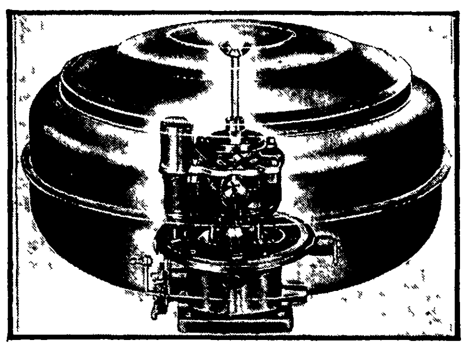


Fig. H4 Holley Centri-Flo carbur t r

HOLLEY CENTRI-FLO CARBURETOR

MODEL 1901

1952 LINCOLN & MERCURY—Fig. H4. This unit is a concentric carburetor with a fully insulated fuel bowl. All metering parts are located at the center line of the fuel bowl. The fuel bowl is entirely surrounded by air and is located away from the engine heat, thus preventing percolation.

Service on the unit is similar to the Holley carburetors used formerly on these cars and which is described in the carburetor section of this manual.

SAGINAW

1952 BUICK, CADILLAC, OLDSMOBILE

THE unit consists of a conventional manually operated steering gear to which hydraulic power mechanism has been added. The hydraulic mechanism furnishes additional power to *assist* the manual operation so that the turning effort required at the steering wheel is greatly reduced.

The engine drives the oil pump which furnishes hydraulic pressure. When the engine is not running, or when any part of the power mechanism is inoperative, steering is entirely manual and requires approximately the same effort at the steering wheel as the conventional manual gear.

With the engine running, steering is entirely manual under conditions which require an effort of less than four pounds at the steering wheel rim. When a greater effort is required, the power mechanism operates to *assist* in turning the front wheels. The effort then required at the steering wheel rim is thereby limited to a maximum of approximately nine pounds for normal steering and parking conditions, compared to possibly 50 pounds with the conventional manual gear. If some abnormal condition requires more work than the power mechanism can do, the driver must assist with increased effort on the steering wheel.

The driver's effort on the steering wheel is always proportional to the force necessary to turn the front wheels. When the effort on the wheel drops to less than four pounds as the turn is completed, power assistance ceases. When the wheel is released to recover from the turn, the front wheels may return to the straight ahead position in the usual manner without assistance or interference from the power mechanism. Through this conventional steering action the driver always has the "feel" of steering which is essential to confidence in controlling the direction of the car.

It should be noted that power steering always follows the manual steering action. *No steering action is obtained except through the manual guidance of the driver.*

POWER STEERING UNITS

The hydraulic power mechanism added to the steering gear includes a power cylinder and rack connected to a separate gear sector on the steering gear pitman shaft, a hydraulic valve mounted concentric with the steering worm shaft and operated by the shaft, a high pressure oil pump driven by a belt from the engine, an oil reservoir, and connecting pipes and hoses.

POWER STEERING GEAR ASSEMBLY

As shown in Fig. 1, the upper end of the pitman shaft is extended and provided with a separate gear sector which meshes with a power rack mounted in the gear housing. The power rack is pinned to the piston rod of the power cylinder, mounted on the rear side of the gear housing, and is held in proper mesh with the pitman shaft sector by a guide attached to a shim-adjusted housing cover (not shown).

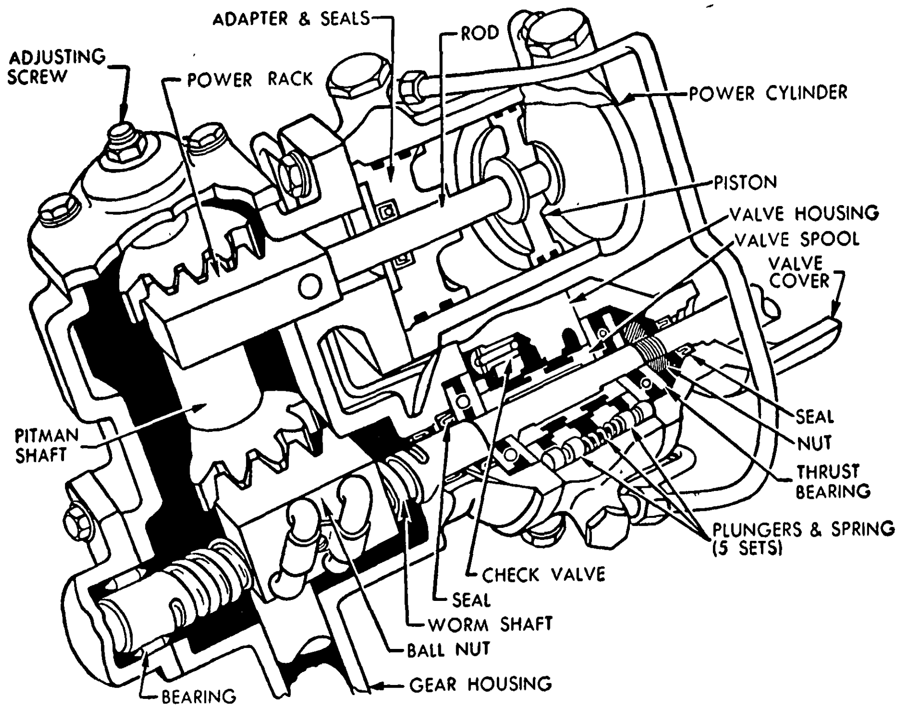


Fig. 1 Saginaw power steering gear assembly

The power cylinder is a double acting type since oil pressure may be applied to either side of the piston through external tubes connected to the hydraulic valve (described later).

An adapter closes the inner end of the cylinder and provides a bearing for the piston rod. The two outer grooves in the circumference of the adapter contain "O" ring rubber seals, and the bore is fitted with a spring loaded rubber seal to prevent escape of oil at the piston rod.

Normal seepage of oil through the bearing is held back to the hydraulic valve through passages in the adapter and cylinder connected to an external tube.

The housing has one central annular groove connected to the oil pump and two outer annular grooves connected to the reservoir.

A valve spool, having a very close sliding fit in the valve housing, is mounted concentric with the worm shaft and between the worm thrust bearings so that it moves with these parts. The spool contains two annular grooves which control the flow of oil between the grooves and oil passages in the housing.

The housing contains five equally spaced *pairs* of centering plungers which are forced outward against the gear housing and the valve cover by a heavy coil spring located between the plungers. The worm thrust bearings contact the plungers so that axial movement of the worm shaft is opposed by the plungers and springs.

The worm shaft and thrust bearings will move the spool endwise in the valve housing, permitting oil flow to the power cylinder, whenever the thrust load on the worm shaft is sufficient to overcome the preload of the centering springs. The resulting control of the power mechanism will be explained later.

A check valve mounted in the valve housing permits the oil displaced by the power cylinder piston to by-pass the oil pump during manual operation whenever the oil pump is not operating. It also prevents oil from overflowing through the reservoir vent under the same conditions.

OIL PUMP

The oil pump, which is mounted on the engine in position to be driven by a belt from the crankshaft pulley, converts some engine power into oil pressure which is used by the power cylinder and rack to rotate the pitman shaft.

The Eaton rotor pump and the Vickers balanced vane pump are optionally used, Fig. 2, to assure adequate supply for production and service.

The Eaton pump houses a drive rotor meshed with a driven rotor which rotates on a different center. As these parts rotate, the pockets formed between them increase and then decrease to propel the oil from entrance to exit ports of pump.

The Vickers pump houses a slotted driving hub or rotor in which twelve vanes slide radially outward to contact the hardened and ground inside surface of a ring. As the shaft and rotor rotate, centrifugal force and fluid pressure against the inner ends cause the vanes to follow the cam contour of the ring, which is so shaped that two opposing pumping chambers are formed. In each pumping chamber, the increasing and decreasing pockets formed between the rotor, vanes, and ring propel the oil from the entrance to the exits ports of the pump.

Both optional pumps contain an overload relief valve which is set to open at 750 psi (pounds per square inch) and a flow control valve which recirculates oil within the pump as required to regu-

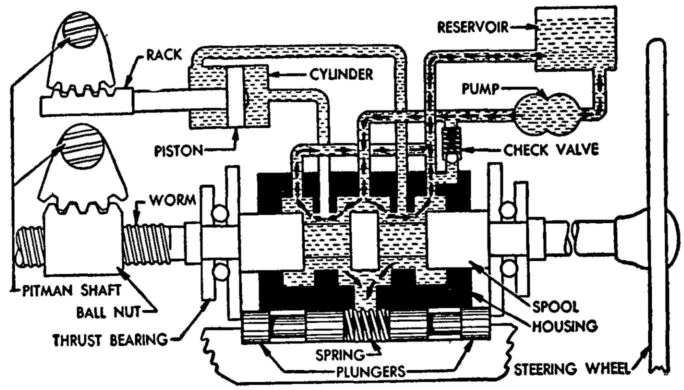


Fig. 3 Oil circulation without power application

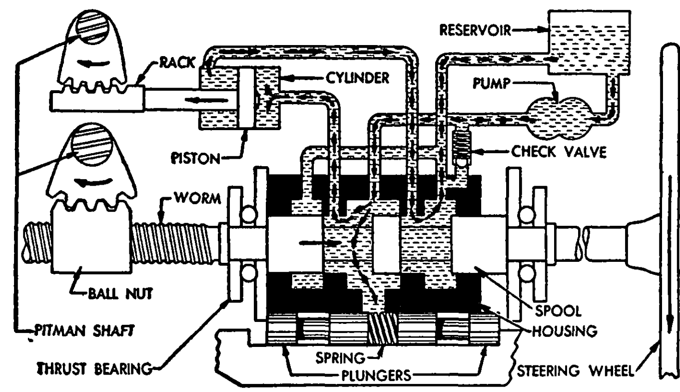


Fig. 4 Oil circulation during power applicati n n a left turn

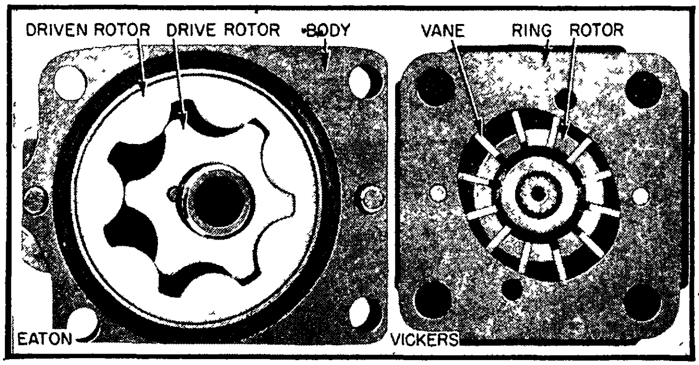


Fig. 2 Eaton and Vickers pumping elements

late the output volume to approximately 1½ gallons per minute at all operating speeds.

RESERVOIR

The reservoir is mounted on the engine at a higher level than the pump. The filler plug is vented and is provided with an oil level gauge rod. The reservoir contains a fine mesh screen of large area. The reservoir provides a reserve supply of oil to assure complete filling of the hydraulic system, and the vented filler plug permits escape of any air that may be introduced into the system during assembly of the various units.

PIPES AND HOSES

Two pipes provided with flexible hoses connect the reservoir to the oil pump. A pressure line hose and a return line hose connect the oil pump to the hydraulic valve. The pressure line hose is reduced in size at the valve end to provide a dampening effect on any turbulence in the oil stream. The same hoses are used with the Eaton and Vickers oil pump, but the small reservoir inlet pipe and hose assembly is different for each pump.

LUBRICANTS

The hydraulic units are filled with the same oil as specified for Dynaflow and Hydra-Matic transmissions. The steering gear housing is filled with regular steering gear lubricant.

OPERATION OF HYDRAULIC MECHANISM

When the steering wheel is turned, the ball nut must move axially along the worm shaft in order to rotate the pitman shaft and thereby turn the front wheels through the connecting linkage.

Movement of the ball nut is opposed by the force necessary to turn the front wheels, consequently the worm shaft tends to move endwise through the ball nut. The ball nut and worm shaft act like a screw jack to thrust a load against one worm thrust bearing, tending to move the bearing.

Movement of the thrust bearings (and worm shaft) is opposed by the centering plungers and springs in the hydraulic valve, therefore the thrust load must exceed the 300 pound total preload of the five centering springs before the worm shaft can actually move endwise.

A pull of four pounds on the steering wheel rim produces a thrust load of 300 pounds, consequently the worm shaft will move endwise only when the force necessary to turn the front wheels requires an effort of more than four pounds at the steering wheel.

Since movement of the hydraulic valve spool is controlled by the worm shaft and thrust bearings, it remains in the neutral or centered position in the valve housing, Fig. 3, whenever the effort applied to the steering wheel is less than four pounds.

With the valve spool in the centered position, oil merely circulates from the pump through the valve and reservoir without having any effect on the steering operation.

Although the power cylinder is filled with oil, there is no interference with manual steering because the oil displaced by the piston can flow from one side of the piston to the other through the hydraulic valve.

When the steering wheel is turned *left* with an effort greater than four pounds, the resulting thrust load compresses the centering springs, and the worm shaft moves the spool upward in the valve housing. The spool then routes the oil flow from the pump into the upper end of the power cylinder, Fig. 4. The passage to the lower end of the power cylinder is left open for return of oil to the reservoir.

Flow of oil into the power cylinder is resisted by the piston because of its connection to the pitman shaft. The oil pump then builds up just enough pressure to overcome this resistance so that just enough power is applied to rotate the pitman shaft.

Since the pitman shaft is also geared to the ball nut on the worm shaft, it is obvious that the pitman shaft cannot turn unless the steering wheel is also turned. Thus, power steering cannot be applied without manual steering.

As the pump pressure builds up, oil pressure is also directed against the inner end of the centering plungers, Fig. 4. This pressure, added to the centering spring preload, tends to force the spool back to the neutral position.

Since the pump pressure builds up in proportion to the force necessary to turn the front wheels, the corresponding pressure on the plungers creates a reaction that must be overcome by effort on the steering wheel. In this way, the effort required at the steering wheel is regulated in proportion to the resistance of the front wheels, giving the "feel" of steering previously mentioned.

The effort on the steering wheel naturally drops to less than four pounds as the turn is completed; therefore, the centering springs and plungers return the valve spool to the centered position, thereby cutting off application of oil pressure to the power cylinder.

When the spool returns to the centered position, steering becomes entirely manual. The oil merely circulates through the hydraulic valve as previously described and the oil pressure drops because there is virtually no resistance to oil flow.

Power steering on a right turn is accomplished in the same manner described for a left turn except that the worm thrust is in the opposite direction. Therefore, the valve spool moves down to route oil to the lower end of the power cylinder so that power will be applied to turn the pitman shaft in the opposite direction.

When the front wheels strike an obstruction which kicks them to the left, the force is transmitted through the steering linkage and pitman shaft to

exert a downward thrust on the ball nut and worm shaft, which is opposite to the direction of thrust when the steering wheel is turned left. If the thrust load exceeds 300 pounds, the valve spool will move down to route oil flow to the lower end of the power cylinder, thereby applying opposing power to counteract the leftward movement of the front wheels. The opposite action takes place when the wheels are kicked to the right. In this manner, the power mechanism counteracts road shock before it is transmitted to the steering wheel.

The check valve, located in the hydraulic valve housing, remains closed when the oil pump is operating. When the oil pump is not operating, and the steering gear is operated manually, the check valve opens to by-pass the pump so that oil can flow from one end of the power cylinder to the other as the piston moves back and forth. This feature also prevents overflowing of oil through the reservoir vent.

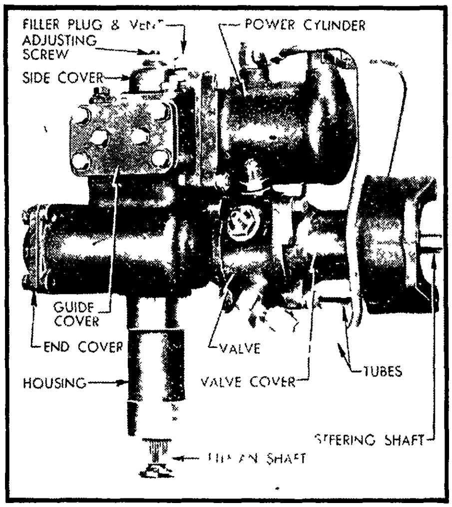


Fig. 5 Left side of Saginaw power steering gear assembly

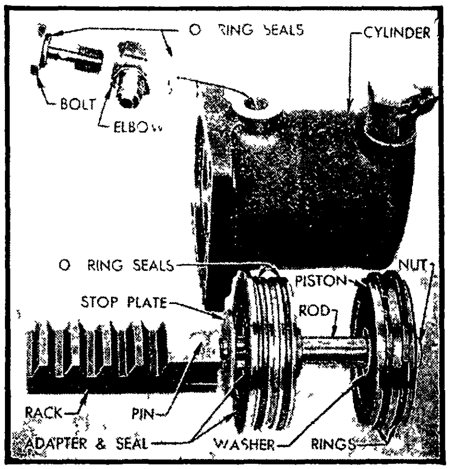


Fig. 6 Saginaw power cylinder and rack parts

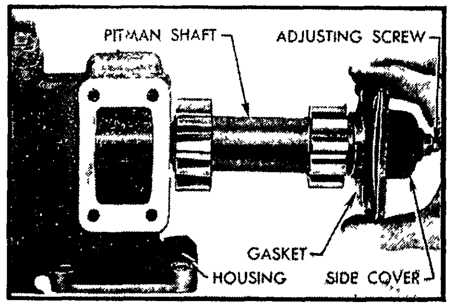


Fig. 7 Removing pitman shaft and side c ver

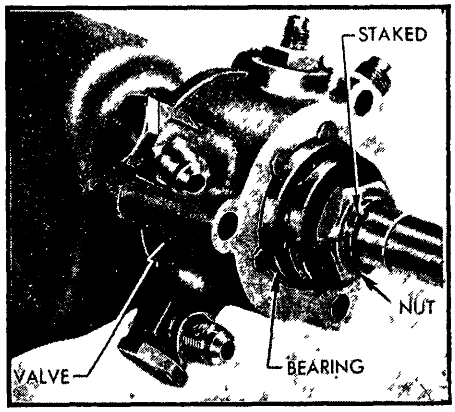


Fig. 8 Detail of thrust bearing and nut

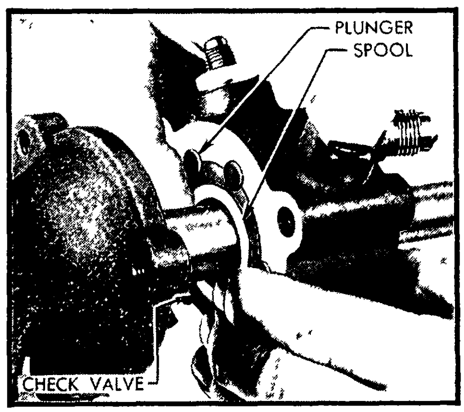


Fig. 9 Removing valve ass mbly

STEERING GEAR SERVICE

NOTE—The special tools illustrated with the following text may be obtained through the Kent-Moore Organization, General Motors Building, Detroit, Michigan.

DISASSEMBLY

1 Remove column jacket, transmission control shaft, and horn cable.
2. Thoroughly clean exterior of gear assembly. Then remove filler plug and drain lubricant from gear housing. Remove hoses and hydraulic valve-to-power cylinder tubes and drain oil from valve and cylinder.
3. Turn steering shaft clockwise as far as possible and remove four corner bolts *only* from power rack guide cover, Fig. 5. Remove cover and guide assembly and all cover shims. Remove power cylinder and rack assembly and gasket from gear housing.
4. Remove bolts and elbows from power cylinder. Push rack up to adapter. Then pull it sharply away to hammer the piston against adapter. It may be necessary to repeat this several times to break the grip of rubber seals between adapter and cylinder so that rack and piston can be removed, Fig. 6.
5. Remove nut, piston, thrust washers, adapter and stop plate from piston rod.
6. Turn steering shaft counterclockwise to move the ball nut to its approximate center position. Then remove gear housing side cover and gasket with pitman shaft attached, Fig. 7.
7. Remove adjusting screw to separate pitman shaft from side cover and take adjusting screw and shim from shaft.
8. Remove hydraulic valve cover. Drive up edge of worm bearing nut where staked into worm shaft keyway, using suitable punch. Then remove nut and thrust bearing, Fig. 8.
9. With steering shaft horizontal, remove hydraulic valve assembly, Fig. 9, using care to keep spool and plungers from falling out. Remove lower thrust bearing from gear housing.
10. Check valve spool and centering plungers for possible sticking in valve housing, Fig. 10. Then carefully remove these parts and centering springs. Remove check valve and all unions and elbows. *Place spool and plungers where they will not be damaged by contact with other parts.*
11. Remove gear housing end cover and gasket. Then remove steering shaft and ball nut from gear housing.
12. Remove clamp and ball return guides from ball nut, turn nut over to remove all balls and remove ball nut from steering shaft worm.

INSPECTION OF PARTS

1. Wash all parts in clean kerosene or other solvent and wipe dry with clean, lint-free cloth.
2. Inspect steering shaft for wear or brinnelling in ball and needle bearing races, which would require replacement of shaft. Check shaft to make sure it is straight.
3. Inspect teeth of ball nut and all sector teeth of pitman shaft. If teeth are excessively worn or scored, replace the part. Replace pitman shaft if serrated end is twisted.
4. Check fit of pitman shaft adjusting screw and shim in slot in end of pitman shaft. *With shim in place, screw head must be free to turn in slot with no perceptible end play to .002" loose.* If end play is excessive, selectively fit a new shim, which is furnished in four different thicknesses.
5. Inspect pitman shaft bushings in gear housing and side cover. Replace bushings in housing and cover assembly if bushings are worn excessively.
6. Remove worm seal from gear housing with a punch and use the tool shown in Fig. 11 to install *a new*

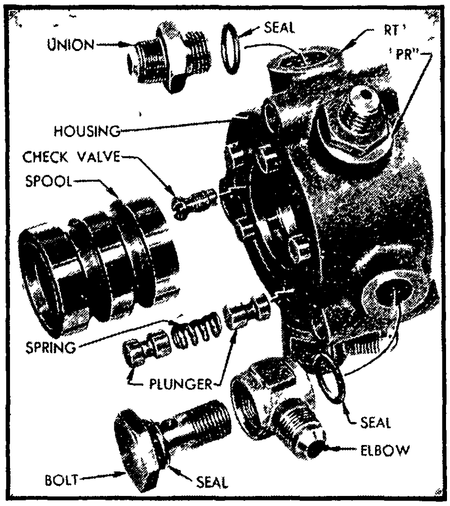


Fig. 10 Lay ut of hydraulic valve parts

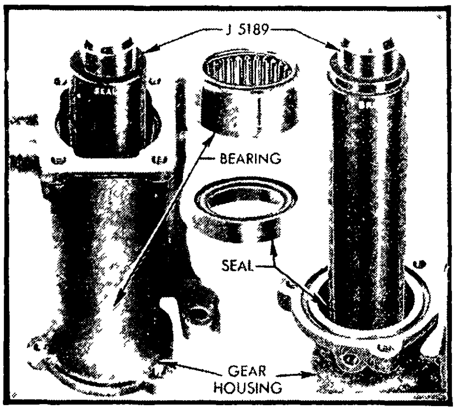


Fig. 11 Installing bearing and seal in valve housing

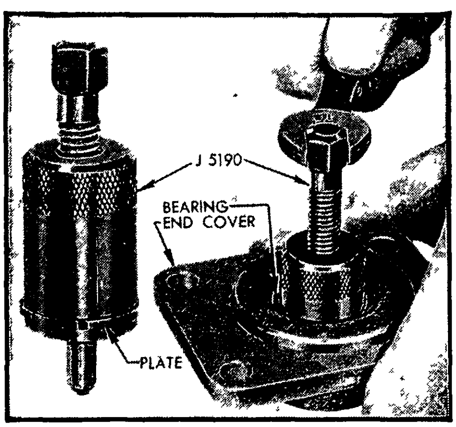


Fig. 12 R m ving bearing from end cover

seal with spring side outward.

7. If worm bearing in housing requires replacement, drive it out with a punch and use the tool shown in Fig. 11 to install the new bearing.
8. If the worm bearing in the housing end cover requires replacement, insert the tool shown in Fig. 12 into the bearing and turn the screw, which will expand two plates under the bearing and will then force the

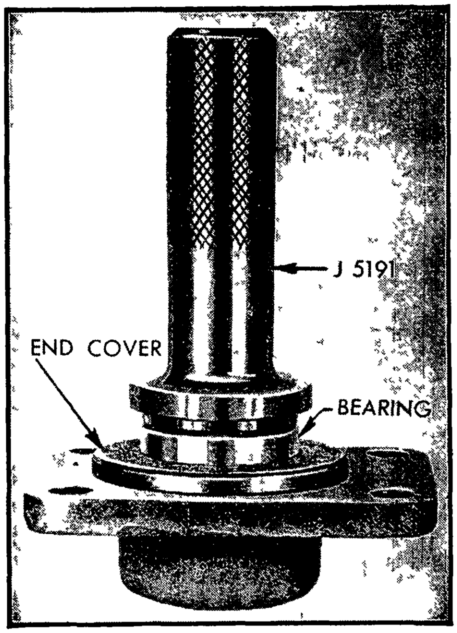


Fig. 13 Installing bearing in end cover

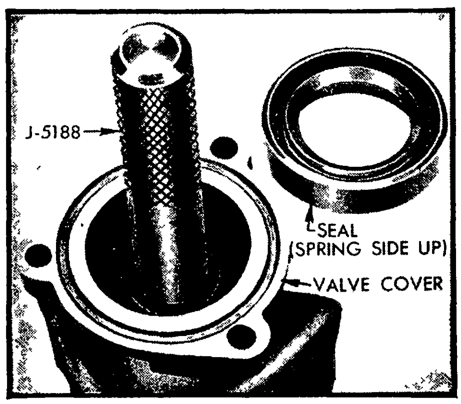


Fig. 14 Installing valve cover seal

tool and bearing out. Install new bearing with the tool shown in Fig. 13, which has a shoulder to locate the bearing at proper depth in cover.

9. Replace pitman shaft seal, installing new seal with feather edge toward inside of gear housing.
10. Inspect oil shedder and control shaft bearing in valve cover. If bearing is at all doubtful replace it.
11. Inspect piston rod, teeth and guide bearing surface of power rack, and rack guide for excessive wear or scoring. If necessary to replace piston rod or rack, drive out coupling pin and use new pin to connect new parts. Stake rack at three places on each side to retain the pin, and file down burrs raised by staking.
12. Inspect power cylinder bore for scores or other damage. Inspect piston rings for scores or breaks. Inspect seal in power cylinder adapter. If seal is worn or damaged, replace adapter assembly (the seal is not furnished separately for service).
13. Inspect valve housing, spool, and centering plunger for scores, nicks

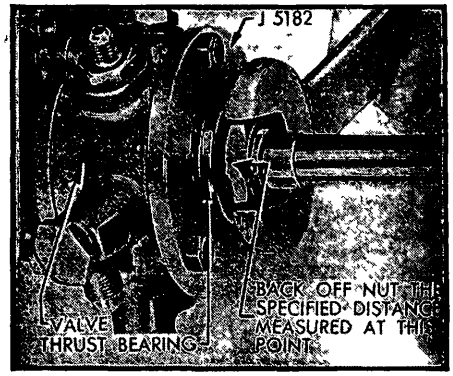


Fig. 15 Adjusting worm thrust b arings

or burred edges. Replace damaged parts and make sure that spool and plungers slide freely in housing

14. Test the check valve by blowing through both ends. Ball should seat when blowing through small end, and allow passage of air when blowing through slotted end of valve body.
15. Remove seal from valve cover with a punch, and use the tool shown in Fig. 14 to install a new seal *with the spring side of seal outward* toward shoulder of tool.
16. Inspect steering column jacket for distortion. A rippled or wavy feeling of jacket surface, particularly at lower end, will usually indicate a sprung jacket. Replace jacket if sprung or otherwise damaged.

ASSEMBLY OF STEERING GEAR

NOTE—Make sure all parts are absolutely clean, and lubricate parts with clean engine oil during assembly.

1. Place steering shaft on bench with upper end to your right, then install ball nut on worm so that when teeth are uppermost the *deeper side* of teeth are toward you. Install 30 balls in each circuit of the worm, nut and return guides, and install guide clamp.
2. Run ball nut to upper end of worm, then install steering shaft in gear housing, using care to avoid damaging worm seal in housing. Install end cover with new gasket.
3. Install lower thrust bearing over steering worm with the large race outward, and place a new "O" ring seal in groove in face of gear housing.
4. Install check valve in valve housing and tighten securely (see Fig. 10). Install valve spool. Install centering springs and all plungers with the narrow lands outward. The valve spool and plungers are a close fit in housing and must be started carefully to avoid jamming. *Do not force these parts into place.*
5. Install hose unions with *new* "O" ring seals, placing union with smaller outer threads in valve housing port marked "PR" and other union in port marked "RT". Install elbows and bolts at the other ports with *new* seals on both sides of each elbow. *Do not tighten these parts at this time.*
6. With steering shaft horizontal, in-

stall valve assembly *with check valve toward gear housing,* using care to keep parts from sliding out of housing.

7. Support steering gear in vertical position, move valve housing around to make sure that thrust bearing balls are seated in races. Then align the large (RT) union with the left edge of cylinder flange on gear housing. Install Valve Cover Adapter J-5182, Fig. 15, with valve cover bolts, center valve spool around worm shaft and tighten bolts securely.
8. Install upper thrust bearing with large race toward hydraulic valve, making sure that balls are seated in races, and install a *new* worm bearing nut.
9. Install steering wheel and turn counterclockwise until centering springs are fully compressed, due to the pressure of the ball nut against the end cover. Hold wheel and tighten worm bearing nut just enough to seat thrust bearings against valve spool, then back off nut $\frac{1}{16}$" to $\frac{3}{32}$" measured at corner of nut hex. Stake outer edge of worm bearing nut down into keyway of worm shaft, making sure that nut does not turn from its adjusted position. The thrust bearing adjustment procedure seats the thrust bearings against all centering plungers but leaves approximately .001" clearance between bearings and spool to avoid the possibility of binding the spool in valve housing.
10. Remove Adapter J-5182 and place Protector J-5189 over threaded end of steering shaft. Place a *new* "O" ring seal in groove of valve cover and install cover. With open side of cover facing right side of steering gear install cover bolts and lockwashers and tighten securely.
11. Place adjusting screw and shim in slot of pitman shaft, install side cover with new gasket, and install lock nut finger tight on screw.
12. Place gear assembly on left side, turn steering shaft until ball nut teeth are centered on pitman shaft bushings and tilt nut slightly toward side cover opening, Fig. 16. Hold pitman shaft with gear sectors straight down as it is installed in gear housing, using care to avoid damaging pitman shaft seal in gear housing as shaft is pushed through it. Install side cover and tighten bolts securely.
13. Install steering wheel and turn slowly through full range to check for free action. Then turn wheel back to midway position to center the ball nut on the central "high point" of pitman shaft sector.
14. Turn pitman shaft adjusting screw clockwise until lash between ball nut and pitman shaft sector is just removed and tighten lock nut.
15. Turn steering wheel two turns right or left from center. Apply a suitable spring scale to a spoke at rim of wheel and, while pulling scale at 90 degrees to the spoke, check the pull required to turn the wheel steadily in the range *where lash normally exists.*

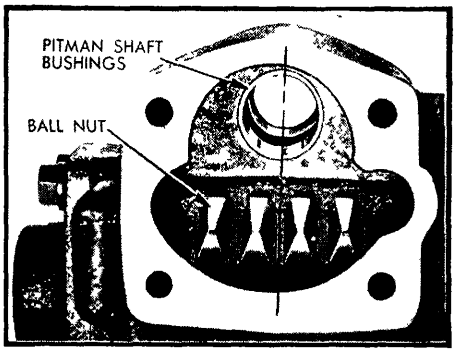


Fig. 16 Position of ball nut for installation of pitman shaft

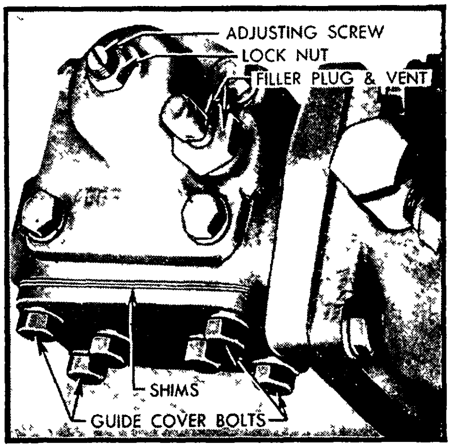


Fig. 17 Lash adjusting screw

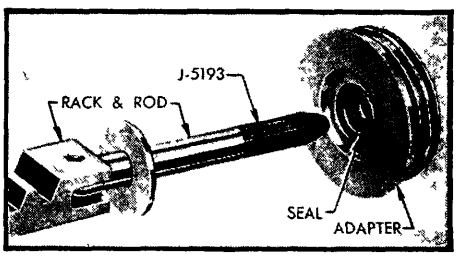


Fig. 18 Application of special rod inserter

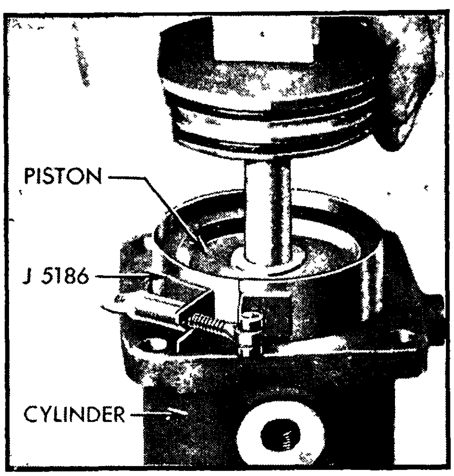


Fig. 19 Installing piston with ring compressor

16. Turn steering wheel back to near center and again use the scale to check the pull required to turn the wheel steadily through the "high point" or no-lash range.
17. The pull through the "high point" should be ½ to ¾ pounds greater than the pull in the lash range. Turn adjusting screw, Fig. 17, as required to obtain this difference in pull after lock nut is securely tightened. Record the final scale reading for use later.
18. Install new "O" ring seals in both grooves of power cylinder adapter. Place stop plate on piston rod. Then install Rod Inserter J-5193, Fig. 18, to protect the seal as rod is pushed through seal and adapter. Install thrust washer, piston with rings, thrust washer, and safety nut on piston rod and tighten securely.
19. Use Ring Compressor J-5186, Fig. 19, to compress the piston rings, then install piston and adapter in power cylinder. It may be necessary to tap the end of power rack with a soft mallet to push rings through compressor and into cylinder. Tap adapter down flush with cylinder flange.
25. Install horn cable contact on steering shaft with outer edge 5" from face of valve cover and notch for cable aligned with hole in shaft. Install horn cable and terminal assembly and solder cable into notch in the contact, using rosin flux. Make sure that contact surface is free of flux and solder.
26. Place Bearing Protector J-5159, Fig. 21, over end of steering shaft. Install steering column jacket and transmission control shaft assembly, using care to avoid damaging the fabric control shaft bearing in valve cover.
27. Remove unions from hydraulic valve and fill valve as completely as possible with Automatic Transmission Oil, Type A. Then install and tighten unions. Attach pressure and return line hoses, fill them with oil and install shipping plugs in open ends.
28. Remove both elbow bolts from power cylinder and fill cylinder and tubes with Automatic Transmission Oil, Type A, then install and tighten elbow bolts securely.

NOTE—It is desirable to fill the valve, tubes and cylinder as completely as possible to exclude air which would have to be bled out after gear assembly is installed in car. Rapping the valve and cylinder with a soft mallet during the filling operation will aid in eliminating air pockets.

29. Fill the gear housing to filler opening with specified gear lubricant for synchromesh transmissions and install filler plug with vent.

SERVICE OPERATIONS ON CAR

LUBRICARE (1000 MILES) — Thoroughly clean surrounding area before removing filler plugs to avoid entrance of dirt. Remove reservoir filler plug, wipe off the attached gauge rod, insert rod in reservoir *with plug seated on edge of filler opening.* Remove plug and check oil level, which should be at mark

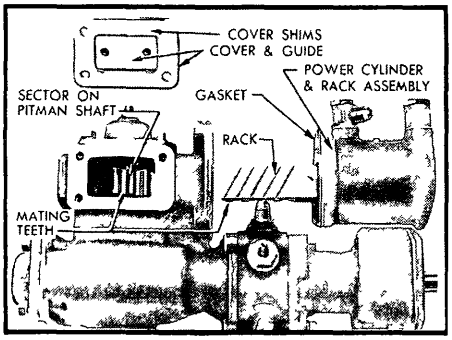


Fig. 20 Position of rack and sector for installation of power cylinder

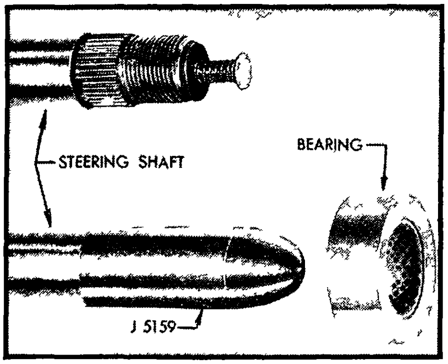


Fig. 21 Use of steering shaft bearing protector J-5159

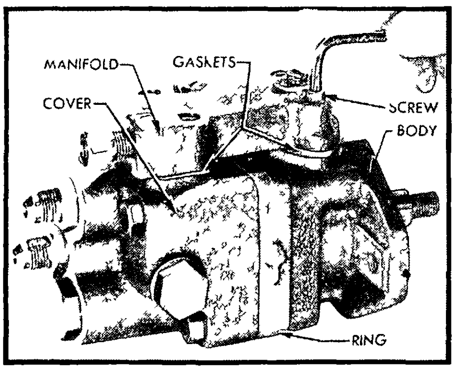


Fig. 22 Removing manifold from Vickers pump

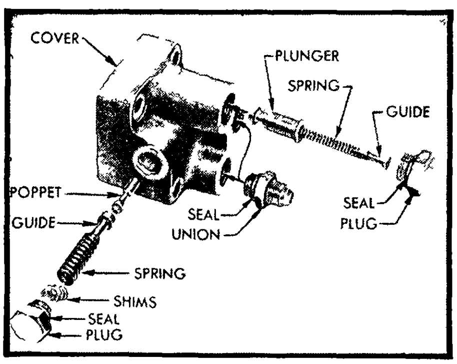


Fig. 23 Relief and flow control valve parts of Vickers pump

on rod Add Automatic Transmission Oil, Type A, as required to bring oil level to mark on rod

Remove gear housing filler plug with attached vent and add lubricant up to filler opening, using gear lubricant specified for synchromesh transmissions *Do not fill with pressure because lubricant may be forced through worm and piston rod seals into the hydraulic system*

PUMP DRIVE BELT ADJUSTMENT—The pump drive belt has proper tension when one side can be depressed ⅜" (Buick), ⅞' on Cadillac and Oldsmobile, with thumb pressure applied midway between pulleys

To adjust belt, loosen pump mounting bolts and move pump horizontally as permitted by the slotted bolt holes in mounting bracket Then tighten bolts securely

BLEEDING HYDRAULIC SYSTEM

After a pump or steering gear is installed, or a disconnected oil line is reconnected all air that entered the hydraulic system must be bled out, otherwise noisy and unsatisfactory operation will result While some air will bleed out during operation of the steering gear this is not dependable The following procedure must be performed to assure complete elimination of all air

1 After connecting all hoses and filling reservoir to proper level, let the job set for five minutes with engine shut off If a Vickers pump is installed, remove pipe plug from top of pump manifold and when oil starts to flow out of opening install plug just tight enough to prevent oil from flowing out Then wait five minutes (Eaton pumps do not have pipe plug)
2 Start engine and run it at approximately 1000 rpm for two or three minutes Then turn steering wheel from one extreme to the other until all air is worked out as evidenced by operation of the oil pump at a normal noise level
3 In some cases it may be necessary to repeat the setting, engine running and steering operations to eliminate all air Tighten the plug in the Vickers pump manifold when bleeding operations are completed

PITMAN SHAFT & POWER RACK ADJUSTMENTS

1. Disconnect pitman arm from steering tie rod and check tightness of pitman arm nut with an 18" wrench.
2. Turn steering wheel slowly through its full travel to check for binding, which would indicate misalignment of steering gear in mountings Any binding due to misalignment must be corrected before adjustments can be properly made
3. Remove filler plug with vent attached and use a clean oil gun to draw out approximately ¾ pint of lubricant from gear housing
4. Loosen four corner bolts of power rack guide cover just enough to assure lash between power rack and pitman shaft If bolts are loosened too much, rack will bind on sector teeth
5. Adjust ball nut to pitman shaft lash and power rack to pitman shaft lash

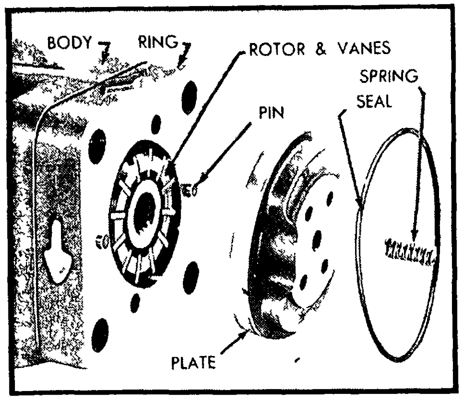


Fig. 24 Pressure plate, ring, rotor and vanes of Vickers pump

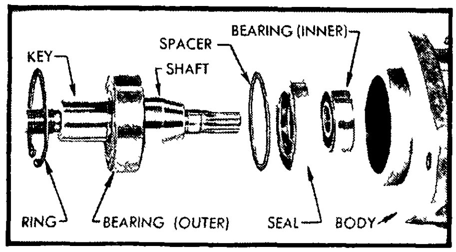


Fig. 25 Drive shaft, bearings and seal of Vickers pump

as described previously during steering gear assembly procedure

6 Fill gear housing to filler opening with proper lubricant
7 Connect steering tie rod to pitman arm, turn tie rod plug up solid, back off two turns and install cotter pin

SERVICING OIL PUMP

1. When removing the pump, use plugs and caps to cover the hose connectors and unions on pump, and plug open ends of pressure and return line hose to avoid entrance of dirt
2. When installing the pump, connect the pressure hose line marked "PR" on pump end to the union installed in pump port marked "PR" On the Eaton pump this union is the one nearest engine but on the Vickers pump it is the one farthest from engine
3. Connect the return line hose marked "RT" on pump end to the other union on pump This pump port is marked "RT"
4. Connect the two reservoir line hoses to pump Then fill reservoir to proper level and bleed the hydraulic system as previously described

NOTE — The small reservoir-to-pump pipe and hose assembly, the drive belt, and the pump pulley used with the Eaton pump are different from the corresponding parts used with the Vickers pump If it becomes necessary to replace an Eaton pump with a Vickers, or vice versa, the three parts listed must also be changed

SERVICING VICKERS PUMP

DISASSEMBLY—1 With all inlet and outlet ports plugged and capped to avoid entrance of dirt, thoroughly

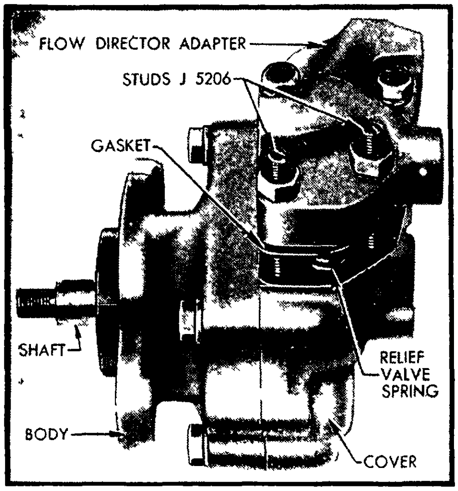


Fig. 26 R m ving adapter with sp cial studs from Eaton pump

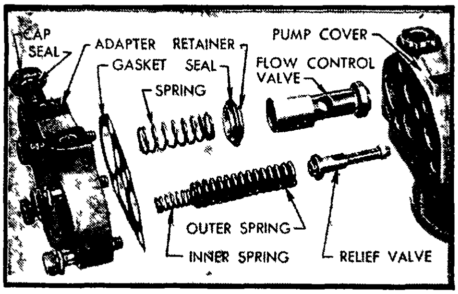


Fig. 27 Lay ut of relief and flow c ntr l valv s of Eaton pump

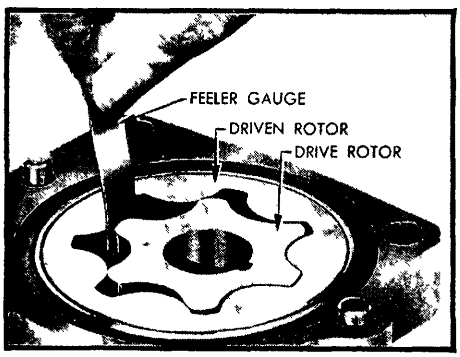


Fig. 28 Ch cking clearance b tw n r t rs of Eaton pump

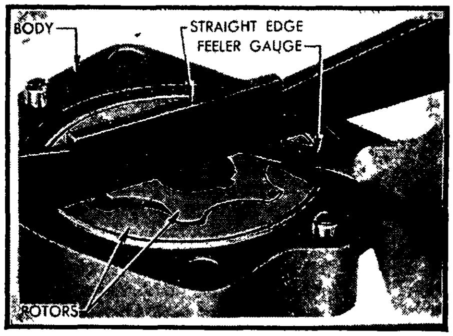


Fig. 29 Checking side clearance of rotors in body of Eaton pump

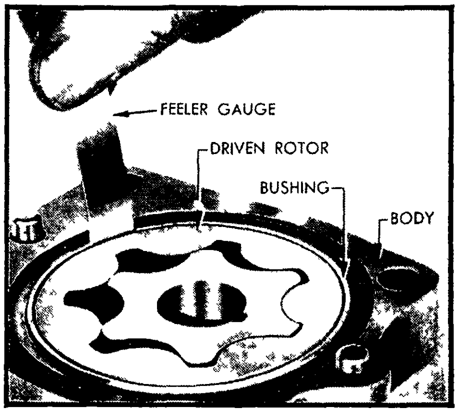


Fig. 30 Checking clearance between rotor and bushing of Eaton pump

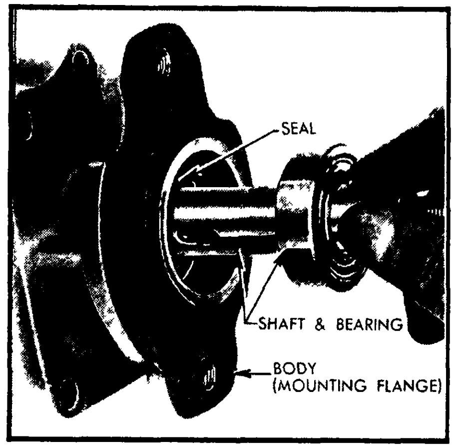


Fig. 31 Installing bearing and shaft in Eaton pump

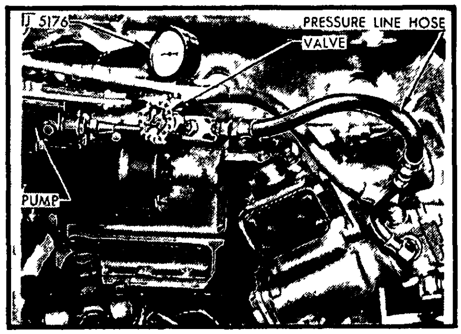


Fig. 32 Applicati n of pressure gauge J-5176

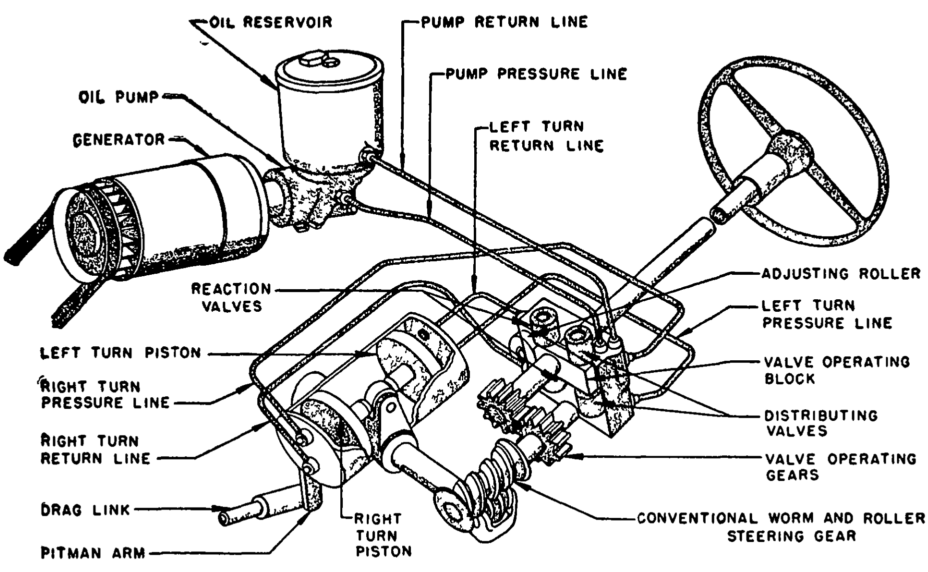


Fig. 33 Schematic drawing of Gemmer "Hydraguide"

clean exterior of pump

2 Remove manifold and two gaskets, Fig 22, remove bolts and separate cover from pump body

3. Remove parts from pump cover, Fig. 23, being careful not to lose any of the shims

4. Remove pressure plate spring and "O" ring seal, Fig 24 Then remove pressure plate which is fitted over two dowel pins extending through the ring Remove ring from dowel pins Then remove "O" ring seal and rotor with vanes

5 Remove bearing retaining ring, using Ring Compressor J-5207 Press drive shaft and outer bearing out of pump body, Fig 25 Shaft must be pressed through the inner ball bearing which is kept in the body by the shaft seal Remove bearing spacer, drive the shaft out with a punch and remove inner ball bearing

INSPECTION—1 Wash all parts except shaft and bearing with clean kerosene or other solvent and wipe dry with clean lint-free cloths Wipe (do not soak) bearing and shaft as solvent may dilute the lubricant in the sealed bearing

2. Inspect drive shaft for wear and check both ball bearings for roughness or noisy operation If the large bearing must be replaced, press the new bearing on shaft with a tool that applies pressure on the inner race only

3. Check fit of vanes in slots of rotor;

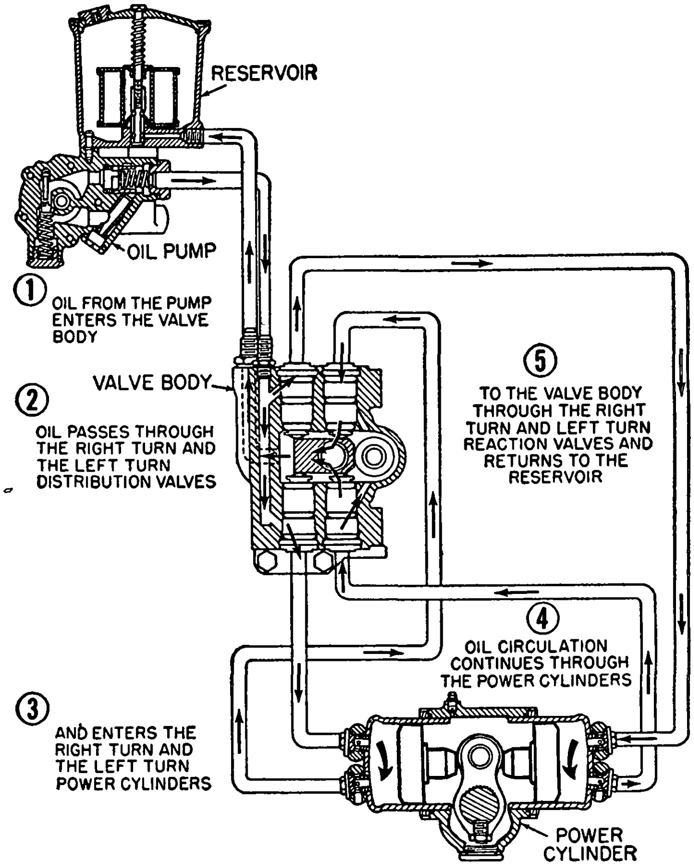


Fig. 34 Oil flow in neutral position. Gemmer

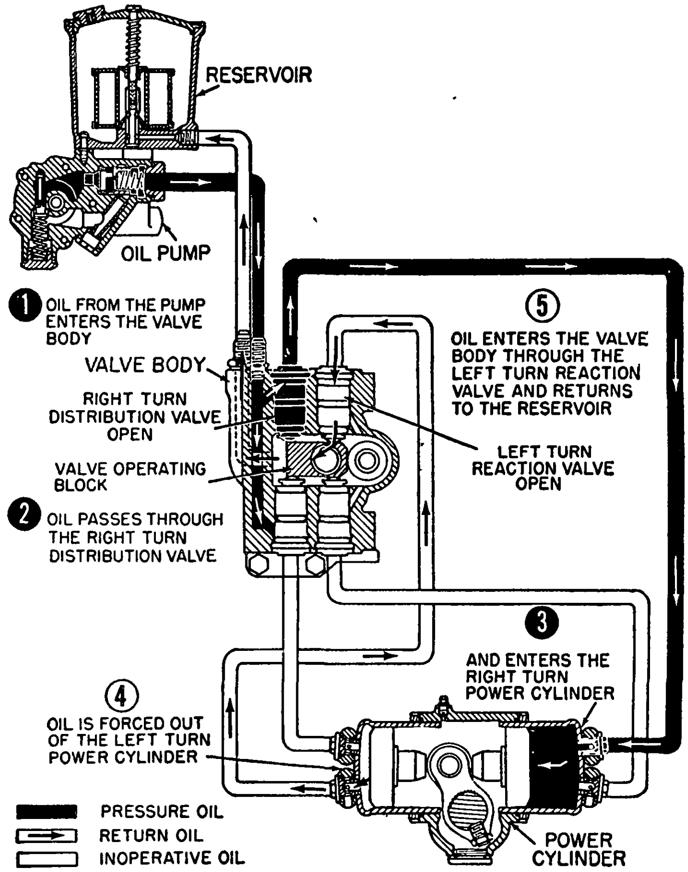


Fig. 35 Oil flow during left turn. Gemmer

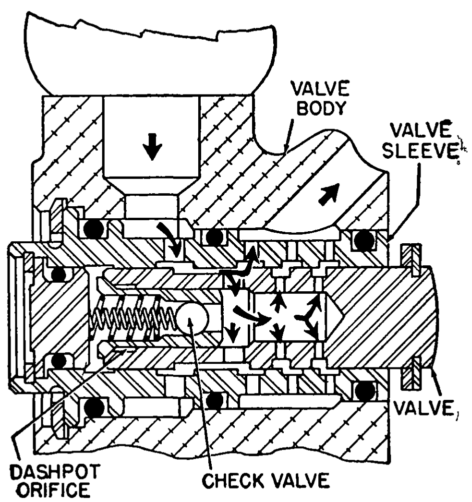


Fig. 33A Valv d tail. Oil nters an internal passag in each valv (all id nti-cal) thr ugh four h les ar und the circumf rence of the sl v and four h l s in th valve

vanes must slide freely but snugly in slots. Tightness may be relieved by thorough cleaning or removal of irregularities. Replace rotor if excessive looseness exists between rotor and vanes, and replace vanes if they are irregularly worn or scored.

4. Inspect all ground surfaces of the ring for roughness or irregular wear. Slight irregularities may be removed with a hard Arkansas stone. Replace ring if inside cam surface is scored or worn.
5. Inspect the flat faces of the pressure

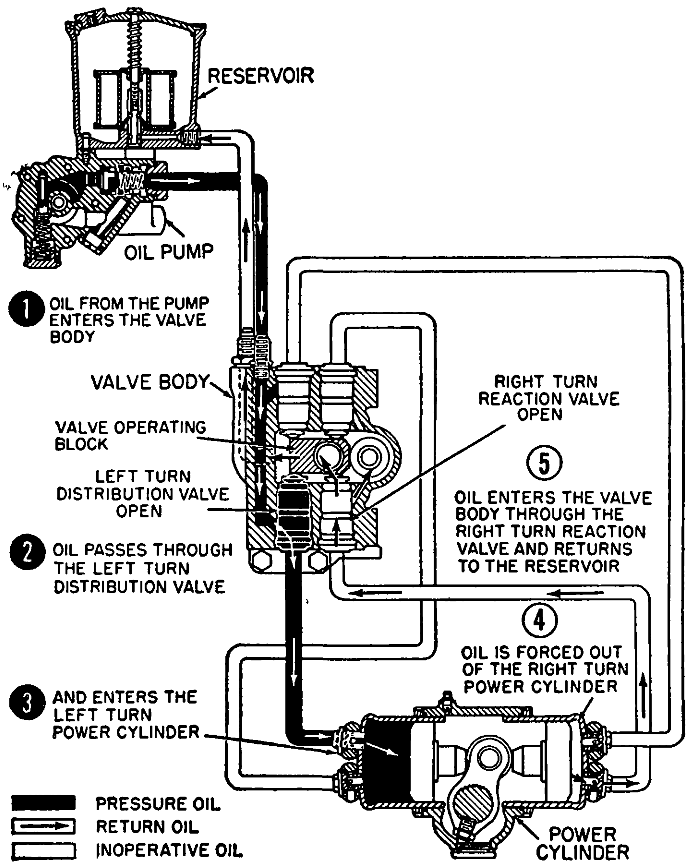


Fig. 36 Oil fl w during right turn. G mmer

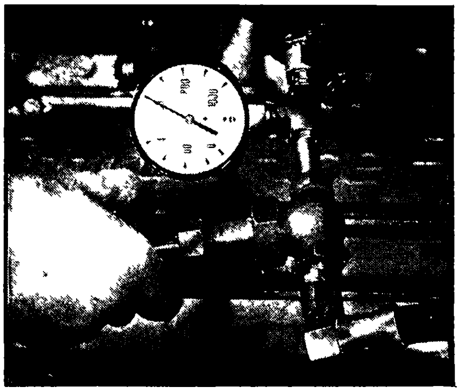


Fig. 37 Applicati n of pressure gauge t ch ck il pressure in system

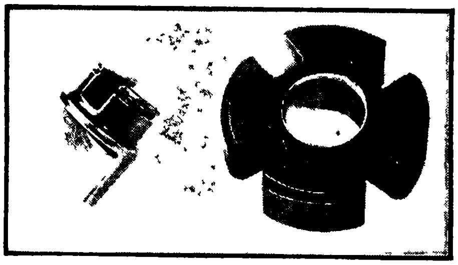


Fig. 38 Two types of oil pump drive couplings

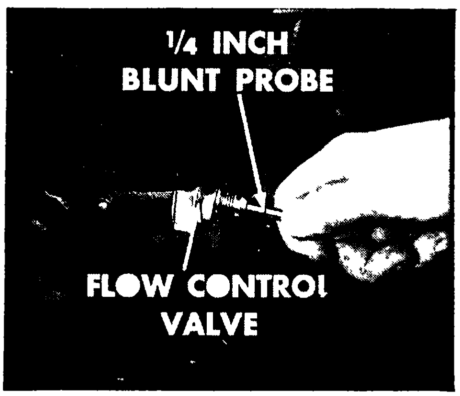


Fig. 39 Checking for a stuck fl w control valve

plate and body for wear and scoring. These faces may be repaired by lapping until smooth and flat, after which all lapping compound must be removed.

6. Inspect ground surfaces of relief valve poppet and flow control valve plunger, paying particular attention to seating surfaces. Slight irregularities may be corrected by lapping or polishing.
7. Inspect all passages in cover and body for obstructions or dirt.

ASSEMBLY—Assemble the pump by reversing the procedure for disassembly, paying attention to the following items:

1. Make sure that all parts are absolutely clean, and lubricate them with clean engine oil during assembly.
2. Use all new seals and gaskets.

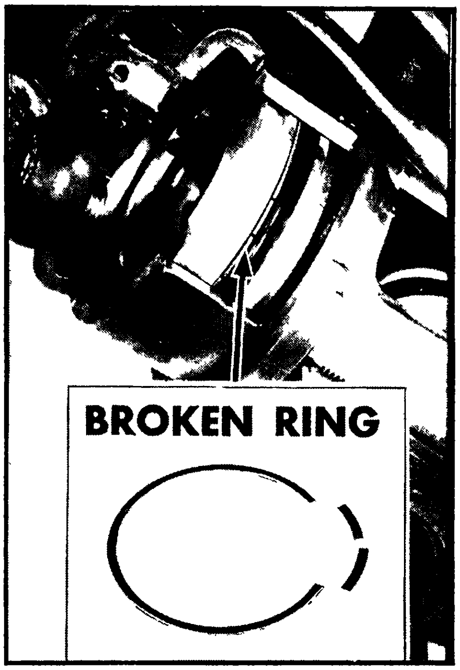


Fig. 40 Lack of hydraulic assistance is caused by a broken ring or by defective valves

Fig. 41 Tightening piston arm set screw

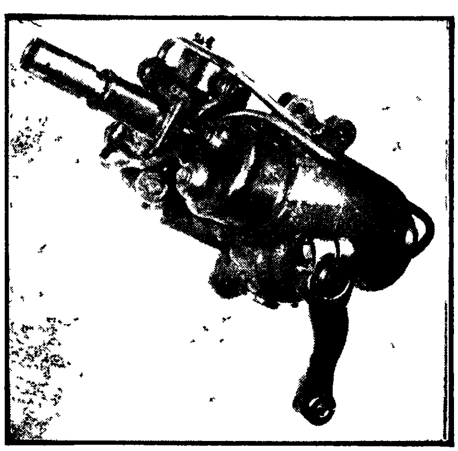


Fig. 42 P wer st ring gear unit

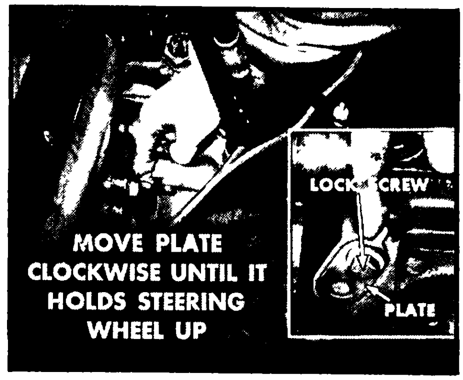


Fig. 43 Adjusting spur g ars

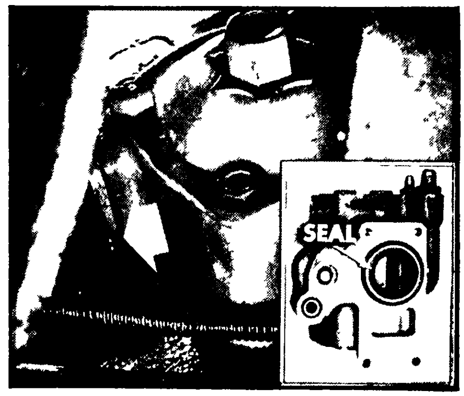


Fig. 44 "O" ring seal in valv b dy

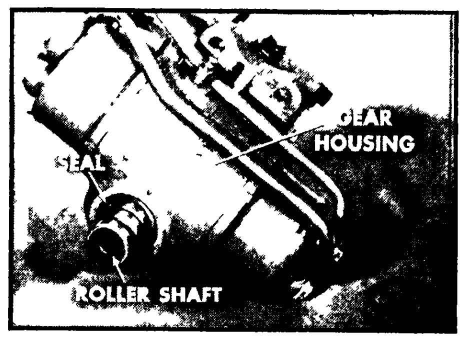


Fig. 45 Seal at roller shaft

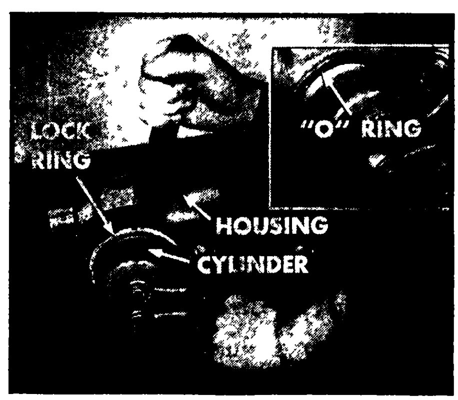


Fig. 46 C rr cting il l ak b - tw n cylind r l ck rings and housing by tightening l ck rings with spann r wrench

3. Make certain that the bearings and shaft seal are firmly seated in their proper positions. After the inner ball bearing is installed, the shaft seal must be installed with the two $\frac{1}{16}$" holes in casing toward the outside. Use a tube or shaft 1¾" in diameter to apply pressure against outer edge of seal during installation.
4. The ring must be installed over the dowel pins with the embossed arrows pointing in a counterclockwise direction as viewed from rear end of pump. When viewed from the front or shaft end of the pump, the arrows on the ring point in a clockwise direction, which is the direction of rotation of the pump shaft.
5. Install vanes in slots of rotor with the rounded edge outward toward the ring.
6. Before installing the cover, make sure that the pressure plate spring is located in the recess in the pressure plate. Turn cover bolts down snugly only, then install the manifold with gaskets before tightening the cover bolts securely. This is necessary to assure proper alignment of the cover, manifold and body.
7. Install relief valve spring with all original shims and tighten relief valve plug securely.
8. When assembly is completed, rotate pump shaft to make sure of free movement. Then plug or cap all hose connections to exclude dirt until pump is installed.
9. If any relief valve parts were replaced, test pump for valve operation after installation on car as follows: (a) Test pump pressure as described under "Trouble Diagnosis" further on. (b) Relief valve should start to open, indicated by slight buzzing noise in pump, at 700 psi or slightly higher. With engine speeded above idle, maximum pump pressure should not exceed 900 psi. (c) Change the number of relief valve shims as required to obtain above operation.

SERVICING EATON PUMP

DISASSEMBLY—1. With all inlet and outlet ports plugged and capped to avoid entrance of dirt, thoroughly clean exterior of pump.
2. Remove large hex cap and seal from the flow director adapter but leave hose connector in place. Remove hose unions and seals from pump cover.
3. Remove adapter bolts and install Studs J-5206, one at a time, at the two locations shown in Fig. 26. Loosen the stud nuts and two remaining adapter bolts evenly to relieve the pressure of springs located under the adapter. If adapter does not separate from pump cover as bolts and nuts are loosened, rap with a soft mallet to loosen it. Remove adapter, gasket and studs.
4. Remove parts from pump cover, Fig. 27, and place valves where they will not be damaged by contact with other parts.
5. Remove cover bolts and use a soft mallet to tap cover loose from locating dowels in pump body. Remove rubber seals, rotors, and drive pin from pump body.
6. Use Compressor J-5207 to remove shaft bearing retainer ring. Then press against inner end of pump shaft to remove shaft and bearing from pump body.

INSPECTION—1. Wash all parts except shaft and bearing in clean kerosene or other solvent and wipe dry with clean lint-free cloth. Wipe (do not soak) shaft and bearing as solvent may cause dilution of lubricant in the sealed bearing.
2. Check pump cover and body for wear caused by the rotors. Replace either part if surface is scored or appreciably worn. Replace bearing in cover if worn or noisy.
3. Inspect drive and driven rotors; if noticeably worn or scored replace both parts, which are furnished in matched sets. If the rotors appear satisfactory, check the clearance between them at all points with feeler gauges, Fig. 28. Replace if clearance exceeds .006".
4. Using straight edge and feeler gauges, check side clearance of rotors in pump body, Fig. 29. If this clearance exceeds .0025", replace pump body.
5. Check clearance between driven rotor and bushing in pump body, Fig. 30. Replace body if clearance exceeds .006".
6. Inspect pump shaft seal in pump body. If worn, damaged or of doubtful condition, remove old seal with a punch. Install new seal with spring-loaded edge inward, pressing seal squarely into place with a suitable tool to avoid distortion of seal casing.
7. Inspect pump shaft for wear and check bearing for roughness or noisy operation. If either part required replacement, use an arbor press to disassemble and assemble these parts to avoid damaging the bearing.
8. Carefully inspect the relief and flow control valves for nicks, scores or deep scratches; also inspect their bores in pump cover. Minor nicks may be removed with a hard Arkansas stone, but the parts should be replaced if otherwise damaged. The valves must be free in their bores with a maximum clearance of .0025".
9. Replace flow control and relief valve springs if they are distorted or of doubtful strength.

ASSEMBLY—Assemble the pump by reversing the procedure for disassembly, paying attention to the following items:
1. Make sure all parts are absolutely clean, and lubricate them with clean engine oil during assembly.
2. Install shaft and bearing as an assembly, and press against outer race to seat bearing in body, Fig. 31.
3. Use an new damper gasket and new rubber seals at all points.
4. When assembly is completed, rotate pump shaft to make sure of free movement. Then plug or cap all unions and connectors to exclude dirt until pump is installed.

TROUBLE DIAGNOSIS

The following text will cover only those causes of trouble which may be due to the hydraulic power mechanism. Causes which are due to the mechanical components of the steering gear, linkage and front suspension must be eliminated before assuming that the hydraulic power mechanism is at fault. The mechanical items include, front wheel alignment, tire condition and pressure, wheel bearing adjustment, lubrication and adjustment of steering linkage, and proper alignment of steering gear in mountings to eliminate binding.

Excessive Play or Looseness in Steering Mechanism—1. Excessive lash between pitman shaft sectors and the ball nut or power rack. 2. Loose worm thrust bearing adjustment. 3. Valve spool sticking in valve housing.

Front Wheel Shimmy—1. Air in hydraulic system, requiring bleeding. 2. Excessive lash between pitman shaft sectors and the ball nut or power rack.

Poor Centering or Recovery from Turns—1. Binding of steering shaft. 2. Valve spool sticking in valve housing. 3. Faulty valve centering springs.

Rattle or Chuckle in Steering Gear—Excessive lash between pitman shaft sectors and ball nut or power rack. A very slight rattle may occur on turns because of the increased lash off the "high point". This is normal, and lash must not be reduced below specified limits to eliminate this slight rattle.

Hard Steering When Parking—It is a normal condition to feel an increase in parking effort if the hydraulic oil temperature exceeds 170°F after excessive turning or on very hot days.

To determine whether hard steering actually exists, place the car on a clean dry floor, apply brakes and, with engine idling, turn steering wheel from side to side to bring oil temperature to approximately 170°F. Apply Gauge J-5178 (15 lbs.) to a spoke at rim of steering wheel and check the pull required to turn the wheel steadily, with gauge held at 90° degrees to the spoke. If the pull required to turn the steering wheel exceeds 10 pounds, check the following possible causes: 1. Pump drive belt loose. 2. Low oil in reservoir; if oil is excessively low, check all hydraulic lines and joints for evidence of external leakage of oil. 3. Air in hydraulic system; tighten valve cover bolts and all oil line connections on steering gear, pump and reservoir, then bleed hydraulic system.

If the preceding suggestions do not reveal the cause of hard steering, make the following oil pressure tests:

Testing Hydraulic Oil Pressure—
1. Disconnect pressure line hose at oil pump. Attach Gauge J-5176, Fig. 32, to pump and connect the hose to end of gauge where the valve is located.
2. With engine idling and gauge valve open, note oil pressure on gauge while turning steering wheel from one extreme to the other. Especially note the maximum pressure which can be built up with the wheel held in either right or left extreme position. **Caution:** Do not hold wheel in extreme position for an extended period because it will drastically increase the oil temperature and

will cause undue wear on the oil pump relief valve.

3. With oil temperature between 150 and 170°F, the maximum oil pressure should be not less than 700 psi for satisfactory power steering operation.
4. If the maximum oil pressure is less than 700 psi, it indicates trouble in the pump, or external oil lines, or steering gear, or a combination of these parts. To eliminate the lines and gear, close the gauge valve and quickly test pressure of the pump only with engine idling; then open the valve to avoid increasing oil temperature.
5. Comparing the maximum pressures obtained in these two tests will indicate the source of trouble as follows: (a) First test (step 2) pressure low, and second test (step 4) pressure normal — indicates faulty external oil lines or steering gear. (b) First test (step 2) and second test (step 4) pressures equally low—indicates faulty oil pump. (c) First test (step 2) pressure low, and second test (step 4) pressure higher but below normal — indicates faulty pump and also faulty external oil lines or steering gear.

Low Oil Pressure Due to Pump—1. Pump drive belt loose. 2. Low oil level in reservoir. 3. Oil too light. 4. Loose pump assembly bolts. 5. Faulty internal pump condition such as dirt or sludge, sticking or scored relief or flow control valve, worn rotor parts, shaft oil seal leakages.

Low Oil Pressure Due to External Oil Lines—1. Loose connections. 2. Leakage at hose unions or oil tube elbows.

Low Oil Pressure Due to Steering Gear—1. Leakage at worm shaft seal, evidenced by an accumulation of hydraulic oil in gear housing. Leakage at valve cover seal, evidenced by oil dripping from top of valve cover. 2. Pressure loss in hydraulic valve or power cylinder.

Oil Pump Noisy—1. Air in hydraulic system. 2. Reservoir air vent plugged. 3. Drive belt too tight. 4. Oil too heavy. 5. Sludge or dirt in pump. 6. Bearings, shaft or other rotating parts worn.

GEMMER HYDRAGUIDE

1951-52 CHRYSLER & 1952 DE SOTO

The Gemmer Hydraguide consists of two basic units: One, a conventional worm and roller mechanical gear with a hydraulic power device and its valves built into the same housing, Fig. 33. The other unit is an engine-driven hydraulic oil pump combined with an oil reservoir and filter and mounted on the engine.

Initial movement of the steering wheel in either direction opens a valve which starts the application of hydraulic power. Manual steering effort is reduced 90%. When the engine is not running or if the power should fail the car can be steered mechanically in the usual manner.

OPERATION OF POWER SYSTEM

The basic operation of the hydraulic power steering unit starts with the oil reservoir. Oil is drawn into the pump from the reservoir and is pumped under pressure through the system.

From the pump, the oil goes through the two-piece flexible hose to the valve body. There, the valves direct the flow of oil to and from the power cylinders.

In the valve body are the two distribution and two reaction valves of identical construction, Fig. 33A. The distribution valves direct oil to the cylinders toward which the turn is being made. That is, on left turns oil goes through the left turn distribution valve. The reaction valves lead oil away from the opposite cylinder. That is, on a left turn, oil is led away from the right-turn power cylinder through the right-turn reaction valve.

NEUTRAL POSITION—Fig. 34. In the neutral position (wheels straight ahead) the valve operating block holds the four valves partially open. With valves partially open, oil circulates freely at low pressure through the system. Oil flows through the two distribution valves and their hydraulic lines to the two power cylinders, and out through the other two hydraulic lines to the two reaction valves and back to the reservoir. That means that oil pressure is the same on both power pistons in the power cylinders so they don't move, and no steering action takes place.

LEFT TURN POSITION—Fig. 35. When the steering wheel is turned to the left, the spur gear at the end of the steering tube climbs up on the teeth of the worm shaft spur gear. This climbing action is caused by the resistance to turning offered by the worm shaft spur gear. The upward movement of the steering tube spur gear is permitted by the spherical bearing on the upper end of the shaft, and to the fact that this gear is free at its lower end.

Bear in mind, also, that the valve operating block is also attached to the steering tube spur gear shaft so it moves with the worm gear—either up or down. As the valve operating block moves up, it closes the right-turn distribution valve and the left-turn reaction valve, cutting off the flow of oil through those valves.

As the valve operating block closes those two valves, it allows the springs in the opposite two valves—left-turn distribution and the right-turn reaction valves—to completely open those valves to the flow of oil. So, oil under pressure enters the left-turn power cylinder through the open left-turn distribution valve, pushing the piston downward. The downward movement of one piston forces the opposite piston down, pressing the oil out of the right-turn power cylinder through the right-turn reaction valve and back to the reservoir.

This piston movement turns the piston arm attached to the roller shaft. Thus, hydraulic assistance is added to the manual effort applied by the driver.

When the driver releases pressure on the steering wheel, and the torque on the spur gears is relieved, the steering column spur gear is allowed to move back down the worm spur gear. As it does, the valve operating block also moves down, allowing the valves to return to their neutral positions. Since this equalizes oil pressure in the power cylinders, the front wheels can then return to the straight-ahead position of their own accord.

RIGHT TURN POSITION—Fig. 36. On a right turn, the valves, power pistons, and the valve operating block operate in the opposite directions. The steering tube spur gear moves down the worm shaft spur gear, causing the valve operating block to move downward against the opposite valves—left-turn distribution and right-turn reaction valves—cutting off the flow of oil through those valves. Oil then flows to the right-turn cylinder, and is forced out the left-turn power cylinder.

TROUBLE DIAGNOSIS

UNIT IN CAR—There are three general conditions which can affect the operation of the power steering unit, and which require further diagnosis:

1. Lack of assistance. This means that the power steering fails to assist in making a turn.
2. Noises during operation. These noises can usually be traced to the pump, the gears, or various other parts of the system.
3. Oil leaks. These leaks are usually caused by damaged gaskets, "O" rings, seals, loose oil line connection, or any combination of these conditions.

LACK OF ASSISTANCE

As lack of assistance can be traced to lack of oil pressure in the system, a check must be made to find out whether the oil pump is sending oil under pressure to the rest of the system, or whether the pressure is being lost somewhere within the system. A preliminary check of oil pressure can be made without a gauge, but a more thorough check can be made with a gauge.

To make a pressure check without a gauge, start the engine and turn the steering wheel to either extreme position. If the pressure hose flexes, the pump is building up pressure. This indicates that there is pressure in the system, but it won't tell whether the pressure is enough to give the proper hydraulic assistance.

To make the test with a pressure gauge, disconnect the pressure hose from the pump and install the pressure gauge, Fig. 37, with its shut-off valve between the pump and pressure hose. Run the engine at idle speed and slowly close the shut-off valve. The pressure should build up gradually to about 600 pounds. If it doesn't build up, it may be that the pump drive coupling is broken. This will mean removing the oil pump from the generator and examining the coupling.

BROKEN PUMP DRIVE COUPLING—If the pump drive coupling is broken, turn the pump shaft several turns with your fingers to make sure that it is turning freely. If it is binding, it is probably the cause of the broken coupling, in which case the pump as well as the coupling will have to be replaced.

There are two types of couplings, Fig. 38. On earlier production models a steel pump drive coupling was used. On later production models a rubber coupling was introduced. These two types of couplings are not interchangeable—the same type must be used for replacement.

PRESSURE BUILDS UP SLOWLY — If the pressure builds up slowly (see above), check the fan and generator belt tension.

There should be between ½ and ¾" deflection when the belts are depressed between the pulleys.

FLOW CONTROL VALVE STUCK—If the pressure gauge registers only about 200 pounds, most likely the flow control valve is stuck in the open position.

To check for a stuck flow control valve, disconnect the gauge from the pump and push a clean, ¼" probe against the valve, Fig. 39. If it moves inward about 1/16", it was stuck in the open position. Remove the valve and clean it up with crocus cloth. Reinstall the valve, hook up the gauge and again check the pressure.

If cleaning the valve fails to increase pressure higher than about 400 pounds, it means that the pump rotors are worn, or that the pressure relief valve spring is weak. If a new spring does not correct the trouble, install a new pump.

PISTON RINGS BROKEN—If the oil pressure is correct and you still do not get an assist from the power cylinders, open the shut-off valve and cramp the wheels in both directions. The pressure should build up on each turn to about the same pressure as was obtained with the shut-off valve closed. If the pressure does not build up to that amount, look for a broken ring on one of the pistons, Fig. 40, or trouble in the valves which operate during that turn.

For example, if the pressure is low on a left turn, it indicates that either the ring is broken on the left-turn power piston or there is trouble in the valves which operate during a left turn. This means that the gear housing must be removed from the car and overhauled.

NOISE DURING OPERATION

Noise during operation can usually be traced to the pump, the gears or to various other parts of the system. Some of these noises are given below, together with their diagnosis and correction.

COLD WEATHER—When temperature drops below 10°F., a groaning noise may be heard when the engine is first started. This cold weather noise is caused by increased oil viscosity. If the engine is run for about three minutes before starting to drive, the noise will disappear. NOTE: The SAE 10W engine oil in the hydraulic power steering system should be replaced with SAE 5W oil in those climates where SAE 5W oil is recommended for the engine.

PRESSURE RELIEF VALVE — Sometimes a singing noise is heard in the pump, which can usually be traced to the pressure relief valve. This noise will be heard when the steering wheel is held in either extreme position or when the front wheel is cramped against the curb. This is a warning that the pump is getting hot. Releasing the manual force on the steering wheel will stop the singing.

SNAPPING NOISES—These noises can be corrected without removing the steering unit from the car, and are caused by the following conditions:

Loose Steering Tube Coupling Screw—This is the screw which secures the coupling to the steering column spur gear. If the screw is loose, a chattering noise will be heard. By removing the steering column from the car and using a socket wrench the screw can be tightened.

Loose Piston Arm on the Spline of the Roller Tooth Shaft—This arm is secured on the shaft by a set screw and lock nut, Fig. 41. If the arm is loose, remove the access plug and gasket from the lower part of the housing. Be sure to place a container under the access plug to catch the oil. The set screw and nut are then accessible and the screw can be tightened with an Allen wrench. Tighten the lock nut.

Worn Drag Link Socket—Correction for this condition is to replace the drag link.

Intermediate Arm Not Tight—The arm may be loose on its bearing, or the arm bracket may be loose on the frame crossmember. In the first case, adding shims will tighten the bearings. If the bracket is loose, tighten the bolts.

Gear Mounting Bolts Loose—Two of these bolts are accessible through the engine compartment and one is accessible from underneath the car. Tighten to 50-56 lbs. ft. torque.

Loose Steering Arm on Roller Tooth Shaft—Tighten the clamp bolt, Fig. 42, to a torque of 120 lbs. ft.

Pump Rotor or Shaft Bearing Noises—If a groaning noise is heard when the engine is running at slow speed, but increases to a whine as engine speed increases, it is probably caused by scored or damaged pump rotors or shaft bearings. If such is the case, replace the entire pump.

SPUR GEAR ADJUSTMENTS — If a rattle is heard in the spur gears on straight-ahead driving, due to backlash between gears, they may be adjusted as follows:

NOTE—There should be about ⅛" end play in the steering tube which is necessary in order to obtain instant operation of the hydraulic valves.

One mechanic should pull up on the steering wheel and hold it there while another mechanic moves the eccentric adjusting plate, Fig. 43, clockwise just enough so the steering wheel will stay in the "up" position without being held there. Then move the eccentric adjusting plate counterclockwise slowly until the steering wheel snaps down into position of its own weight. At this point, tighten the adjusting plate lock screw.

NOTE—If the adjusting plate is already turned clockwise as far as it will go before adjustment is started, remove the plate from the pin on which it is mounted and move it around one or two serrations on the pin. Be sure to hold pressure on the pin as the plate is being removed so the pin will not be pulled out. If this should happen, the entire steering gear will have to be disassembled in order to get the pin spacer back in place.

OIL LEAKS

All bolted faces are provided with "O" rings or gaskets. Seals are used to keep the hydraulic system oil from mixing with the gear oil, and to prevent external leaks.

Most leaks are caused by loose connections or attaching screws. For examples, at drain plug gaskets, at the pressure relief valve plug, and at the hose adapters on the oil pump and reservoir. Another source of leakage is at the connection between the reservoir and oil pump. The reservoir is held to the pump by four screws, reached through the top of the reservoir. Tightening these screws will usually correct a leak at this point.

SEALS—When engine oil is observed dripping from the lower end of the gear housing, it may mean that oil is leaking past the worn gear seal or the large "O" ring in the valve body, Fig. 44, where the valve body is bolted to the gear housing. In this case, the unit must be removed and a new seal and "O" ring installed.

A seal is used on the roller shaft to prevent engine oil in the hydraulic system from leaking into the worm and roller tooth compartment and mixing with the gear oil. The presence of oil in the gear compartment indicates a failure of that seal, or a failure of the seal between the valve body and gear housing. In either case, the unit must be removed from the car, disassembled and new seals installed.

SEAL AT END OF ROLLER SHAFT—Fig. 45. If this seal is found to be leaking, it can be replaced without removing the gear housing from the car. To get at the seal, remove the starting motor and pitman arm. The pitman arm clamp screw can be made accessible by putting together two 10" and one 6" extensions, and use a ratchet handle. Run the extensions along the inside of the frame, from the rear toward the front of the car. Remove the snap ring, then remove the seal with a suitable tool, being careful not to scratch the roller shaft.

The new seal is installed with a suitable sleeve, after which install the snap ring.

LEAK BETWEEN LOCK RINGS & HOUSING—Such a leak can be corrected by tightening the lock rings with the spanner wrench shown in Fig. 45. If the leak cannot be stopped by this method, it probably means that the "O" ring is damaged and will have to be replaced.

TUBE FITTINGS AT VALVE BODY & POWER CYLINDERS—A leak at these points can usually be corrected by tightening the fittings.